PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 04

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) Version 04

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SECTION A. General description of the proposed A/R CDM project activity:

A.1. Title of the proposed A/R CDM project activity:

>> **Moldova Soil Conservation Project**

Document version no. 5; Date: 21 October, 2008

A.2. Description of the proposed A/R CDM project activity:

>>

Soil erosion and landslides are major environmental problems that adversely affect land productivity in several regions of the Republic of Moldova. These problems if allowed to continue could result in long-term adverse impacts on the land productivity in several parts of the country.

The Moldova Soil Conservation Project implemented as an AR CDM project proposes to achieve multiple objectives of restoring productivity of degraded lands, enhancing forest product supplies to local communities and promoting actual net GHG removals by sinks. The project area covers degraded lands in the northern, central and southern regions of the country.

In conformity with the approved methodology AR-AM0002, the project covers lands categorized as degraded lands under the official land use classification of Republic of Moldova. The decision nr.636, 26 May 2003 of Republic of Moldova categorizes degraded lands as those that have negative anthropogenic or natural processes that could cause at least 5% or more of loss in productivity and corresponding increase in the restoration expenditure. Such lands have also been found to show productivity declines as observed from the loss carbon pools in the baseline scenario. Degraded lands are adversely affected with physical, chemical, and biological processes such as accelerated erosion, leaching, soil compaction, salinization, water logging, flooding, loss of fertility, decline in natural regeneration, disruption of hydrological cycle or increased drought risk[1]. Several anthropogenic and natural causes are to be responsible for land degradation as documented in the literaure[2]. The Annex 3 on baseline information collected as part of the baseline study provides details on the methods used in demonstrating the degraded status of lands.

The State Forest Agency, Moldsilva is the implementation entity of the project. Moldsilva and local councils traditionally lacked financial resources to restore degraded lands. Due to lack of investments, public and community lands degraded over time and have shown significant productivity declines and have become susceptible to erosion and land slides. In the absence of restorative action, these lands are expected to degrade further and continue to be the major sources of GHG emissions.

[1] A detailed categorization of degraded lands is represented as per Aricle 21 of the Law on the Improvement of Degraded Lands by the means of afforestation (nr. 1041-XIV, 15.06.2000) is presented in Section A.4.1.4

[2] There is large convergence of views of most researchers on the topic, e.g., Chisholm, A., and R. Dumsday, Eds., (1987) *Land Degradatlon,* Cambridge Univ. Press, Cambridge; Barrow, C. J. *Land Degradation* (1991) Cambridge Univ. Press, Cambridge; Eswaran, H., R. Lal and P.F. Reich (2001) Land degradation: an overview. In: Bridges, E.M., I.D. Hannam, L.R. Oldeman, F.W.T. Pening de Vries, S.J. Scherr, and S. Sompatpanit (eds.). Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification, Khon Kaen, Thailand. Oxford Press.

The incentive in the form of revenue from sale of certified emission reduction credits (CERs) from afforestation/reforestation activities under the CDM has served as catalyst for the project and in establishing legally binding institutional arrangements and stakeholder relationships involving Moldsilva and 384 local councils that represent the rural communities in the country.

Out of a total project area of 20,289.91 ha, Moldsilva and local councils own about 40% and 60% of land, respectively. As per contractual arrangement, Moldsilva is authorized to undertake afforestation/reforestation (AR) activities on lands owned by local councils and to manage these lands until after the establishment of forest and to transfer them to the local councils for subsequent management.

The past forest management of Moldsilva has shown that AR activities with locally adaptive and naturalized species planted along with native species is a cost-effective option to prevent soil erosion, prevent land slides, stabilize slopes, and generate wood and non-wood product supplies to meet the wood requirements of rural communities. As native species often require better soil conditions, their share could be increased on the restored lands in the subsequent crediting periods.

Republic of Moldova's national policies and legal provisions such as Land Code (no 350-XIV/July 12, 2001), Forest Code (law no. 887/June, 21, 1996), Water Code (no. 440-XIII/ April, 27, 1995), Law on Rehabilitation of Degraded Lands through Afforestation (1041-XIV/June, 15, 2000), Strategy on Forest Fund Development, Action Plan for Conservation of Biodiversity (no.112-XV/April 27, 2001), the national initiatives implemented under the UN Framework Convention on Climate Change, the Convention on Biological Diversity and the UN Convention to Combat Desertification form the basis for undertaking this project.

The AR CDM project activity promotes **sustainable development** of the **Republic of Moldova**. It is implemented over 20,289.91 ha of degraded lands. The project contributes to **sustainable development** in several ways such as restoring degraded lands, preventing soil erosion, increasing forest cover, improving soil productivity and increasing supplies of fuelwood, timber, and non-timber products to meet the needs of rural communities as well as replenishing the carbon stocks of degraded lands and contributing to the mitigation of climate change. The anticipated benefits of the project are outlined below.

- ***Prevention of future land degradation***: The project will prevent land slides, improve hydrological regime and minimize water and wind erosion. The afforested areas will act as shelter-belts and limit adverse impacts of soil erosion from degraded lands on adjoining lands.

- ***Supply of forest products and services***: Local population will benefit from increases in supplies of forest products. In the medium to long-term, the project will provide multiple products, services, and income from sale of timber and non-timber products such as medicinal plants, honey from beekeeping etc., and fuelwood supplies to meet the household cooking energy needs of the rural and urban households.

- **Community based management of degraded lands**: The project activity is made possible with active cooperation of local councils, who own about 40% of lands under the project, and are expected to manage these lands after their transfer from Modlsilva.

- ***Local employment***: The project is expected to create local employment through planting, weeding, tending, thinning, protection, and harvest of wood. The project will provide employment to men in site preparation, planting and harvesting, and to women in nursery management, weeding, and collection of non-timber forest products.

- ***Increase in GHG removals in soil and biomass pools***: The project activity is expected to enhance the GHG removals by preventing soil erosion, which is estimated to account for carbon losses up to 50 t/ha (0.9 tonnes of carbon ha^{-1} yr^{-1}) in areas of severe wind and water erosion. The GHG removals will be enhanced through restoration of soil productivity and creation of above- and below-ground carbon pools.

- ***Biodiversity conservation***: Biodiversity impacts of the project are expected to be in terms of protection of threatened species, improvements in ecological succession and restoration of habitats of endangered flora and fauna.

The project adopts renewable 20-year crediting period, which is expected to be extended for further two consecutive 20-year crediting periods, for a total project period of 60 years. The project is expected to generate revenue from the sale of timber from thinning and from the sale of Certiified Emission Reduction (CER) credits over the first 20-year crediting period.

The cost of implementation the project during first 11 years (2002-2012) is estimated at US $18.74 million. Moldsilva is expected to finance the costs of implementation of the project during this period.

A.3. Project participants:

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Moldsilva, State Forest Agency of Moldova and World Bank's Prototype Carbon Fund and BioCarbon Fund are the project participants in implementing the project. **Table 1** presents details of the project participation. The Republic of Moldova has issued a Letter of Approval for the project, which is submitted as part of the project validation.

Table 1: Project participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Republic of Moldova	Moldsilva, State Forest Agency, a public entity of the Republic of Moldova	No
The Netherlands	International Bank for Reconstruction and Development as trustee of the Prototype Carbon Fund	Yes
(*) In accordance with the CDM A/R modalities and procedures, at the time of making the CDM-AR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Moldsilva is the implementing agency. It represents the local councils that participate in the project and has contractual arrangements with all of them for management of the afforested areas under the project.

Moldsilva, Bd. Stafan cel Mare, 124, Chisinau, MD 2001, Republic of Moldova, Contact: Mr. Anatolie Popuşoi, e-mail*:* **moldsilva@mdl.net**

The Prototype Carbon Fund and BioCarbon Fund of the World Bank support projects implemented in compliance with the Clean Development Mechanism (Art.12) of the Kyoto Protocol. The funds promote implementation of projects that limit GHG emissions and purchase the resulting Certified Emission Reductions under the Emission Reduction Purchase Agreements.

Prototype Carbon Fund, 1818 H St NW, Washington DC, 20433, USA, Contact: Ms. Joelle Chassard, Email: **Jchassard@worldbank.org**

BioCarbon Fund, 1818 H St NW, Washington DC, 20433, USA, Contact: Ms. Joelle Chassard, Email:**Jchassard@worldbank.org**

A.4. Description of location and boundaries of the A/R CDM project activity:

The project covers degraded lands eligible for undertaking afforestation and reforestaion activities. The Article 2 of the Law on Rehabilitation of Degraded Lands through Afforestation (nr. 1041-XIV, 15.06.2000) demonstrates the status of degraded lands and highlights the need to restore them through afforestation and reforestation project interventions.

The project proposes to restore the productivity of several categories of degraded lands such as degraded pastures, glades and abandoned arable lands through AR activities involving native and naturalized locally adaptive species. Based on site productivity, project lands can be categorized under the site productivity classes III and IV. The poor site quality reflects their high degradation and consequently low productivity.

The activities undertaken under the project include: site preparation, nursery management, planting stock development, planting, protection, and management of plantations. The species for planting are selected based on suitability to soil and climate and adaptability to the sites. On severely degraded lands, planting activities are implemented with the objective of establishing vegetation with locally adapted and naturalized species such as *Robinia pseudoacacia, Populus sp* mixed with native species. The long-term experience of forest management in Moldova has shown that *Robinia* is widely adapted to poor sites, on which other species cannot be established through cost effective means. The Robinia plantations account for more than 50% of area afforested in the country since 1950. The native species are proposed to be planted as site conditions improve after one or two rotations of naturalized and locally adaptive species. Secondary plantings using native species such as Oak (*Quercus sp)* and associated species are expected to improve productivity and vegetative cover of restored lands. Project areas planted with *Quercus sp* are proposed to be managed over a 100 year rotation, areas planted with *Robinia sp* and associated species are to be managed under 30-year rotation. Three rotations of Robinia are expected to be implemented during the project. The areas planted with *Populus sp* and associated species are to be managed under 40-year rotation

On partially degraded sites, Oak (*Quercus sp.*), Poplar (*Populus alba, P. nigra*) are chosen as lead species. Other broadleaf species and shrubs are planted to improve floral diversity. The project is expected to improve soil conditions and promote regeneration of native species over long-term.

The planting activities under the project activities are implemented from 2002 and 2006. These activities involved manual and mechanical methods of soil preparation and planting. The post-planting activities included protection, gap planting, tending, pest management, thinning, fire control, and harvesting. **No nitrogenous fertilizers** have been used in the project and **no biomass burning activities are practiced.** However, the project proposes to monitor biomass burning that may occur from natural fires.

The local councils are expected to manage the planted sites as per approved management plan. The monitoring plan will ensure that the project activities are implemented as per project design document and progress will be assessed by monitoring and verification of carbon pools at regular intervals.

A.4.1. Location of the proposed A/R CDM project activity:

The project will cover all districts of Republic of Moldova except the eastern territories of Transnistria.

A.4.1.1. Host Party(ies):

>>
Republic of Moldova

A.4.1.2. Region/State/Province etc.:

>>
All districts of the country, except Transnistria

A.4.1.3. City/Town/Community etc:

>>
All districts of the country, except Transnistria

A.4.2 Detailed geographic delineation of the project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:

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The AR CDM project covers 20,289.91 ha spread over 2421 sites in 384 local councils and municipalities, spread over 23 forest enterprises in different parts of the country. The planting sites range from 0.25 ha to more than 50 ha. About half of the project area is represented by planting sites that are under15 ha. **Table 2** presents the details on number of planting sites and area represented by them.

Table 2: Distribution of planting sites and their areas in the project

S.No.	Area of planting site (ha)	Number of sites	Area (ha)	Percent area (%)
1	0.25-4.99	1144	2728,41	13,4
2	5.00-9.99	602	4171,17	20,6
3	10.00-14.99	310	3658,97	18,0
4	15.00-19.99	151	2581,99	12,7

5	20.00-29.99	120	2818,47	13,9
6	30.00-49.99	67	2397,6	11,8
7	≥ 50.00	27	1933,3	9,5
Total general		2421	**20289.91**	**100.0**

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau

The project areas and project boundary confirms to the guidelines outlined in the Section III.1 of the approved methodology AR-AM0002. The project boundaries have been defined and GPS measurements of the boundaries were completed and verified through field surveys. As per monitoring and quality assurance and quality control procedures adopted for the project, geographic co-ordinates of each land parcel (polygon) are noted using the global positioning system (GPS), and photographic evidence is recorded and archived in the project database. **Annex 5** of this PDD lists the details of the project sites in different forest enterprises and geographical zones of the country. All plots are represented on cadastral maps of 1:10,000. **Table 3** presents the distribution of project area by land use category and by forest enterprise.

Under the Article 2 of the Law on Improvement of Degraded Lands through Afforestation (nr. 1041-XIV, 15.06.2000) degraded lands are identified as lands subjected to erosion, destructive action of anthropogenic factors and have lost the capacity for agricultural production. The following categories of degraded lands included in the project are expected to get ameliorated through afforestation and reforestation activities.

a) Lands with strong and excessive superficial erosion;
b) Lands with depth/linear erosion – surface erosion, ravine and gully erosion;
c) Lands affected by active landslides, crumbling, wash-out etc;
d) Sandy soils exposed to wind and water erosion;
e) Stony soils and lands with the deposition of heavy shower's;
f) Lands with the permanent excess humidity; and
g) Low or unproductive lands.

Information highlighting degraded status of project lands is presented in **Annex 6**. Figure A6.1 presents the distribution of degraded lands under the project for a representative district/Judet Orhei. The **Table A6.1** of **Annex 6** highlights the status of degraded public lands transferred from mayoralities/local councils to Moldosilva for restoration under the project. Table A6.2A of Annex 6 presents the Republic of Moldova's decision on transfer of degraded lands to Moldosiva for the purpose of the project. The cadastral and land use information in 1995 and 2005 for the project area presented in **Table A6.3 of Annex 6** shows that the productivity of areas decreased over the period. In addition to this data, analysis of baseline study and field surveys demonstrated the productivity decline in the project area over time.

The project area falls under the categories of pastures, glades, degraded lands, and abandoned arable lands and the lands are eligible for AR CDM project as they have not supported woody vegetation since 1990 and no natural regeneration has been witnessed on the project lands.

Table 3: Categories of lands included in the project

S. No	Enterprise	Degraded lands			Pastures				Total
		Vine yards	Eroded lands	Sub-total	Past-ures	Arable lands	Glades & open spaces	Sub-total	
1	Bălţi		511.8	511.8	362.1	5.0	14.9	382	**893.8**
2	Călăraşi		87.2	87.2	198.3			198.3	**285.5**
3	Chişinău	25.2	277.2 4	302.4	489.0 3	79.0	95	663.0 3	**965. 47**
4	Cimişlia		12.4	12.4	691.74		155	846.74	**859.14**
5	Codrii			0.0		12.0		12.0	**12.0**
6	Comrat		342. 3	342. 3	1267. 6	15.4	177.2	1460.2	**1802.5**
7	Edineţ		180.6	180.6	565.94	25.2	3.8	594.94	**775.54**
8	Glodeni		461.3	461.3	743	1.3	84.4	828.7	**1290**
9	Hânceşti		234. 3	234.3	374.28		86.3	460.58	**694.84**
10	Ialoveni		78	78.0	585.83	15	47.77	648.6	**726.6**
11	Iargara		121.1	121.1	1068	1	318.3	1387.3	**1508.4**
12	Manta-V	10.12	125.17	135.3	450.25	1.44	122	573.69	**708.98**
13	Nisporeni		484.8	484.8	50.2		18.4	68.6	**553.4**
14	Orhei		315.5	315.5	418.22	117.7	7.0	542.92	**858. 42**
15	P.Domnească		66.9	66.9	66		18.7	84.7	**151.6**
16	Plaiul Fagului			0.0	205.96	12.0		217.96	**217.96**
17	Silva-sud		121.5	121.5	695.8		1363.8	2059.6	**2181.1**
18	Soroca		594.39	594.4	263.6			263.6	**857.99**
19	Străşeni		200.01	200.0	205.09		25	230.09	**430.1**
20	Şoldăneşti		74.0	74.0	307.9	57.5		365.4	**439.4**
21	Teleneşti		103.4	103.4	170.54	78	44.2	292.74	**396.14**
22	Tighina		34.9	34.9	1821.55	175.02	307.4	2303.97	**2338.87**
23	Ungheni		148.72	148.7	774.71	2.94	415.79	1193.44	**1342.16**
Total		**35.3**	**4575.49**	**4610.8**	**11775.64**	**598.5**	**3304.96**	**15679.1**	**20289. 91**

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

In terms of land ownership and management, the project lands can be categorized into three categories – lands of the Forest Fund managed under Moldsilva; lands of the local councils; and the lands transferred from local councils to Moldsilva for the purposes of AR CDM project.

Socioeconomic characteristics of project area

Based on socioeconomic characteristics, the project area is stratified into northern, central and southern geographical regions of the country. **Table 4** summarizes the characteristics of these regions. The degraded lands are represented in all the regions. However, the proportion of eroded and degraded lands is high in the northern region.

Table 4: Socio-economic characteristics of project regions

Characteristics	Northern	Central	Southern
No. of villages	200	218	176
Population	690,383	812,905	626,627
No. of households	68565	114390	65395
Major crops	Cereals, vegetables, sunflower	Cereals, grapes, sunflower, fruits, vegetables	Cereals, grapes, fruits, berries, sunflower
No. of cattle	172,800	125,500	106,500
No. of sheep and goats	272,700	213,400	460,400
Landscape regions	Balti steppe, forest steppe plateau	Lower Nistru steppe plain, Codrii forests	Bugeac steppe plain
Forest cover	7.2%	13.5%	6.7%
Major environmental issues	Landslides, soil degradation	Forest degradation; lack of firewood	Drought, overgrazing,

Source: Social Impact Assessment, Report prepared by SISI "Opinia" as part of the Moldova Soil Conservation Project, Moldsilva, Chisinau.

A.5. Technical description of the A/R CDM project activity:

A.5.1. Description of the present environmental conditions of the area planned for the proposed A/R CDM project activity, including a concise description of climate, hydrology, soils, ecosystems (including land use):

>>

Republic of Moldova is situated in the Southeastern Europe between $45^0$28' – $48^0$30' Northern latitude and $26^0$30' – $30^0$05' Eastern longitude. It covers an area of 33,800 km^2 and is divided into 5 municipalities, 32 raions, which are further divided into 892 communities and 61 towns. The average population density of the country is 128.6 persons / km^2.

Geology

The Carpathian Mountains have major influence on the relief and geology of Moldova. The terrain is uneven with sharp changes in topography and soil erosion and landslides are common features throughout the country. **Figure 1** presents the uneven topography, landslide activity and degraded status of lands in the project area. The annual loss of soil from erosion is estimated at 26 millions tonnes, equivalent to 2,000 ha of chernozem soil. The impact of soil loss in terms of the lost annual agricultural production is estimated at US$ 53 million.

Figure 1: Uneven topography and land slide activity in the project area.

Landslides represent long term risk to agriculture, housing, roads, and other infrastructure. If no remedial measures are implemented, they are expected to increase at the rate of 1,000 ha per annum. Protection against landslides was frequently cited as an important natural resource management issue during socio-economic surveys. . Postponing the restoration of these areas increases the risk of landslides on adjoining lands and further delays their rehabilitation due to cumulative increases in the risk from prior land slides. **Table 5** highlights the number of reported major landslides during 1995 to 2001.

Table 5: Landslide activity

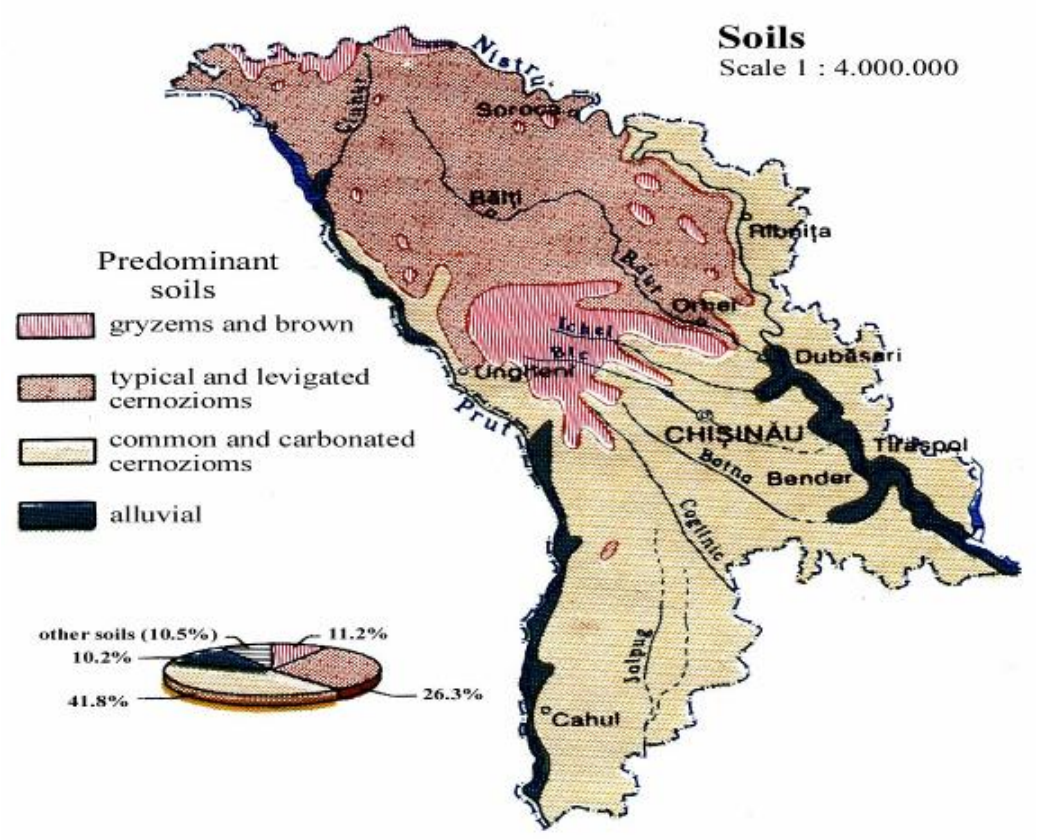
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
No. of activated land slide reports	13	57	121	126	268	98	65
Administrative regions	8	10	14	14	14	12	5

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Soils and climate

The soil types of Moldova can be categorized into chernozem (80%), dark brown and forest grey (11%), and meadow (9%). **Figure 2** presents the soil types of the project area. Lands that were covered with forest or steppe vegetation in the past have been subjected to wind and water erosion, landslide, gully and and ravine formation. There is a large variation in temperature and precipitation. Average annual temperature is $+9.4^{0}$C and temperatures fluctuate over a wide range. The country receives very low precipitation of about 560 mm in the North and 380 mm in the South and precipitation fluctuations are of common occurrence.

Figure 2: Soil types of Moldova



Soil erosion

The soil erosion is observed in the form of mass movement (landslides and soil creep) and particle movement (through-wash, rain splash, rain flow, rill wash and gully erosion) in several plots throughout the project area. The erosion and unsustainable land use practices contribute to loss of soil organic carbon each year and a major factor contributing to about 40-60% loss in soil productivity. Considering the very slow rate of soil formation, loss of more than 1 t/ha/yr can be considered irreversible over a period of 50-100 years. **Figure 3** reflects the unproductive status of degraded lands in different geographic regions and soil types. **Table 6** presents the average annual loss of soil organic matter and soil carbon under different soil erosion intensities. The soil loss increases several-fold in response to the increases in slope and erosion.

Figure 3: Status of degraded lands

Table 6: Loss of soil, organic matter and carbon from lands through erosion[3]

Slope(^{0})	Magnitude of erosion	Dehumific-ation, t/ha/year	Loss of soil through erosion, t/ha/year	Loss of humus through erosion, t/ha/year	Total loss of organic carbon, t/ha/year
0	No erosion	0.6	0	0.00	0.35
1-2	slight	0.6	10	0.35	0.55
2-4	little	0.5	20	0.70	0.69
4-6	Moderate	0.4	30	0.90	0.75
6-8	strong	0.4	50	1.10	0.87
8-10	excessive*	0.3	60	0.90	0.69

* Eroded soils from abrupt slopes have low content humus; therefore, dehumification is less important.

Source: Sistemul informational privind calitatea invelisului de sol al Republicii Moldova (banca de date), Chisinau, Pontos, 2000; Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

The geology and soil type are the major factors that contribute to mass movement of soil and land slides. **Figure 4** presents the distribution of landslide occurrences in Moldova. Considering the high intensity of erosion in the north and the central regions, project sites located in these regions are subject to more frequent landslide events in comparison to those observed in the southern region.

[3] Sistemul informational privind calitatea invelisului de sol al Republicii Moldova (banca de date), Chisinau, Pontos, 2000

Figure 4: Distribution of landslides

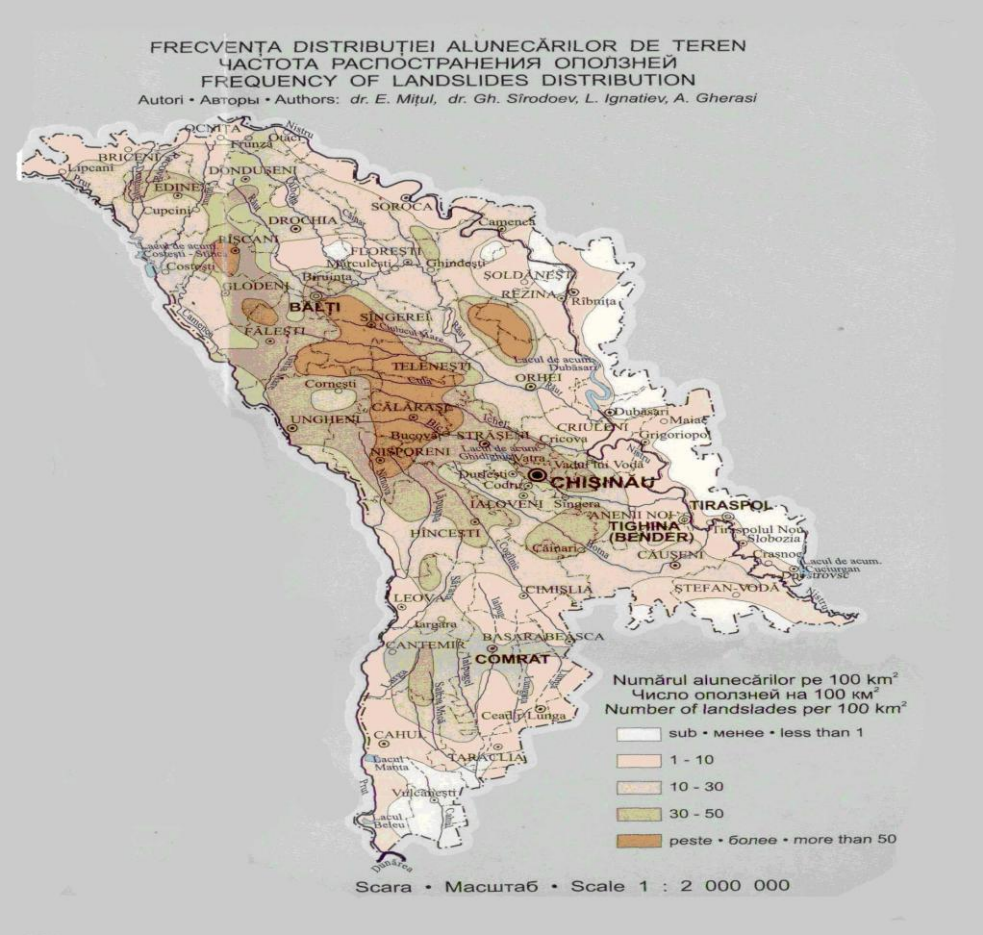


Table 7 presents level of degradation of the project sites by soil type and severity of erosion. The degradation is the result of several adverse factors (erosion, land slides, salinization, anthropogenic activity etc.). The erosion categories A1 to A4 represent the linear erosion and categories S1 to S4 represent the surface erosion. About 17886.3 ha or 80% of the project area is affected by some form of erosion and remaining 20% of the area is affected by other adverse factors such as excessive presence of carbonates, alluvial depositions, salinization, permanent excessive humidity etc.

Table 7: Degradation of lands with MSCP caused by different adverse factors

Soil type	Erosion											Other factors	Total
	Gully erosion				Superficial erosion								
	A1	A2	A3	A4	S1	S1-2	S2	S2-3	S3	S3-4	S4		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1201- typical cernoziom	79.7	18.9	69.3	34.8	2422	851.38	990.7	696.44	229.52		55.5	1217.83	6665.96
1207 – gley cernoziom					149.6	129.18	88.05	32.2	5.7				404.7
1217 – forest xeromorphic cernoziom								4.3				13.5	17.8
1221 – carbonate cernoziom			114		1207	323.09	1342	841.68	710.27		30.01	108.4	4676.02
1222 – meadow cernoziom					7		13.1	12.09	4.1				36.29
1301 – alkalized cernoziom			68.8	11.9	337.6	162.18	135.1	101.17	16.4			221.6	1054.74
1401 - cernoziom podzol					329.5	76.68	53.36	35.4	24.4		5.4	92.4	617.15
1403 - cernoziom podzol compact								15					15
1405 - cernoziom podzol pseudorendzinic					15.6								15.6
1407 - cernoziom podzol salt					13								13
1601 – forest grey soil					393.1	22.3	98.04	60.26	31.2			108.1	713.04
1609 - Forest dark grey					95.4	3.2	21.9	44	17.67			5.9	188.07
1610 - Forest light grey					3.7	19		4.6					27.3
2201 brown podzol								44.5				19.5	64
2301 – brown luvial					29.5								29.5
4201 – typical podzol								8				58	66
6101 – typical marshy soils					13.7		4.9		6			43.03	67.63
6103 – meadow marshy soil					66.6			3.5				25.1	95.2
9000 - soils damaged by landslides	308.1	7.5	505		276.4	13.47	232.8	312.05	418.44		8.25	30.7	2112.47
9501 – aluvial soil					19.3		75.6	11.1	63.7			397.5	567.2
9601 - erodisoil	2.1	21.5	36.7		267	586.3	395	492.14	692.37	0.73	18.8	43.7	2556.34
9801 – degraded lands					125.3	36.7	57.3	9.6	39.7			18.3	286.9
Total	**390**	**48**	**793**	**47**	**5771**	**2223**	**3508**	**2728**	**2259**	**0.7**	**118**	**2403.6**	**20289.9**
Share, %	1.9	0.2	3.9	0.2	28.4	11.0	17.3	13.4	11.1	0.0	0.6	11.8	**100.0**

Source: Project Implementation Unit, Moldova Soil Conservation Project, Chişinău

Table 8 summarizes information on degraded lands of the project affected with erosion. As shown in the table below, most project sites are affected by strong to very strong surface and gully erosion.

Table 8: Summary of soil erosion status of the project sites

	Linear Erosion				Surface Erosion				Without Erosion	Total
	A1	A2	A3	A4	**S1* moderate**	**S2** strong**	**S3*** very strong**	**S4 excessive**		
No. of parcels	40	11	129	11	846	810	286	21	316	2470
Area (ha	389.9	47.9	793.4	46.7	7896.7	6235.6	2260.2	118.0	2403.6	20,289. 9
Area fraction (%)	1.9	0.2	3.9	0.2	39.4	30.7	11.1	0.6	11.8	100.0

- include S1-S2, ** includes S2-S3, *** includes S2 3-S4

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Figure 5 highlights the distribution of ravines. The severity of ravines increases in the southern region.

Figure 5: Distribution of ravines

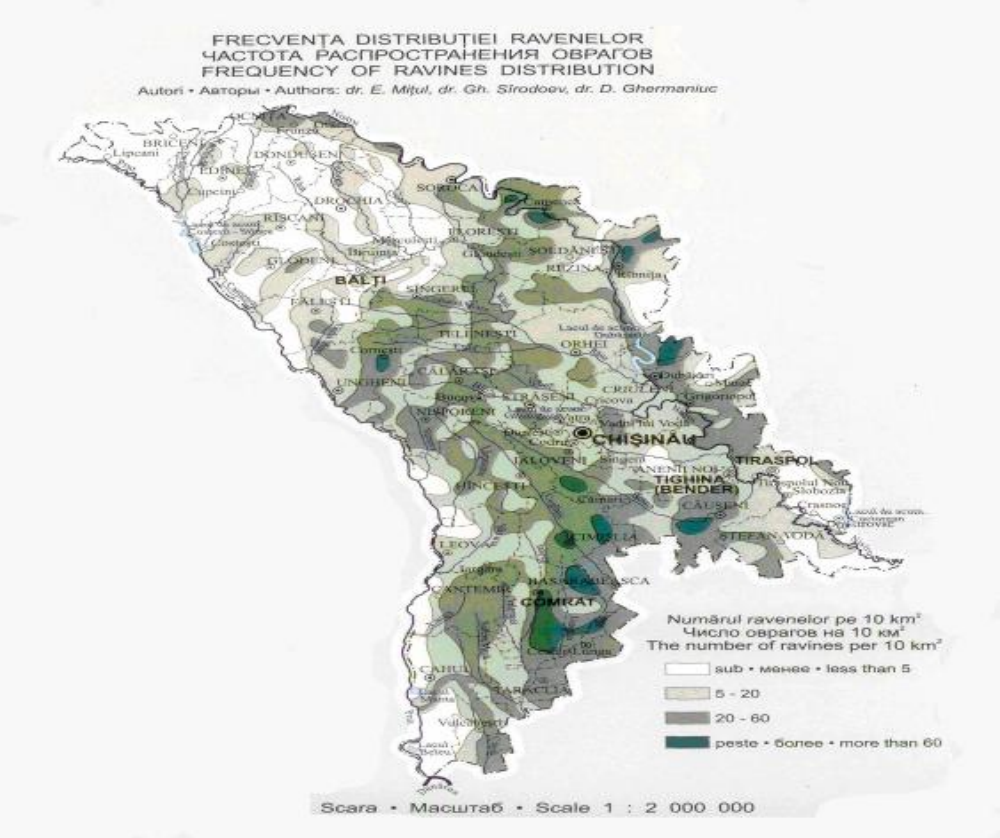
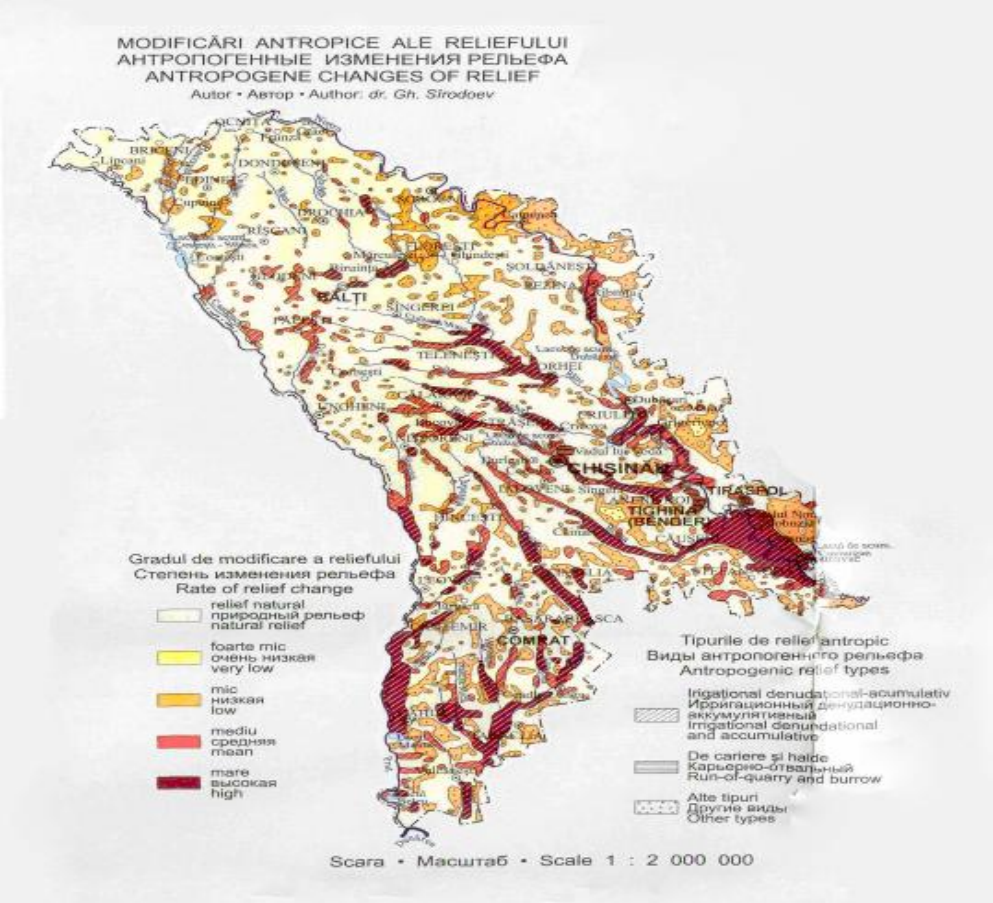


Figure 6 highlights anthropogenic influence on land use and relief. Taking into account the information from Figures 4 to 6, it is clear that the geographic and anthropogenic factors together contribute to landslides in the north and the central regions and to severe soil erosion in the southern region.

The AR CDM project is expected to increase the humus levels of the soils at the rate of 0.005-0.01% per annum, which is expected to increase the soil organic matter over time and contribute to the stabilization of degraded lands (Sistemul informational 2000).

Figure 6: Anthropogenic influences on land use and relief



Ecosystems

Based on ecosystem diversity, the three bio-geographic regions (the broadleaf Western European forests, the Mediterranean forests, and the Eurasian steppe) are recognized in Moldova. The most diverse areas are located in the floodplains and wet regions; and the most threatened diversity is located in the steppe zone. The steppe zone has undergone significant fragmentation due to anthropogenic influences involving conversion of steppe to other categories of land use and subsequent invasion of weedy species. These negative changes have also resulted in the undesirable consequences for wildlife habitat.

Figure 7 presents the distribution of natural reserve areas protected under legislation. The establishment of natural reserves helped to limit the adverse anthropogenic impacts on the floral and faunal diversity.

Figure 7: **Protected areas and landscape reserves of Moldova**

The Northern, Central, and Southern geographic zones show distinct differences in their ecosystems. The floral diversity of degraded lands is significantly low. The vegetation comprises hardy species mixed with weeds. The *northern* zone represents damp climate and forest soils with characteristic pedunculate oak (*Quercus robur*) and cherry vegetation. *The central zone* is a compact massif comparable to broadleaf forests of the Central Europe. The soils of Central region range from brown to grey and light grey on slopes to dark grey in depressions, and support *Fagus sylvatica, Quercus petraea and Quercus robur* vegetation. The *southern zone* is a dry steppe characterized by oak at high elevations, pedunculate oak (*Quercus robur*) mixed with blackthorn and downy oak (*Quercus pubescens*) on the South and South Western slopes at low elevations.

In the northern zone, primary species include: *Stipo capillatae, Bothriochloetum herbosum, Festuceto valesiaci, Bothriochloetum herbosum, Festuceto valesiaci, Bothriochloetum ischaemii, Poaeto bulbos, Bothriochloetum ischaemii, Poaeto angustifolii, Festuceto valesiaci, and Bothriochloetum iscaemii.*

Species found in the central zone are: *Festuea sulcata; Stipeta ucraini, S. lessinae, S. pennatae, S. tirsi, S. pulcherrimae, Fistuceta valesiaci,* and *S. herbosum*.

The species of the southern zone are: *Festucetum herbosum, Festucetum valesiaceae, Festuca valesiaca, Festuea sulcata, Stipeta ucraini, S. lessinae, S. pennatae, S. tirsi, S. pulcherrimae, Fistuceta valesiaci,* and *S. herbosum.*

A.5.2. Description of the presence, if any, of rare or endangered species and their habitats:

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The **Table 9** presents the faunal diversity of the project area in the northern, central and southern zones. There is significant decline in the faunal diversity on degraded lands with the largest decline reflected on the degraded lands of the southern zone. The *threatened* species of vertebrate fauna on degraded lands include: *Sicista subtilis, Cricetus cricetus, Mustela eversmanni, Aquila rapax, Circus cyaneus, Circus macrourus, Circus pygargus, Otis tarda, Tetrax tetrax, Vipera ursine, Elaphe quatuorlineata*.

Table 9: Faunal diversity of the project area

Order	**Northern Zone**		**Central Zone**		**Southern Zone**	
	Pastures	Degraded lands	Pastures	Degraded lands	Pastures	Degraded lands
Mammals	14	13	14	14	11	6
Birds	17	6	18	6	19	5
Reptiles	3	3	3	3	8	5
Amphibians	2	1	2	1	2	1
TOTAL:	**36**	**23**	**37**	**24**	**40**	**17**

Source: Dr. A. Munteanu – Scientific Director, Institute of Zoology, Moldova Academy of Sciences (personal communication).

About 13 threatened bird species are reported to nest on the project sites. In case of amphibians, two threatened species are reported be associated with the pasture lands and one threatened species is associated with the degraded lands. In case of mammals, two species of rodents, *Spermaphilus citellus* and *S. suslica* that are threatened are reported to be associated with the project area, and *Spermaphilus citellus* is listed in the Red Data Book of Moldova and Europe. The number of rare and endangered species of the project area is presented in **Table 10**. A large proportion of bird and reptile species in southern zone are threatened.

Table 10: Occurrence of threatened species in the project area

Order	**Northern Zone**		**Central Zone**		**Southern Zone**	
	Pastures	Degraded lands	Pastures	Degraded lands	Pastures	Degraded lands
Mammals	2	1	1	1	1	-
Birds	4	-	4	-	5	-
Reptiles	-	-	1	-	4	2
Amphibians	1	-	1	-	1	-
TOTAL	**7**	**1**	**7**	**1**	**11**	**2**

Source: Dr. A. Munteanu – Scientific Director, Institute of Zoology, Moldova Academy of Sciences (personal communication).

The spatial diversity and species density depends on the status of vegetation and its extent of disturbance. A comparison of Table 6 and Table7 shows that a large number of faunal species in the pastures are reported to be in the threatened category. Anthropogenic influences are assumed to be the major factors contributing to high proportion of threatened species in the pastures.

Invertebrates although have not been studied in detail with regard to their status and distribution in the project area. It has been reported that several invertebrates are found in the ecotone between pasture and degraded lands. Therefore, restoration of the ecotone is critical for restoring the endemic diversity. Studies report that out of 37 species of insects in the country's red data book, 11 species are found to be associated with the steppe vegetation. These include: *Mantis religiosa, Sago pedo, Bombus paradoxus, Bombus argillaceus, Bombus fragrands, Megachile rotunda, Xylocopa valga, Satanas gigans, Ascalaphus macaronius, Papilo machaon* and *Tomares nogeli*. Whereas, *Bombus paradoxus, B. argillaceus, B. fragrands, Ascalaphus macaronius* and others have been reported be endemic to the ecotone strips.

A.5.3. Species and varieties selected for the proposed A/R CDM project activity:

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The following criteria are used in the selection of species for planting under the project:

1. Adaptability of species to soils and climate in order to establish quickly on degraded lands and creation of favourable conditions for the subsequent establishment of native species.

2. Fast growing locally adapted species (e.g.*Robinia pseudoacacia, Gleditschia triachantos, Poplar sp*) to variety of soils, slope and elevation. They require short period for canopy closure and harvested over a short rotation period. The rotation period for Robinia under the project is 30 years.

3. Slow growing native species (*Quercus, Fraxinus*) are given priority on less degraded sites as they need better soils for their establishment and require more than 10 years to complete the canopy closure and have long rotation period. The rotation period for oak under the project is 100 years.

4. Species preferences of the local communities to meet their demands for fuelwood, timber, and non-wood forest products.

5. Low fodder collection costs to the local communities after the growth and establishment of the plantations.

Major species of the project

The species composition of the project is remarkably diverse and contributes to several objectives that are central to the restoration of site productivity. The tree and shrub species are effective in restoring degraded lands and in meeting community needs and in improving biodiversity are given preference. Furthermore, species with similar growth characteristics and management requirements are grouped under *species groups*. The species included in the AR activity are grouped under following species groups:

- Quercus- group: *Quercus rubra, Q. robur, Q. petraea, Fraxinus, Carpinus, Tilia, Acer, Cornus, Prunus, Pyrus, Corylus, Viburnum, Sambucus*

- Robinia-group: *Robinia pseudoacacia, Gleditsia triacanthos, Sophora, Ulmus, Acer, Cornus, Corylus*

- Populus-group: *Populus alba, P. nigra, Salix, Ulmus, Acer, Sambucus, Corylus, Sorbus, Viburnum*

- Pinus-group: *Pinus nigra, P. sylvestris, Acer, Cotinus, Eleaegnus, Tamarix, Rosa, Crataegus, Prunus, Rubus*

An overview on the species that are included under the major species-groups is presented below.

Quercus rubra – is widely adapted to variety of climate conditions. The long rotation of up to 100 years, ability to grow on several soil types, resistance to diseases, deep root system and high biomass accumulation and litter production capabilities reflects its role in improving the site quality. It produces high quality timber that can be used for structural purposes in construction activities. The acorns are important sources of food for many species of birds and mammals.

Robinia pseudoacacia **–** is a short rotation species with a rotation of 30 years. It is a major source of fuel wood and windbreak. It is a hardy species with well-developed root system and is known to survive on a variety of soils and endure droughts. Its natural range has expanded because of its use in planting activities aimed at land reclamation and erosion control since the early 1900s. During last 100 years, it has naturalized as pioneer species adapting mostly to degraded lands in highly variable climate regimes.

Gleditschia triacanthos – is a fast growing and drought resistant tree species that is well adapted to saline and calcareous soils. It is a small to medium tree with triple tapering thorns on young branches. Its wood is used for small timber needs such as fencing and fuelwood. Considering the large area under vineries and the demand for fence posts, it is expected to contribute to the local demand for fence posts.

Sophora japonica – is a deciduous medium to large fast growing tree reaching up to 12 to 18 meters height over a short rotation cycle of 25-40 years. The tree species is propagated by seed and cuttings and has high wood density. It is adaptable to saline, calcareous, low fertile poorly drained and compacted soils in drought prone areas.

Populus nigra – is a fast growing soft wood tree species widely grown in the Eastern Europe. It has strong abilities to grow on moist to dry, sandy and rocky soils. It is resistant to dry and cold periods, tolerates wet climate but also performs well under drought conditions.

Pinus nigra is resistant to dry and cold periods, and has the capacity to grow on poor, sandy and rocky soils and is resistant to diseases.

Shrubs: The shrub species such as *Cotinus coggygria, Crataegus monogyna, Rosa canina, Corylus avelana, Cornus mas, Prunus cerasifera, Ligustum vulgaris* planted in between the tree species have the ability to adapt to wide range of conditions in the degraded lands.

The project AR activity has been completed from 2002 to 2006. The details of the AR activity by forest enterprise are presented in **Table 11**. The forest enterprise Tighina has the largest area afforested under the project, whereas Codrii has the least area represented under the project.

Table 11: Area afforested under project from 2002 to 2006

S.No	Forest enterprise	Year					
		2002	2003	2004	2005	2006	Total
1	Bălţi	247.3	271.6	264	110.9		893.8
2	Călăraşi	112.7	25.5	51.3	93	3	285.5
3	Chişinău	125.5	361.67	145.94	232.99	99.37	965.47
4	Cimişlia	222.33	125.4	218.4	257.5	35.51	859.14
5	Codrii		12				12
6	Comrat	350.5	419.4	350.7	430.9	251	1802.5
7	Edineţ	263.7	178.99	246.25	86.6		775.54
8	Glodeni	274.4	316.3	348	349.6	1.7	1290
9	Hînceşti	486.64	171.4	34.3	2.5		694.84
10	Ialoveni (Răzeni)	99.9	171.94	218.03	210.23	26.5	726.6
11	Iargara	293.9	273	500.3	393.6	47.6	1508.4
12	Manta-V	111.7	141.93	229.91	188.9	36.54	708.98
13	Nisporeni	270.5	184.8	44	54.1		553.4
14	Orhei	359.32	174.9	175.7	109.6	38.9	858.42
15	Pădurea Domnească	20.5	50	58.7	20.8	1.6	151.6
16	Plaiul Fagului	52.3	50.94	53.1	61.62		217.96
17	Silva-Sud	444.7	639.3	553.8	418.3	125	2181.1
18	Soroca	321.1	276.03	140	84.36	36.5	857.99
19	Străşeni	157.3	102.47	84.08	86.25		430.1
20	Şoldăneşti	57.8	170.5	55	113	43.1	439.4
21	Teleneşti	198.2	122.84	43.7	31.4		396.14
22	Tighina	466.5	471.3	515.76	608.34	276.97	2338.87
23	Ungheni	364.7	385.94	289.44	302.08		1342.16
Total		**5301.5**	**5098.2**	**4620.4**	**4246.6**	**1023.3**	**20289.9**

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

A.5.4. Technology to be employed by the proposed A/R CDM project activity:

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The project activities are undertaken as per the national guidelines on scientific forest management[4] and silvicultural practices implemented by Moldsilva on the degraded lands[5].

The project uses scientific methods in site preparation, integrated soil and water conservation, nursery technologies involving improved seed, nursery management, planting, silvicultural operations and

[4] National guidelines: Îndrumările tehnice pentru regenerarea pădurilor şi împădurirea terenurilor forestiere din Republica Moldova", Kisinew, 1996.

[5] The forest management and silvicultural expertise of Moldsilva during the last 50 years contributed to successful plantations of over 200,000 ha and helped in increasing the forest cover from 6% to 9.6%.

environmentally safe management practices. The technologies and practices implemented under the project are as follows:

Use of GPS in the demarcation of project boundary: The project uses Global Position System (GPS) and Geographic Information Systems (GIS) to delineate the project boundary and to verify the location of project sites. These technologies will be used throughout the project implementation period to cost-effectively monitor and account carbon stock changes in the project.

Site preparation: The project adopts anti-erosion, surface levelling, slope control, landslide prevention, and runoff reduction measures. In order to prevent soil erosion and limit GHG emissions, biomass burning is not be used in the site preparation. Mechanical preparation is selectively used for sites with heavy weed infestation and break hard sub-soil. Site preparation activities are carried out as per the recommended soil management practices.

Choice of species: Native species (*Quercus robur, Fraxinus excelsior, Salix alba, Populus alba, Populus nigra, etc.*) and non-native species *(Robinia pseudoacacia, Gleditschia triachantos, Sophora japonica, Elaeagnus angustifolia, Pinus nigra, etc.*) are mixed in different proportions as per their suitability to the sites. Based on the growth characteristics and similarities in their management needs, the species are aggregated into species groups for the purpose of ex ante estimation of GHG removals by sinks.

On partially degraded sites, native species such as *Quercus sp* are planted. On poor and marginal lands, locally adapted fast growing, non-native and naturalized species such as *Robinia and Sophora* are used. The past experience has demonstrated the successful establishment of locally adaptive species for land reclamation stabilizes the soils prior to the establishment of native species that require better soil conditions. The fast growing locally adaptive species have also been successful in meeting the rural fuelwood needs from degraded lands. Additionally, several secondary species such as *Pyrus pyraster, Malus sylvestris, Acer platanoides, Acer campestre, Cerasus avium, Tilia sp., Carpinus betulus, Ulmus sp. etc* included in the project increase the diversity of planted species.

A large proportion of shrub species such as *Cotinus coggygria, Crataegus monogyna, Rosa canina, Corylus avellana, Cornus mas, Prunus cerasifera, Ligustum vulgaris* have also been included in the planting activity to maximize soil conservation and erosion control objectives.

Improved seed and planting stock: As part of the measures to promote improved planting stock, seed collected from rigorously selected plus trees and provenances has been used in the production of nursery stock. Standard operational procedures have been followed in collection of improved seed, testing and planting stock development.

Nursery technology and improved practices: To improve the germination of seed and establishment of seedlings, seeds are subjected to scarification, stratification and other special treatments. For the seeds of *Robinia*, *Gleditsia*, and *Sophora,* dormancy is interrupted through treatment with water at the temperatures of 60º-80ºC and stirring the seed in hot water for 20-30 minutes and soaking them in water for about 12-24 hours. Improved germination results are obtained by treating seed with micronutrients and biofertilizers. In addition, seeds are treated with fungicides and insecticides prior to sowing. The optimal depth of sowing for species used in the project is outlined below:

- Populus, Ulmus, Betula, Abies – 0.3 to 0.8 cm;
- Picea, Pinus, Larix, Sorbus, Morrus. – up to 2 cm;
- Acer, Betula, Robinia, Gleditsia, Ligustrum, Cornus – 2 to 4 cm;

- Oak, Castanus, Juglans and other seeds of the similar size – 6 to 8 cm.

The nursery practices that contributed to improved seed germination are harrowing, mulching, weed control, tillage and irrigation. To promote favourable conditions for seedling growth, manual or mechanical weeding is carried at periodic intervals. However, no fertilization is used either during nursery or during the forest establishment stage.

Forest establishment: Tending operations are done to maximize the survival of seedlings in the second and third years. These operations focus on protection, weeding, pest management and fire control and implemented as per the recommended technical and silvicultural guidelines of Moldsilva[6]. To ensure high survival rates during the plantation, gaps are planted in the second and third years.

Short and long rotation species: The project activities use the short rotation and long rotation species. *Robinia* is a major short rotation species *used in* plantings undertaken during the last 4 to 5 decades. It is considered as a naturalized species. Therefore Robinia along with other species with similar silvicultural characteristics are used as short rotation species in the project. Depending on the improvements in site productivity, native long rotation species are proposed to replace the fast growing short rotation species after one to two rotations. **Table 12** presents the species and technologies used in the project. **Figure 8** shows the afforested areas of the project.

Figure 8: Area afforested under the project

[6] M.S (1985): Indrumari tehnice pentru ingrijirea si conducerea arboretelor din Republica Moldova, Centrul de Amenajări şi Cercetări Silvice, Chisinau, 1995

Table 12: The species selected for planting under the project and their silvilcultural practices by land use category and site conditions

Species group	Secondary tree species and shrubs	Land use category	Soil conditions and relief	Forest activities
1	2	3	4	5
Quercus rubra	Secondary *Acer platanoides* *Acer campestre* *Pyrus communis* *Prunus avium* *Malus sylvestris* *Fraxinus excelsior* *Tilia cordata* *Carpinus betulus* Shrubs *Corylus avellana* *Cornus mas* *Viburnum opulus* *Vibirnum lantana* *Sambucus nigra*	Glades and waste grounds degraded pastures degraded agricultural lands	• Slopes (6-12^0) with non-eroded, slightly or moderately eroded soils	• Manual or mechanized soil preparation, • Manual or mechanized plantation of about 6,000 seedlings/ha • Plantation method with Kolovos spade or planting machine using 2-4 years old seedlings • Tending using manual or mechanized weeding • Completion of plantation in 2 to 3 years using gap filling • Pest and weed control measures
Populus nigra	Secondary, *Acer platanoides* *Tilia cordata* *Ulmus glabra* *Alnus glutinosa* *Fraxinus excelsior* *Shrubs* *Corylus avellana* *Cornus mas* *Viburnum lantana* *Sambucus nigra* *Viburnum opulus*	Glades and abandoned lands; degraded lands; degraded pastures	• Inferior slopes up to 6^0, flood-plain alluvial soils	• Manual or mechanized site preparation, • Plantation of 2,200 seedlings/ha in pits 60cmx60cmx60cm • Tending through manual and mechanized weeding • Completion of plantation in 2-3 years through gap filling • Pest and weed control measures

Robinia pseudoacacia	Secondary *Acer platanoides* *Acer campestre* *Pyrus communis* *Prunus avium* *Malus sylvestris* *Fraxinus excelsior* Shrubs *Cotinus coggygria* *Crataegus monogyna* *Ligustrum vulgare* *Rosa canina*	Landslides; ravines; glades and waste lands;	• Active landslides • Semi-stabilized landslides and active embankments; • Semi-stabilized landslides, moderate to excessive erosion, carbonates at 50-100 cm depth • Alkaline layer deeper than 50 cm • slopes with 6-35 degree and more than 35 degrees	• Manual or mechanized site preparation • Manual plantation of about 6,000 seedlings per 1 ha • Planting of 1-2 year seedlings with the help of Kolovos spade • Tending through manual weeding • Completion of plantation in 2-3 years through gap filling
Gleditsia triacantos, Sophora japonica	Secondary *Acer campestre* *Malus sylvestris* *Pyrus communis* *Ulmus glabra* Shrubs *Cotinus coggygria* *Rosa canina*	Landslides; ravines; glades; other degraded lands; and degraded pastures	• Carbonates up to a depth of 30-50 cm; • Weak to moderate salinization in >100 cm soil depth	• Manual or mechanized site preparation • Manual or mechanized plantation of 6,000 seedlings/ha • Plantation of 1-2 years with the Kolesov spade • Tending through manual weeding • Completion of plantation in 2-3 years through gap filling
Quercus rubra	Secondary *Acer campestres* *Acer platanoides* *Malus sylvestris* *Pyrus communis* *Ulmus spp.* Shrubs *Hippophae rhamnoides*	Landslides; degraded pastures; former arable degraded lands; glades and waste land	• Semi-stabilised and stabilised landslides • Moderate and weakly eroded • Clay texture	• Manual or mechanized site preparation • Manual or mechanized plantation of 6000 seedlings/ha • Planting of 1-2 years seedlings with Kolesov spade • Tending through manual weeding • Completion of plantation in 2-3 years through gap filling
Pinus nigra	Secondary *Pyrus communis* *Acer tataricum* *Acer platanoides* Shrubs *Cotinus coggygria* *Crataegus monogyna* *Rosa canina* *Ligustrum vulgare* *Prunus* spp.	Landslides; ravines; glades and waste land; other degraded lands	• Excessively eroded soils • Bed rock visible at surface • Strong and very strong alkalization • Excessive and very strong gulley erosion	• Manual or mechanized site preparation • Manual plantation of about 2,400 seedlings/ha • Planting 2-4 years seedlings with Kolesov spade on 600 beds per 1 ha at 4 seedlings per bed of main species, 2 secondary species, and bushes • Tending activities using manual wedding • Completion of gap filling in 2-3 years

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

A.5.5. Transfer of technology/know-how,if applicable:

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The project has organized training programs and conferences on forest management and generating awareness on the sustainable land management. Several training programs have been conducted to train the project personnel on aspects related to project management, monitoring and community awareness. The training and outreach programs organized under the project are as follows:

2001: National level workshops and training programs were organized to plan the design of the project.

2002 & 2003: National and forest enterprise level training programs have been organized to strengthen the implementation of the project.

2004: Four technical meetings were organized involving the representatives of forest enterprises to share on their information.

2005: Three technical meetings involving the representatives of territorial divisions of Moldsilva were organized to share experiences from the project implementation. A seminar on the implementation of national forestry strategies/programs was held in May 2005 with focus on the communication and outreach to local councils.

2006: An international conference was held to share the project experience among the participants from Albania, Belarus, Moldova and Romania.

A.5.6. Proposed measures to be implemented to minimize potential leakage:

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In order to ensure that pre-project grazing and other economic activities are not displaced, the project implemented socioeconomic measures outlined below:

- Implementation of livestock improvement and pasture management programs to improve livestock and pasture productivity and to avoid the displacement of low productive livestock.
- Benefit-sharing arrangements in the project area to ensure legally binding commitments of local stakeholders to prevent leakage from grazing and economic activities
- Assistance to livestock holders and improvements to the livestock/pasture management are intended to prevent leakage
- Implementation of participatory land-use planning is intended to avoid land-use conflicts resulting from grazing and other forms of leakage
- Incentives to households to pursue improved land use alternatives on the existing lands
- Imparting training in skill development programs to promote the alternative livelihood opportunities

A.6. Description of legal title to the land, current land tenure and rights to tCERs / lCERs issued for the proposed A/R CDM project activity:

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Out of total project area of 20,289.8 ha, about 40% of area is under the control of Moldsilva. The local councils that control the remaining area adopted resolutions for transfer of lands to Moldsilva for the purpose of planting under the project. The councils signed contracts with Moldsilva permitting the agency to carry out plantations and to maintain them until canopy closure for a period of up to 10 years.

Subsequent to this period, management of afforested areas will be vested with the respective local councils.

Law on improvement of degraded lands through afforestation (1041-XIV/2000, dated June 15, 2000) forms the legal base for this AR CDM project. The land allocation for planting activity has been done as per the provisions of the Land Code and Governmental Decision Nr. 246 and dated 03.05.1996 as per the procedure outlined below:

- A commission is constituted with representatives from public agencies, environmental institutions, regional forestry institutions and local councils to identify degraded lands under the control of local councils for plantation purposes.

- As per the directive of the commission, each local council makes decisions on the allotment of land for planting and recommends on the management of lands during and after the planting.

- As per the recommendations of a local council, the government issues approval authorizing the transfer of land from local council to Moldsilva;

The pattern of ownership of the project lands is as follows:

- In the five forest districts of Balti, Manta V, Padurea Domneasca, Silva-Sud, Straseni, most project lands are under the control of Moldsilva;

- In the northern and the central region, about a third of project lands are under the control of local councils and in the southern region, the share of lands under the control of local councils increase to more than 40%.

For lands that are in the possession of local councils, arrangements are made to transfer them to Moldsilva and after the termination of the contract, afforested areas are expected to be returned to the respective local councils. Upon transfer to local councils, the aforested lands will remain as forests in the future. The contract between Moldsilva and local councils is legally binding. **Table 13** presents the sequence of planting activities implemented on project lands that have different ownership and management structures.

The following institutional arrangements define the rights and access to sequestered carbon:

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- Legal basis of dialogue and partnership between local councils and Moldsilva clarifies the status of transferred lands and reflects the lack of conflict on the rights and ownership to the lands;

- Large-scale participation of communities economizes on the costs protection and defines the flow of CDM benefits to local communities and justifies the transaction costs of monitoring large number of sites as per the bottom-up approach to site selection; and

- Long-term project horizon and legally binding contractual arrangements between Moldsilva and local councils are expected to hedge against the non-permanency risk to a significant extent

Table 13: Annual planting areas of the species groups

Ownership	Planting Year	Tree Species Group			Total area, ha
		Populus	*Robinia*	*Quercus*	
Forest Fund (FF)	2002	180.5	690.0	86.5	957.0
	2003	51.2	922.5	152.2	1125.9
	2004	29.1	790.87	88.9	908.87
	2005	25.5	556.3	75.5	657.3
	2006	5.6	207	32.4	245.0
Sub-Total		**291.9**	**3166.66**	**435.5**	**3894.06**
Local communities (P)	2002	60.8	2034.93	258.8	2354.53
	2003	37.4	2839.4	383.2	3260.0
	2004	11.3	2755.9	63.4	2830.5
	2005	3.3	2673.4	291.1	2967.8
	2006	8.5	689.16	26.1	723.7
Sub-Total		**121.2**	**10992.85**	**1022.5**	**12136.58**
Transferred to Forest Fund (TF)	2002	25.9	1849.46	114.6	1989.96
	2003	1.7	617.7	92.83	712.25
	2004	3.2	868.4	9.4	881.0
	2005		566.2	55.3	621.5
	2006		48.6	6.0	54.6
Sub-Total		**30.8**	**3950.35**	**278.13**	**4259.28**
Total Project		**443.92**	**18109.86**	**176.13**	**20289.91**

* Note: For the purpose of CER estimation, 10.8 ha of Pinus III and 8.0 ha of Pinus IV are included in Quercus IV, because the productivity of these species is relatively identical.

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

A.7. Assessment of the eligibility of the land:

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The project qualifies as the afforestation and reforestation activity as per the draft decision CMP-1 of CP7 of Marrakech Accords (2001). The degraded sites that lack woody vegetation and not planted for the past 50 years confirm to the definition of afforestation and the degraded sites that have not been planted after 31 December 1989 confirm to the definition of reforestation. For areas No prior natural regeneration has also been witnessed on any of the project sites[7].

Furthermore, Republic of Moldova has defined the criteria for of "forest" as laid out in section F, paragraph 8 a-c of the annex to the decision -/CMP.1, modalities and procedures for afforestation and

[7] Draft decision -/CMP.1 Land-use, land-use change and forestry (LULUCF) from CP. 7 "Marrakech Accords" on the definitions, modalities, rules and guidelines relating to LULUCF under the Kyoto Protocol.

(b) "**Afforestation**" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years through planting, seeding, and/or the human-induced promotion of natural seed sources

(c) "**Reforestation**" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989

reforestation project activities under the clean development mechanism (http://cdm.unfccc.int/DNA) making it eligible to host the AR CDM project activity.

As per the Order Nr 7-P as of 11.01.2006 of the State Forestry Agency, Moldsilva (under the provisions of the Forest Code– Articles 3, 11 and 12 Statutes of Moldsilva, and approved by the Government of Republic of Moldova), the following criteria define the forest.

- A minimum area of 0.25 hectares covered with vegetation;
- A minimum tree crown cover or stocking level of 30%; and
- A minimum height of 5 meters.

The above thresholds comply with the UNFCCC definition of forest for the purposes of afforestation and reforestation activities under the Clean Development Mechanism of the Kyoto Protocol[8].

The project follows the Version 01 of the land eligibility tool - *Procedures to Define the Eligibility of Lands for Afforestation and Reforestation Project Activities* (Annex 16, EB22)[9] and Version 02 of the land eligibility tool - *Procedures to Demonstrate the Eligibility of Lands for Afforestation and Reforestation Project Activities* (Annex 18, EB26)[10]. The eligibility of lands to be included in the project is demonstrated using the information:

a) Baseline studies conducted prior to the project indicate that the lands to be afforested under the proposed AR CDM project activity include low productive bare lands and lands in different stages of degradation while confirming to thresholds of definition of forest as communicated by the Designated National Authority of Republic of Moldova to the UNFCCC.

b) The soil and land use/cover maps demonstrate that the lands falling under the project are affected by severe forms of soil erosion, land slides and other forms of degradation that limit the use of such lands for other productive purposes.

c) The data on land use from official records demonstrates that the project lands have not been afforested during the last 50 years or reforested since 1989.

The data from GPS coordinates and field studies confirms the eligibility of lands included under the project.

[8] For LULUCF activities under Articles1 3.3 and 3.4, the following definitions shall apply: (a) "**Forest**" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.

[9] http://cdm.unfccc.int/EB/022/eb22_repan16.pdf

[10] http://cdm.unfccc.int/EB/026/eb26_repan18.pdf

A.8. Approach for addressing non-permanence:

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The planting activity involves species of different rotation lengths. The project addresses non-permanence by undertaking plantings of long rotation and short-rotation species. The adoption of long rotation species such as *Quercus*, which has a rotation of 100 years, extends the operational length of the project beyond the length of the maximum crediting period of 60 years. Furthermore, mixture of long rotation and short rotation species facilitates the sequencing of forest product supplies to meet the local demands. The long operational period of the project beyond the maximum crediting period ensures the cost effective restoration of degraded lands by promoting permanent vegetation and stabilizing the fragile lands. The lands afforested are expected to be under vegetative cover on a permanent basis.

The **temporary Certified Emissions Reductions** (**t-CER**) approach used to account for the GHG removals by sinks seeks to renew the t-CERs at the end of each commitment period during the 20-year renewable crediting period. The adoption of renewable crediting period reflects the project entity's commitment in this regard. Therefore, project design involving short rotation and long rotation species, renewable crediting period and legally binding institutional arrangements between Moldsilva and local councils and regulatory framework of the government supporting planting activities effectively address the issues of non-permanence.

A.9. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

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Table 14 presents the estimates of ex ante net anthropogenic GHG removals by sinks of the AR CDM project.

Table 14: **Estimates of net anthropogenic GHG removals by sinks**

Summary of results obtained in Sections C.5., D.1. and D.2.

Year	Estimation of baseline net GHG removals by sinks (t CO_2 e)	Estimation of actual net GHG removals by sinks (t CO_2 e)	Estimation of leakage (t CO_2 e)	Estimation of net anthropogenic GHG removals by sinks (t CO_2 e)
2002	0	-13310	115	-13425
2003	0	-5649	115	-5764
2004	0	14479	115	14364
2005	182	44854	115	44558
2006	649	88683	298	87736
2007	1060	115785	290	114435
2008	1681	146247	291	144274
2009	2372	170648	267	168009
2010	3136	197852	154	194562
2011	3956	227889	521	223412
2012	4825	251367	478	246064
2013	5722	268121	427	261972
2014	6629	276802	375	269798

2015	7536	283601	150	275914
2016	8434	283614	743	274436
2017	8469	218671	740	209462
2018	9364	213915	685	203866
2019	10253	211048	635	200160
2020	11172	218823	205	207446
2021	12123	264153	493	251538
2022	12399	224919	493	212027
Total (t CO_2e)	109,962	3,702,513	7,705	3,584,846

Note: As per the methodology AR-AM0002, for the years in which the baseline net GHG removals by sinks represent negative values, they are assumed to be zero. This contributes to the conservative estimation of net anthropogenic GHG removals by sinks.

A.10. Public funding of the proposed A/R CDM project activity:

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The project is financed and implemented by the State Forest Agency, Moldsilva with the participation of local councils. The revenue from the sale of temporary Certified Emissions Reductions (tCERs) of the project is expected to partially supplement the Moldsilva's financial resources allocated to the project.

This project does not receive funding from any sources related to the Official Development Assistance and the Parties to the Annex I of the Kyoto Protocol.

SECTION B. Duration of the project activity / crediting period

B.1 Starting date of the proposed A/R CDM project activity and of the crediting period:

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The starting date of the project is 1 October 2002. The project is eligible as an early start project. The first crediting period of 20 years (20-yr-00-mm) under the renewable crediting period option has the starting date on 1 October 2002 and will end on 30 September 2022.

B. 2. Expected operational lifetime of the proposed A/R CDM project activity:

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100 years.

Considering the project includes *Quercus rubra* and associate species, which will be managed under the long rotation of 100 years or more, the operational life time of the project is expected to be **100 years.** The Operational life time of the project will extend beyond the total crediting period of 60 years under the CDM regulations, and will include additional 40-year period that will cover the management of forests generated under the project and the steps implemented to keep the degraded lands under permanent vegetation cover.

B.3 Choice of crediting period:

The crediting period chosen is the renewable crediting period for AR CDM projects.

B.3.1. Length of the renewable crediting period (in years and months), if selected:

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The crediting period chosen for the project is a 20-year renewable crediting period, with further renewals of up to two further 20 year crediting periods for a total crediting period of 60 years of the project period.

Under the renewable crediting period option, the first crediting period of 20 years (20-yr-00-mm) will cover the period from the project's start date on **October 1, 2002** and will extend to **September 30, 2022**.

B.3.2. Length of the fixed crediting period (in years and months), if selected:

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SECTION C. Application of an approved baseline and monitoring methodology

C.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed A/R CDM project activity:

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AR-AM0002: Restoration of Degraded Lands through Afforestation / Reforestation (version 01).

C.2. Assessment of the applicability of the selected approved methodology to the proposed A/R CDM project activity and justification of the choice of the methodology:

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The application of approved methodology AR-AM0002 to the project context is demonstrated by showing that the project meets all applicability conditions of the methodology AR-AM0002 outlined below.

- The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the project activity provide at least the same amount of goods and services as in the absence of the project activity.

- Lands to be reforested are severely degraded (due to such agents as soil erosion, land slides, or other physical constraints as well as anthropogenic actions) with the vegetation indicators (tree crown cover and height) below the thresholds for defining forests, as communicated by the DNA consistent with decision 11/CP.7 and 19/CP.9, and the lands are still degrading. As outlined in the previous sections, the lands are eligible for AR project considering they are in various stages of degradation.

The project complies with this applicability condition considering the transparent criteria outlined below are used to identify the degraded lands.

(a) The baseline study demonstrates that the sites of the baseline strata show consistent declines in the initial organic carbon reflecting the continuous loss of organic carbon over time. As the rate of degradation across the sites shows declining carbon stocks, the lands could be categorized as degraded per the methodology.

As per the Article 2 of the Law on Improvement of Degraded Lands through Afforestation (nr. 1041-XIV, 15.06.2000) degraded lands are identified as lands subjected to erosion, destructive action of

anthropogenic factors and have lost the capacity for agricultural production. The following categories of degraded lands included in the project are expected to get ameliorated through afforestation and reforestation activities.

a) Lands with strong and excessive superficial erosion;
b) Lands with depth/linear erosion – surface erosion, ravine and gully erosion;
c) Lands affected by active landslides, crumbling, wash-out etc;
d) Sandy soils exposed to wind and water erosion;
e) Stony soils and lands with the deposition of heavy shower's;
f) Lands with the permanent excess humidity; and
g) Low or unproductive lands.

(c) The degraded status of lands are assess for the lands specifically included in the project. The appendix presents the list of land parcels and their status of degradation in 1995 and 2005 demonstrates that the proportion of degraded lands has increased over the time period.

(d) Moreover, as per the Article 2 of the Republic of Moldova's Law on Improvement of Degraded Lands (nr. 1041-XIV, 15.06.2000), the degraded lands are those that are affected with erosion, pollution or destructive action of anthropogenic factors and have lost the productive capacity. The following categories of degraded lands within the project boundary are considered eligible for restoration through afforestation and reforestation.

(e) Environmental conditions and human-caused degradation do not permit the encroachment of natural forest vegetation. The adverse environmental conditions of the project sites have not permitted the establishment of vegetation. Therefore, natural regeneration is not likely to occur on the project lands.

(f) Grazing will not occur within the project boundary in the project case.

The project complies with this applicability condition in the following ways.

(i) Grazing is prohibited on land parcels pf the project in compliance with the Article 59 of the Forest Code and Government Decision of the Republic of Moldova nr. 740 17 June 2003, which forbid grazing on the lands of forest fund and forest protection belts.
(ii) The rules of local councils also forbid grazing on lands that have steep slopes; lands subject to erosion and landslides; in the flood-plains of Prut and Nistru rivers; and lands identified for watershed protection.
(iii) More than 70% of the project sites are between 1 ha to 10 ha and as these sites are in moderate to severe degraded stages they do not support significant vegetation. As a consequence, closure of these sites is not expected to lead to a shift in grazing pressure on adjoining lands considering the adequate alternative land for grazing purposes.
(iv) The leakage prevention activities included in the project to improve livestock management, high value breeds and programs to reduce less productive livestock under a Japanese PHRD are aimed preventing the shifting in grazing pressure to areas outside the project. The project monitoring will also cover the implementation of leakage prevention measures in the project.

- The application of the procedure for determining the baseline scenario in section II.4 leads to the conclusion that the baseline approach 22(a) (existing or historical changes in carbon stocks in the

carbon pools with the project boundary) is the most appropriate choice for determination of the baseline scenario and that the land would remain degraded in the absence of the project activity.

The data and information collected on the project sites supports the use of baseline approach 22(a) - existing or historical carbon stocks for identifying the most plausible baseline scenario of the project.

- Historical and existing patterns of the land use in Moldova highlights the demands on the land use and the resulting loss of productivity over past several decades.

- The past national and sector policies of Moldova have not provided fiscal and other incentives to stakeholders for restoring the degraded lands.

- Degraded lands have been traditionally used for meeting the local needs of the local communities. However, financial constraints of the government and public agencies such as Moldsilva to prevent them to invest in the restoration of degraded lands leading to the continuation of past land use that contributed to further degradation.

- Average annual rate of pre-project afforestation and reforestation at the national level is used to calculate the pre-project rate, which is 0.373% of the available national level degraded land and is adopted as the baseline scenario for the pre-project AR for the crediting period. Even if the baseline AR rates continue in the absence of the project, it is reasonable to assume that this small AR rate has insignificant role in restoring the degraded lands.

- Considering the lack of mandatory policies for restoring the degraded lands, public and communal lands are likely to degrade further and affect the local ecology and economy and as well as spread to the adjoining lands. Therefore, likelihood of regeneration of degraded lands through ecological succession appears remote.

- The national and sector policies although highlight the need for restoring degraded lands, the lack of resources force the government and public agencies to continue with the historic land use practices.

In line with the provisions of the AR-AM0002, the project seeks to assess the carbon changes in all the five pools. Furthermore, leakage is either absent or negligible considering the implementation of the leakage prevention programs in parallel with the project.

C.3. Assessment of the selected carbon pools and emission sources of the approved methodology to the proposed CDM project activity:

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AR-AM0002 includes all five carbon pools (above-ground and below-ground biomass, dead wood, litter, and soil organic carbon).

Table 15 Carbon pools under the project

Carbon pool	Selected (Yes/No)	Justification
Above-ground biomass	Yes	Major carbon pool. Both tree and non-tree Biomass components are covered

Below-ground biomass	Yes	Below-ground biomass stock is expected to increase due to the implementation of the A/R CDM project activity.
Dead wood	No	Deadwood is either insignificant or absent in the baseline degraded lands. Therefore, non-accounting of deadwood pool is conservative.
Litter	No	Small amounts of above-ground vegetation observed in the degraded lands are expected to result in insignificant quantities of litter in the baseline. Excluding this pool is therefore considered conservative.
Soil organic carbon	Yes	Soil organic carbon is expected to increase due to implementation of the project activity (when compared with the soil carbon stock under baseline scenario) and is included under the project activity.

Per the AR-AM0002 methodology, four categories of emissions are considered: fossil fuels, emissions from the loss of non-tree biomass, emissions associated with biomass burning and emissions from fertilizer application.

- Fossil fuels: Fossil fuels that are expected to be consumed by the machinery and transport vehicles in the project activities are calculated and monitored.

- Non-tree biomass: The degraded lands contain small quantities of non-tree vegetation. Based on the local studies the peak biomass of the degraded lands was estimated at 2.4 tonnes/ha. It is assumed that 40% of the non-tree biomass (0.96 tonnes /ha) is lost in site preparation.

- Biomass burning: As national regulation of the Republic of Moldova prohibits the burning of the biomass in the afforestation and reforestation activities, the emissions from biomass burning are not relevant for the ex ante estimation purposes. However, any natural occurrences of fire will be monitored during the project implementation and recorded.

- Fertilizers: As no fertilizers are used in the project, therefore the nitrous oxide emissions are not relevant for the project activity.

C.4. Description of strata identified using the *ex ante* stratification:

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The steps of AR AM0002 were used in the *ex ante* stratification of the project. As per the steps of Section II.3 of the approved methodology AR-AM0002, the project area is stratified taking into account physiographic variables, pre-project vegetation, soil characteristics, anthropogenic influences under the baseline scenario and species and planting regimes proposed for implementation in the project to restore the degraded lands.

a. Stratification under the baseline scenario

The baseline scenario comprises bare lands or lands with sparse vegetation that are below the thresholds of the definition of forest. The baseline is stratified by applying the **steps** of approved methodology AR AM0002.

Step 1: Information on land use collected from official reports and cadastral record was used to analyze historic and existing land use to confirm the applicability of the baseline approach 22(a) adopted in the approved methodology.

Step 2: Preliminary stratification was done taking into account pre-existing land use and vegetation status. It was found that most project sites are bare lands in varying stages of degradation or have sparse non-woody vegetation that is well below the thresholds of Moldova's national definition of forest.

Step 3: Based on the preliminary stratification, detailed field surveys were undertaken to evaluate the status and characteristics of aboveground tree and non-tree biomass, deadwood, litter and soil organic carbon pools. From the baseline study, it was found that the pre-existing aboveground woody and non-woody vegetation on the project sites was either absent or insignificant, which translates into insignificant role of pre-existing aboveground vegetation in the *ex-ante* stratification. The carbon pools surveyed and analyzed as part of the baseline study are noted below and additional information on them is presented in Annex 3 under baseline information.

- above-ground vegetation – scattered tree and non-tree vegetation was surveyed to assess the variability of above-ground biomass. Data on pre-existing conditions and carbon pools was taken into account in the stratification of the baseline scenario. The non-tree - herb and shrub - vegetation was assessed by measuring non-tree vegetation in plots laid out in the field.

- deadwood – the deadwood was either insignificant or absent in the degraded lands and is not likely to influence the baseline stratification, therefore, it was ignored in the ex-ante stratification.

- litter – small amounts of above-ground vegetation observed in the degraded lands is expected to result in insignificant quantities of litter. Therefore, it has no influence on the stratification of the baseline;

- soil – the variables such as soil type, depth, gradient, intensity of erosion and drainage were considered in the baseline stratification. Considering the lack of woody vegetation or its sparseness, soil carbon pool was found have significant influencing in the baseline stratification.

The results of the baseline study indicated that soil organic carbon is expected to decline due to degradation of soils under the baseline scenario. As the restoration of soil productivity is a major objective of the project, site productivity was considered as one of the criteria in the *ex ante* stratification. The categorization of rich and poor soils based on humus and organic matter content and aggregation of site productivity classes III and IV under rich and poor sites facilitated *ex ante* stratification

As part of baseline study, poor and rich sites were sampled to establish the baseline carbon stock and to evaluate the expected changes in the baseline over time. Considering the degraded status of soils and expected negative change in the baseline soil carbon stock in the absence of vegetation, the loss of carbon from soils is expected to dominate the overall carbon stock change under the baseline.

b. Stratification under the project scenario

The species included in the project, their growth characteristics and management will influence the actual net greenhouse gas removals by sinks. Therefore, in selecting the species for the project, species composition, suitability of species to the planting site, species mix, silvicultural characteristics, growth rates and rotation period and silvicultural management were taken into account in the *ex ante* stratification.

b.1. Stratification taking into account changes in carbon stocks of biomass

Species proposed for the restoration of degraded lands were categorized into main and associate species. The associate species grown in mixture with main species were aggregated under the main species groups taking into account their common growth characteristics. Additionally, rotation cycles of species - mix of short rotation and long rotation species, their end use and management requirements such as planting, thinning, harvesting and replanting cycles were also considered.

For the purpose of final *ex-ante* stratification, four main species Populus, Pinus, Quercus and Robinia planted either as sole stands or mixed with associated species were recognized. As each of the four species types are planted on rich and poor soils, ***fourteen*** *ex ante* project strata are recognized under the project. The project strata are outlined below.

1) Pinus_Rich Soils (not categorized into age class because of small area planted under the species)
2) Pinus_Poor Soils (not categorized into age class because of small area planted under the species)
3) Populus_Rich Soils_Ageclass0-3yr
4) Populus_Rich Soils_Ageclass > 3yr
5) Populus_Poor Soils_Ageclass0-3yr
6) Populus_Poor Soils_Ageclass > 3yr
7) Quercus_Rich Soils_Ageclass0-3yr
8) Quercus_Rich_Soils_Ageclass0- 3yr
9) Quercus_Poor Soils_Ageclass0-3yr
10) Quercus_Poor Soils_Ageclass0-3yr
11) Robinia_Rich Soils_Ageclass0-3yr
12) Robinia_Rich Soils Ageclass > 3yr
13) Robinia_Poor Soils_Ageclass0-3yr
14) Robinia_Poor Soils_Ageclass > 3yr

The typology of *ex ante* stratification is presented in **Table 16** below. The Table 16 (a) and Table 16 (b) outline the project strata of pasture and degraded lands and Table 16 (c) summarizes the area by species groups for rich soil and poor soil strata and for the total project area.

Table 16: Ex-ante stratification for assessing carbon stock changes in the biomass

(a) Pasture lands

Pasture							
S. No	**Species Group**	**Poor soils**		**Rich soils**		**Total**	
		No. of sites	**Area, ha**	**No. of sites**	**Area, ha**	**No. of sites**	**Area, ha**
1	Robinia	533	3633.81	1082	10083.7	1615	13717.5
2	Quercus	32	361.62	160	1174.44	192	1536.06
3	Poplar	2	14	70	392.72	72	406.72
4	Pines	4	9.7	3	9.1	7	18.8
Total		**571**	**4019.13**	**1315**	**11659.97**	**1886**	**15679.10**

(b) Degraded lands

Degraded lands							
S. No	Species Group	Poor soils		Rich soils		Total	
		No. of sites	Area, ha	No. of sites	Area, ha	No. of sites	Area, ha
1	Robinia	281	1920.46	263	2471.88	544	4392.34
2	Quercus	2	6.7	32	174.57	34	181.27
3	Poplar	0	0	6	37.2	6	37.2
4	Pines	0	0	0	0	0	0
Total		**283**	**1927.16**	**301**	**2683.65**	**584**	**4610.81**

(c) Total Project

Total Project							
S. No	Species Group	Poor soils		Rich soils		Total	
		No. of sites	Area, ha	No. of sites	Area, ha	No. of sites	Area, ha
1	Robinia	814	5554.27	1345	12555.6	2159	18109.9
2	Quercus	34	368.32	192	1349.01	226	1717.33
3	Poplar	2	14	76	429.92	78	443.92
4	Pines	4	9.7	3	9.1	7	18.8
Total		**854**	**5946.29**	**1616**	**14343.62**	**2470**	**20289.91**

Sub-strata and stand models

The species groups chosen to define project strata are categorized into sub-strata based on the age class. Based on the plantings undertaken from 2002 to 2006, the age class is represented by categorizing the planting period into two classes – age class of 0 to 3 years (planting years 2004, 2005, and 2006) and age class of greater than 3 years (planting years 2002 and 2003).

The stand models adopted under the project include both sole species plantings and mixtures of main species (Robinia sp, Quercus sp, Poplar sp and Pinus sp) and associate species. For the purpose of stratification, sole and mixed stand models are represented under the respective four main species strata.

b.2 Stratification taking into account changes in carbon stocks of soil

As the tree species establish and grow during the project period, the soil carbon is expected to accumulate during the crediting period. To assess the carbon stock changes of the soil under the project, sample plots will be laid out to monitor carbon stock change in the soils of the project. The monitoring of the soil organic carbon under the project will be done between 10 and 20 years of the crediting period using sample plot measurements. The soil carbon status of the baseline and project scenarios will be compared in order to estimate the net change in the soil carbon over the project period. The details of sampling and sample size requirements for measuring and monitoring soil carbon after the project implementation is presented in the monitoring section E.2 of this PDD and the accompanying monitoring plan enclosed under **Annex 4**.

C.5. Identification of the baseline scenario:

>>

C.5.1. Description of the application of the procedure to identify the most plausible baseline scenario (separately for each stratum defined in C.4.):

>>

The most plausible baseline scenario is identified using the **steps** outlined in the Section II.4 of the approved methodology AR AM0002:

Step 1: Information from land records, field surveys and local councils supplemented with information from interviews of the local communities is used to list the plausible scenarios of existing and future land use activities on degraded lands.

Step 2: The alternative uses are assessed taking into account the attractiveness of land use, feedback from stakeholders, and national or sectoral policies that impact the project area. In listing the alternatives, usage patterns of similar lands in the vicinity and the barriers influencing alternative uses are also taken into account. Surveys of land uses in the vicinity confirmed that the degraded lands are expected to continue in the existing use in future in the absence of project related interventions.

The provisions of the tool for demonstration and assessment of additionality (EB 21; Annex 16) were also used to evaluate the alternative uses of the degraded lands in the absence of the project AR CDM project interventions.

Step 3: The data and information from the official sources, field surveys and interviews are used to demonstrate the lands to be planted[5] are "degraded" by applying the Step 3a and Step 3b below:

Step 3a: The historical and existing land use/cover change, social-economic context and factors influencing the land use/cover change, data from archives and cadastral maps and field data from the base line study the following indicators considered in the baseline study demonstrated the continuation of land degradation.

• vegetation degradation - the tree and non-tree vegetation has decreased for reasons other than sustainable harvesting activities;
• soil degradation - soil erosion has increased over the period; soil organic matter has decreased in the recent past as observed from the measurements of the baseline study.
• anthropogenic influences - loss of soil and vegetation is observed to be related to the anthropogenic actions.

Step 3b: The evidence from the baseline line study demonstrated (a) the lack of on-site seed pool that required for natural regeneration; (b) the absence of external seed sources that enable natural regeneration; and (c) the absence of seed sprouting and growth of young trees required to regenerate the degraded lands by natural means.

Moreover, considering the small rates of pre-project planting undertaken historically over a 10-year period, degraded lands are not likely to get restored with such low rates of pre-project aforestation and reforestation activities. As a consequence, lands are expected to degrade further, thereby limiting the alternative uses for the degraded lands.

Step 4: The results of baseline study summarized in Annex 3 on baseline information demonstrates that the lands do not show significant deviation from the historical land use pattern taking into account the data on land use practices and pre-project planting rates over the most recent 10-year period.

The available evidence also demonstrates that the national or sectoral land-use policies adopted prior to 11 November 2001 do not influence the areas of the proposed A/R CDM project activity. The small and insignificant rates of planting activity undertaken on the degraded lands over 10 year period prior the project also highlight that the national and sector land-use policies adopted did not influence the planting rates or alternative uses of the degraded lands.

Step 5: The data and information on vegetation, soil, physiography (slope, aspect, altitude etc.) and land use over a 10-year period prior to the project and the changes in adjoining land use do not lead to more profitable alternative(s) over the next 5 year period and do not lead to an increase in the carbon stocks or other profitable uses for the lands under the project.

In accordance with the baseline approach 22(a) and as per the **five** steps of the approved methodology AR AM0002, the following scenarios of land use alternatives are identified.

Listing of scenarios of land use alternatives

Scenario 1: Abandonment of degraded lands from further use and migration of rural population in order for the degraded lands to regenerate through natural succession process over a long period.

Scenario 2: The historical and existing use of degraded lands leads to further degradation under growing population demands and will result in adverse impacts on adjoining lands.

Scenario 3: Investment in engineering structures in order to stabilize the degraded sites prone to land slides and soil erosion.

Scenario 4: Less degraded lands to be used for alternative agricultural uses and measures implemented to improve their productivity

Scenario 5: Restoration of degraded lands through afforestation and reforestation requires to be undertaken to prevent further loss in carbon pools.

Analysis of the s*cenario 1* - abandonment of degraded lands from further use and migration of rural population has the least probability of being realized considering the predominance of rural economy that is closely tied to the land use. Therefore, scenario 1 is unlikely to be realized.

With regard to the *scenario 2* - degraded lands are prone to severe forms of landslides and erosion and these lands are often without vegetation and are either excluded from production or subjected to marginal subsistence use. Financial constraints of Moldsilva and local councils do not allow for increased rates of planting to take place to restore the degraded lands as evidenced from the small rates of pre-project planting over the past 10-year period. Therefore, investments needed to reclaim these degraded lands cannot be realized in the foreseeable future, which could further increase erosion on degraded lands.

Analysis of the *scenario 3* shows that although use of engineering structures to stabilize the land slides and to minimize erosion is an alternative, it is costly and infeasible alternative considering the large financial resources required for the task. As engineering investments can only stabilize the sites but not increase the productivity of lands, this scenario is least plausible.

The scenario 4 – less degraded lands to be considered for alternative agricultural uses is not feasible as these lands are under the public ownership either the management of Moldsilva or local councils and are widely distributed as small parcels (i.e., about 50% of the lands are under less than 5 ha). Considering their small size, upfront investment and recurring transaction costs of managing such lands for agricultural purposes by the public agencies such as Moldsilva and local councils is not a feasible option.

Scenario 5 - denotes the possibilities of restoring degraded lands through afforestation and reforestation. However, feasibility of this scenario is limited considering the investment barriers of the Moldsilva and local councils and absence of incentives to undertake the activity. As significant proportion of degraded land is under the control of local councils, weak finances of the local councils will not permit them to participate in the afforestation and reforestation activity in the absence of incentives.

The alternatives and their characteristics are summarized below.

Alternative scenario	Baseline	Remarks
1. Abandonment of degraded lands from further use	No	Considering the predominance of rural economy, this scenario is not likely to be realized
2. The historical and existing use of degraded lands lead to further degradation	Yes	Continuous use of degraded lands is expected to lead severe forms of landslides and erosion as these lands are often without vegetation and are often excluded from production. The small rates of planting undertaken at the historic rate do not also contribute in any significant measure.
3. Use of engineering structures to stabilize the land slides and to minimize erosion	No	Considering the large financial resources required accomplishing the task, this is an infeasible alternative
4. less degraded lands to be considered for alternative agricultural uses	No	Considering the small and widely distributed degraded lands and their status as the public lands do not permit them to be used for alternative agricultural purposes. Moreover, alternative agricultural uses could over a long-term increase their vulnerability to soil erosion and other forms of land degradation.
5. Restoring the degraded lands through afforestation and reforestation	No	Feasibility of this scenario is limited considering the financial constraints of the Moldsilva and local councils and absence of incentives to overcomes the investment barriers

Identification of the baseline scenario

As land degradation is a long-term process that has significant historical significance, it relates the existing land use with the past land use as per the baseline approach 22 (a). Analysis of above scenarios shows that **Scenario 2** is the one that most closely reflects the baseline.

The land use patters of different regions of the country do not allow the consideration of *scenario 1*. Financial constraints do not permit land use alternatives under *scenario 3* and *scenario 4*. So the only realistic land-use option that can be expected without the project is further increase in the soil erosion and land slides, which could lead to further degradation of lands and their eventual abandonment with likely adverse impacts on adjacent lands, with negative consequences for land and communities in the

medium to long-term. Additional information from household surveys, ecological assessments, land capability classification, field studies on land use pattern, experience of Moldsilva and local councils that oversee the management of public and community lands are considered in demonstrating the applicability of the baseline scenario.

As carbon stocks of the baseline are expected to decline under continuous degradation, the net carbon stock under the baseline is expected to be **negative.** Following the provisions of approved methodology AR AM0002, the baseline net GHG removals by sinks are set to zero taking into account the data and evidence available from the baseline study is presented under **Annex 3** of the PDD under the **Baseline Information.** Calculations of the baseline GHG removals by sinks are presented in **Annex 9a**.

The application of steps 1 to 5 and the analysis of the alternatives demonstrates that the **scenario 2** confirms to the baseline approach 22(a) (existing or historical changes in carbon stocks in the carbon pools within the project boundary), and "lands to be planted are degraded lands and will continue to degrade in absence of the project".

C.5.2. Description of the identified baseline scenario (separately for each stratum defined in Section C.4.):

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The baseline scenario is determined separately for each stratum. For strata without growing trees or isolated trees with declining overall carbon in all the pools, the project assumes that the carbon stocks would remain constant in the absence of the project, i.e., the baseline net GHG removals by sinks are zero. For strata with isolated trees, the baseline net GHG removals by sinks are estimated based on methods in GPG-LULUC. The loss of non-tree living biomass due to competition from planted trees or site preparation is accounted as an emission within the project boundary.

The baseline scenario comprises degraded bare lands affected by severe erosion, ravines or landslides. They cover **4610.8 ha** of the project area and include former arable lands, vineyards and orchards excluded from agricultural production. The pasture lands comprise an area of **15,679.1** ha. Most of these lands are also in various stages of land degradation and lack significant above ground biomass. As there is no significant difference between aboveground biomass of degraded lands and pasture lands, they are combined together under the rich and poor soil strata for the purpose of representing the most plausible baseline scenario.

As per the section II.5 of the AR AM0002 methodology, two categories of land use was evaluated for soil organic carbon under the baseline scenario, i.e., (*i*) degraded lands and (*ii*) degraded lands on which small rates of planting was undertaken in the baseline scenario (AR activity implemented prior to the project).

(i) Degraded lands

The sampling procedures outlined in Annex 3 of the PDD under the baseline information demonstrated a continuous decline in soil organic carbon and as well as the baseline net GHG removal by sinks. Therefore, the *baseline net GHG removal by sinks for these lands is* set to zero as per the **Equation B.1** of the AR AM002. This is done to establish the degraded status of lands under the project and not for the quantification purpose.

(*ii*) Degraded lands on which small rates of pre-project planting

The share of pre-project planting is insignificant in relation to the total available degraded land (average annual rate of 75.7 ha or 0.373% of available degraded land was planted annually during the 10-years prior to the project). Furthermore, pre-project planting was scattered throughout the country, precluding a strict demarcation of pre-project AR strata under the baseline.

To calculate the change in soil carbon pool for areas corresponding to pre-project strata, the methods outlined in the *ex-ante* estimation of changes in soil organic carbon under the section II. 7 (a.5) of AR AM002 were considered to establish the parameters. The variables influencing soil carbon such as soil depth, bulk density, and concentration of soil organic carbon in areas representing the pre-project was collected.

The parameters of *ex ante* estimation were used as the initial parameters for soil carbon under the CO_2FIX model. As the soil carbon dynamics in planted areas is dependent on deadwood, litter, soil and climate, these parameters were collected from several sources. The information on average climate parameters such as effective temperature (°C), precipitation (mm), and evapo-transpiration (mm) during the year for Moldovan national context was taken into account. The parameters influencing the soil organic carbon in areas corresponding to pre-project planting were used in the CO2FIX model to calculate the change in soil carbon as outlined in **Equation B.3**.

Considering the very small proportion of annual pre-project planting and slow rate of change in the soil organic carbon, the baseline net GHG removals by sinks was found to be insensitive to the small changes in soil carbon attributable to the pre-project AR activity and it was found that change in the sol organic carbon of pre-project activity planting does not alter the net negative change in the carbon pools of the baseline.

Considering the degraded status of soils and the expected negative change in carbon stock of the baseline and lack of vegetation, carbon loss in soil is expected dominate the total carbon stock change under the baseline. As part of the baseline study, rich and poor sites were sampled to establish the baseline carbon stock and expected changes in the baseline over time. **Table 17** presents the rich and poor sites by forest enterprise.

As changes in carbon pools of degraded lands and pasture lands is expected to follow the similar trends and both categories of lands lack either lack aboveground vegetation or have sparse vegetation that is well below the thresholds of the definition of forest and both categories of lands (degraded lands and pasture lands) do not significantly differ in the initial soil carbon stock as per the baseline study, the two classes of lands were combined for the baseline assessment purpose and categorized under **rich** and **poor** soils based on the relative levels of humus content and site productivity. As a consequence baseline scenario is categorized into **two** strata - rich soil strata and poor soil strata.

Stratum representing rich soils

The rich soils have relatively high humus content and are assumed to represent the sites with more than 70 t C/ha (> 70 tC/ha)

Stratum representing poor soils

The poor soils have low humus content and are assumed to represent the sites with less than 70 tC/ha (≤ 70 tC/ha).

Table 17: poor and rich soil strata of the baseline by forest enterprise

S.No	Forest enterprise	Poor soils		Rich soils		Total	
		No. of sites	Area, ha	No. of sites	Area, ha	No. of sites	Area, ha
1	Bălți	23	150.3	111	743.5	134	893.8
2	Călărași	10	82.8	20	202.7	30	285.5
3	Chișinău	43	265.99	109	699.48	152	965.47
4	Cimișlia	25	65.5	107	793.64	132	859.14
5	Codrii	0	0	2	12	2	12
6	Comrat	66	668.2	71	1134.3	137	1802.5
7	Edineț	25	67	95	708.54	120	775.54
8	Glodeni	24	342.8	71	947.2	95	1290
9	Hîncești	37	422.5	24	272.34	61	694.84
10	Ialoveni (Răzeni)	36	215.26	66	511.34	102	726.6
11	Iargara	69	281.5	149	1226.9	218	1508.4
12	Manta-V	57	176.13	74	532.85	131	708.98
13	Nisporeni	21	203.2	30	350.2	51	553.4
14	Orhei	32	204.2	72	654.22	104	858.42
15	Pădurea Domnească	1	8	26	143.6	27	151.6
16	Plaiul Fagului	7	53.84	29	164.12	36	217.96
17	Silva-Sud	94	724.16	180	1456.94	274	2181.1
18	Soroca	66	352.9	40	505.09	106	857.99
19	Strășeni	27	152.28	42	277.82	69	430.1
20	Șoldănești	5	127	17	312.4	22	439.4
21	Telenești	22	117.4	46	278.74	68	396.14
22	Tighina	75	737.32	113	1601.55	188	2338.87
23	Ungheni	89	528.01	122	814.15	211	1342.16
TOTAL		**854**	**5946.29**	**1616**	**14343.62**	**2470**	**20289.91**

Source: Project Implementation Unit, Moldova Soil Conservation Project and Forest Research and Management Institute, Moldsilva, Chisinau.

The following steps are followed in characterizing the baseline strata and in determining the baseline net GHG removals:

a) Rich and poor sites are further categorized into bare lands in situations where the sites lacked above ground vegetation. In situations where small rates of planting (pre-project AR activity undertaken historically) which can be expected to continue in the absence of the project could occur.

b) Determination of the sum of changes in carbon stock for each stratum:

- For the strata without growing trees, sum of carbon stock changes in all the carbon pools are estimated. If the net changes in carbon stocks are negative, the baseline net GHG removals by sinks are set to zero;

- For the strata with growing trees, the sum of carbon stock changes in above-ground and below-ground biomass is determined based on the data from growth models (yield tables) and allometric equations, and local or national yield data estimates; and

- For strata that relate to the pre-project AR, the changes in carbon stock of biomass and of soil pools is estimated following the methods outlined in Section II. 5 and Section II.7 of the approved methodology AR AM0002.

c) Sum of the baseline net GHG removals by sinks across all strata.

The baseline net GHG removals by sinks of all strata are summed over the period corresponding to the project scenario to maintain consistency between the baseline net GHG removals by sinks and the actual net GHG removals by sinks. Calculations of the baseline GHG removals by sinks are presented in **Annex 9a.**

C.6. Assessment and demonstration of additionality:

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The following sections have been revised to comply with the requirements of the additionality tool

This most recent version of the CDM Executive Board approved "*Tool for the Demonstration and Assessment of Additionality in AR CDM project activities"*[11] is used to demonstrate the additionality and to conform that the project confirms to the steps of additionality tool.

Step 0: Preliminary screening based on the starting date of the AR project activity

The decision to implement the project activity was triggered in response to CDM incentive. The project was initiated in October 2002 and a new methodology, ARNM0007 in support of the project was submitted in February 2005. The call for public inputs on the new methodology occurred in May 2005. After completion of the UNFCCC review process, the CDM Executive Board approved the methodology as AR AM0002 in May 2006. The planting activity of the Therefore, the project qualifies as an early start project.

The project complies with the provisions of the tool for the demonstration and assessment of additionality and demonstrates that the land use in the absence of the CDM is unattractive. The evidence that the incentive from the sale of GHG emission allowances was seriously considered in the decision to proceed with the project activity was assessed taking into account the official and legal documentation and communication involving the project participants and the authorized national agencies and the UNFCCC institutions. The sample documentary evidence showing on the active consideration of the CDM mechanism is listed below and presented in **Annex 7**

[11] http://cdm.unfccc.int/EB/Meetings/021/eb21repan16.pdf

- Letter of Ministry of Ecology, Construction and Territorial Development of the Republic of Moldova dated 20.06.2002 and nr. 1627.01.07 informing the World Bank of the government intention to provide partial financial support of up to 6% to the project and requesting further financial assistance from the World Bank's Prototype Carbon Fund to implement the Moldova Soil Conservation Project during 2002 to 2012, the first commitment period of the CDM (**copy of the letter enclosed as part of Annex 7**).

- Letter of the Country Director of Moldova, the World Bank to the Ministry of Ecology, Construction and Territorial Development of the Republic of Moldova dated 22 July, 2002 highlighting the Memorandum of Understanding signed between Republic of Moldova and the Prototype Carbon Fund to develop the project as the CDM project and the PCF's allocation of funding to the project and to conduct the baseline study and to develop monitoring plan for the project (**copy of the letter of enclosed as part of Annex 7**.

- The Prototype Carbon Fund (PCF) and Moldsilva (project entity) signed a Letter of Intent on 1 April 2003 to purchase an agreed amount of *Emissions Reductions* from the Moldova Soil Conservation Project. The letter confirms the PCF's interest in obtaining the *Certified Emission Reductions achieved by a project under the Clean Development Mechanism defined under Article 12 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change* provided it meets the quality standards of the PCF and the project confirms to the World Bank environmental and social safeguards. The letter further confirms the intent of both the project participants to enter into an Emissions Reductions Purchase Agreement (**copy of the letter enclosed as apart of Annex 7**).

- Letter dated of 3 December 2003, nr. 01-07/887 from the Moldsilva, Republic of Moldova to the UNFCCC outlining the definition of forest applicable to Afforestation and Reforestation projects implemented in the Republic of Moldova (**copy of the letter enclosed as Annex 7**).

- Letter of Minister of Ecology and Natural Resources, Chairman of national Commission for the Implementation of the Kyoto Protcol dated 2 Sepetember 2004 and nr. 018-03/9.04 to 20 July 2004 and nr. 01-07/401 providing the Letter of Approval for the Moldova Soil Conservation Project (**copy of the letter enclosed as Annex 7**).

Step 0a. Preliminary screening based on the specific features of AR activity

Step 0.a.2. Evidence that the land within the project boundary is eligible for the AR CDM project activity

The lands under the project confirm to the land eligibility criteria outlined in the *Procedures to Define the Eligibility of Lands for Afforestation and Reforestation Project Activities*[12].

The lands of the project solely refer to areas that did not contain forest on December 31st, 1989. Official land-use records and land administration documentation dated circa 1989 demonstrate the degraded status of lands, which fall below the forest thresholds as communicated by the Republic of Moldova. The official registries demonstrate that the project area was not forested at the starting date of the project.

[12] Annex 16, EB Report 22: http://cdm.unfccc.int/EB/Meetings/022/eb22_repan16.pdf

The eligibility of land for AR CDM project activity is demonstrated by providing verifiable information relating to the situation during 1990s using ground reference data and land use plans and information from local registers such as cadastre, land use or land management register etc. The **Annex 6** presents the sample of cadastral and official data and information on the land use plans at the district level and the project level. Figure A6.1 of Annex 6 presents the degraded status of lands for a representative district/judet Orhei in **Annex 6**. The **Table A6.1** of **Annex 6** highlights the status of degraded public lands transferred from mayoralities/local councils to Moldosilva for restoring them under the project. **Table A6.2A** of Annex 6 presents the Republic of Moldova's decision on the transfer of degraded lands to Moldosiva for the purpose of the project.

A comparison of the productivity of sites based on the cadastral information on land use and degraded status of the sites in 1995 and 2005 for the project area is presented in **Table A6.3 of Annex 6**. The data shows that the productivity of most areas falling under the project decreased over the decade. In addition to this data, the analysis of the baseline study and field surveys demonstrate a decline in the productivity of sites over time. In addition to this data, analysis of the baseline study and field surveys demonstrated the productivity decline in the project area over time. The detailed plot level data and its status are archived in the database of the project implementation unit.

Step 0.a.3.Evidence that the project activity is human induced

The project activity is directly human-induced through planting. **Table 13** presented in section A.6 outlines the sequence of planting activities implemented on project lands. As the planted project area is expected to grow into forest as per the rules of land eligibility and as well as confirm to the Republic of Moldova DNA's definition of forest.

Step 1: Identification of alternative scenarios consistent with legal and regulatory framework

The alternatives identified are consistent with the following legal and regulatory policies of the Republic of Moldova.

- Forest Code, N. 887-XIII from 21.06.96, *Monitorul Oficial N.4-5/36 from 16.01.97.*
- Land Code, N.828 from 25.12.91, *Monitorul Parlamentului of the Republic of Moldova 1993, N.3 art.58, 59, 60.*
- Law on Natural Resources, N.1102-XIII from 06.02.97, *Monitorul Oficial N.40/337 from 19.06.1997.*
- Law on Environmental Protection, N.515-XII from 16.06.93, *Monitorul Oficial N.10/283 from 30.10.1993.*
- Law on State Protected Natural Areas Fund, N.1538-XIII from 25.02.98, *Monitorul Oficial N.66-68/442 from 16.07.1998.*
- Law on the Protection Water Zones and Belts, N.440-XIII from 27.04.95, *Monitorul Oficial N.43/482 from 03.08.1995.*

- Law on the Improvement of Degraded Lands through Afforestation, N. 1041-XIV from 15.06.2000, *Monitorul Oficial N.141-143 from 09.11.2000.*

- Decision of the Parliament, N.350-XV from 12.07.2001 on the Strategy for Sustainable Development of Forestry Sector, *Monitorul Oficial N.133-135 from 08.11.2001.*

- Decision of the Parliament approving the National Strategy and Action Plan on Biological Diversity Conservation, N.122-XV from 27.04.2001, *Monitorul Oficial N.90-91/700 from 02.08.2001.*

- Decision of the Government nr. 595 as of 29.10.1996 "On the Improvement of the Management of Forestry Economy and Protection of Forest Vegetation".

- Decision of the Government nr. 636 as of 26.05.2003 "On the Approval of the Program for Land Development and for the Improvement of Soil Fertility".

- Decision of the Government nr. 737 as of 17.06.2003 "On the Approval of the State Program for Afforestation and Regeneration of the Lands from the Forest Fund for the period of 2003-2020".

- Decision of the Government nr. 739 as of 17.06.2003 "On the Implementation of the Strategy for Sustainable Development of the National Forest Sector".

- Decision of the Government nr. 740 as of 17.06. 2003 "On the Approval of Statutory Acts for the Management of Forestry Economy".

In addition to the national and sector policies, the afforestation and reforestation rate for the period of 10-years from 1992 to 2001 is taken into account. The annual rate of afforestation and reforestation in the country during the 10 years prior to the project is assessed at 0.373% of the available degraded lands nationally. The low annual pre-project AR rate also highlights the lack of investments in implementing the national and sector policies related to forestry and land use.

Sub-step 1a. Definition of alternatives to the project activity

Consistent with the above policies and regulation of Republic of Moldova, the plausible alternatives outlined in section B.4 are further evaluated for their distinctness from the baseline scenario, conformity to the provisions of additionality and elkigibility as the project scenario.

Scenario 1: Abandonment of degraded lands from further use and migration of rural population in order for the degraded lands to regenerate through natural succession process over a long period.

Scenario 2: The historical and existing use of degraded lands leads to further degradation under growing population demands and will result in adverse impacts on adjoining lands.

Scenario 3: Investment in engineering structures in order to stabilize the degraded sites prone to land slides and soil erosion.

Scenario 4: Less degraded lands to be used for alternative agricultural uses and measures implemented to improve their productivity

Scenario 5: Restoration of degraded lands through afforestation and reforestation requires to be undertaken to prevent further loss in carbon pools.

As discussed in detail in Section B.4, the *scenario 2* is identified as the baseline scenario as per the baseline study. From the remaining alternatives to the project activity, *scenario* 1, *scenario 3 and scenario 4* alternatives are infeasible taking into account the reasons outlined in section B.4. The *scenario 5*, project activity implementation as a non-CDM project is not a plausible option as the elements of project activity such as investment needs of restoration, stakeholder collaboration, and cost effective use of technical capacity are of Moldsilva are only feasible provided the additional resources enable the project entity to overcome the multiple barriers that prevented the restoration of degraded lands in the past.

The lack of investment capacity of the Moldsilva and local councils and absence of incentives have discouraged investments in the restoration of degraded lands and are likely to continue to be so under the business as usual baseline scenario. For these reasons, *Scenario 5* - implementing the project activity as a non-CDM project is also not feasible. Implementation of this alternative as a CDM project partially helps to overcome the investment gap through the sale of CERs and permit the collaboration of Moldsilva and local councils for sharing the investment and revenue from implementing the alternative as the project.

The alternatives and their characteristics are summarized below.

Alternative scenario	**Project**	**Remarks**
1. Abandonment of degraded lands from further use	No	Considering the predominance of rural economy, this scenario is not likely to be realized
2. The historical and existing use of degraded lands lead to further degradation	No	Continuous use of degraded lands is expected to lead severe forms of landslides and erosion as these lands are often without vegetation and are often excluded from production. The small rates of planting undertaken at the historic rate do not also contribute in any significant measure.
3. Use of engineering structures to stabilize the land slides and to minimize erosion	No	Considering the large financial resources required accomplishing the task, this is an infeasible alternative
4. less degraded lands to be considered for alternative agricultural uses	No	Considering small and widely distributed degraded lands and their status as the public lands do not permit the lands to be used for alternative agricultural purposes. Moreover, alternative agricultural uses could over long-term increase the vulnerability to soil erosion and other forms of land degradation. Therefore, this alternative is not feasible
5. Restoring the degraded lands through afforestation and reforestation	Yes	This alternative is feasible provided the financial constraints of Moldsilva and local councils are at least partially offset by the supplemental revenue from the CERs under the CDM

For reasons outlined above, alternatives to project activity, i.e., scenarios 1, *scenario 3, and scenario 4* are **not** feasible, and scenario 2 is the baseline scenario. Therefore, only **scenario 5** has potential to evolve as the **project** scenario provided financing constraints are alleviated with the sale of CERs, if the project is implemented as the CDM project**.**.

Sub-step 1b. Enforcement of applicable laws and regulations

While the national laws and regulation of the Republic of Moldova on land use outline provisions for restoration of degraded lands these provisions are not implemented due to the lack of financial resources.

Sub-step 1c. Selection of the baseline scenario

The steps of approved baseline methodology AR AM0002 are used to select the baseline scenario. The details of baseline selection are presented in the section B2 above.

Step 2: Investment analysis

Investment analysis is undertaken in addition to the barrier analysis (step 3) to assess whether the project meets the additionality criteria.

Sub-step 2a. Determine appropriate analysis method

Option III. Benchmark analysis is used to evaluate the financial attractiveness of the project. The IRR and NPV are used as indicators of the investment analysis.

Sub-step 2b – Option III. Benchmark analysis

Considering the limited financial resources available with Moldsilva and local councils, an option is to borrow from a financial institution such as a national commercial bank for implementing the AR activity. The rate of interest of the banks for agricultural and rural development lending is selected as the required rate of return (RRR) to repay the loan. The benchmark required rate of return on the loan represents the opportunity cost of capital for the commercial bank.

The rate of interest charged by the following commercial banks was considered for selecting the required rate of return on the loan.

Victoria Bank[13]	16.5%
Banca de Economii[14]	15 to 20%

The lowest required rates of return of 15% charged by the Banca de Economii, is adopted as the discount rate for the project.

Sub-step 2c. Calculation and comparison of financial indicators

Investment analysis compares the discounted costs and returns of the AR CDM project. The cash flow analysis considers the costs incurred in site preparation, nursery activities, production of planting stock,

[13] http://www.victoriabank.md/eng/section/101/

[14] http://www.bem.md/en/services/sjuridicalper/credits/tariffs/

planting, tending, protection, thinning and harvesting and other expenditure incurred on the afforested area over a 7 year period. **Table 18** presents the cost estimates of afforestation and reforestation activity per hectare.

Table 18: Cost estimates of the AR activity ($ US/ha)

Activity	Robinia & assoc. sps	Quercus & assoc.sps	Poplar & assoc.sps
Site preparation			
Machinery & Manual	133	155	122
Establishment			
Seedlings	88.2	73.7	115.3
Planting, tending, thinning etc.	217	230	84.8
Gapfilling& maintenance	5	11.1	12.3
Weeding/weedicide	20	20	20
Pestcide spraying		19	
Infrastructure			
Transport of seedlings	35	21	32
Fencing/closure	120	180	120
Protection	19.9	19.9	19.9
Labour			
Skilled labour	13.5	22	4
Unskilled labour	236.1	255	71.9
Monitoring			
Inventory & monitoring	2.1	2.1	2.1
Validation& verification	4.1	4.1	4.1
Miscellaneous	30	45	15
Total	923.9	1057.9	623.4

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

The revenue from forest products during the 20-year crediting period includes the revenue from the sale of fuelwood and timber from thinning and harvest, as well as revenue from the sale of non-timber forest products such as honey, leases for hunting etc. **Table 19** presents the revenue per ha from forest products over a 20-year crediting period.

Table 19: Revenue from forest products per ha over a 20-year crediting period ($ US/ha).

Product	Robinia & assoc. sps	Quercus & assoc.sps	Poplar & assoc.sps
Revenue from Timber			
Sawn timber >14 cm	3		25
Timber for construction 12-24 cm	8		38
Secondary construction timber <11 cm	46	7.5	38
Fuel wood	69	5.6	40
Branches	21	15.9	19
Revenue from Non-Timber products			
Hunting lease	17	17	17
Bee keeping (fee)	26	26	26

Total	190	72	203

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Financial analysis is conducted to evaluate the profitability of the project at 20-year, 40-year, 60-year intervals, which coincide with renewable 20-year crediting periods. The rate of return of the project is also evaluated at 100-year horizon to evaluate the project performance over the longest rotation period of a major tree species (*Quercus sp)* of the project.

Financial performance of the project is assessed in *two* steps. In the *first* step, performance of the AR stand models on one hectare in each production class of land is assessed[15]. In the *second* step, performance of the overall project area is evaluated.

Performance at 20 years (1st crediting period);

Financial performance of the project is conducted using 15% required rate of return as it is the lowest bank lending rate changed by the Banca de Economii in Moldova. The results of the analysis presented in **Table 20** show that the discounted cash flow is negative in all strata. Considering that the degraded lands have very low productivity (site production class III and IV) and revenue during the first 20-year crediting period is limited to thinning, very small returns are anticipated from the project. The negative NPV for the crediting period shows that forestry activity is not a financially profitable option.

As the net present value over 20-year period remains negative at 15% RRR, analysis was repeated with lower rate of interest such as 10%. However, the performance of the project remains negative even at 10%. The financial analysis highlights the significance of discount rate in forestry projects[16]. The project demonstrates that it may not be profitable to undertake the AR project for the restoration of degraded lands even at a significantly lower rate of return than that of the required rate of return. Therefore, investment analysis demonstrates that the project is additional from the financial or investment analysis perspective. Calculations of the investment analysis are presented in **Annex 11**.

Table 20: Financial analysis of net benefits on one hectare of degraded land over 20-year period

Modules	**Cash flow per ha in years**								**Total**	**NPV per ha (USD) @15%**	**NPV per ha (USD) @10%**	**IRR %**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**				
Module 1/												
R III	-271	-251	-112	-67	-34	-7	13	43	-686	-428	-381	1
R IV	-271	-258	-123	-83	-53	-29	-10	17	-809	-537	-544	Negative
Q III	-346	-251	-137	-110	-60	-39	-18	8	-953	-668	-715	Negative

[15] These modules were defined during the initial stratification process. They are: Module 1, pasture land: Robinia productivity classes III and IV, Quercus III and IV, Populus III. Module 2, degraded land: Robinia III and IV.

[16] There is a long standing debate on discount rate for forestry investment and there are no standard rates that can serve as benchmarks. The long term forest investments for soil conservation and habitat protection often can not attain the high IRR and may not have financial return as the major objective considering the primary objectives of the project are to prevent soil erosion and to restore the ecosystem. The IRR of long term forest investments may not exceed 4% to 6%,

Q IV	-346	-252	-133	-113	-63	-42	-22	4	-966	-682	-738	Negative
P III	-238	-211	-59	-5	29	30	33	17	-405	-284	-232	3
Module 2/												
R III	-557	-214	-74	-5	26	35	37	43	-708	-531	-466	Negative
R IV	-557	-220	-77	-21	8	14	14	17	-824	-634	-618	Negative

Note: Module 1: Afforested areas in pasture land; Module II: Afforested areas in degraded land
R III – Robinia type site class III; RIV - Robinia type site class IV; QIII - Quercus type site class III; Q IV – Quercus type site class IV; PIII – Pinus type site class III

Source: Calculations based on the project data

Performance at 40-year (2nd crediting period) & 60-year crediting periods (3rd crediting period)

The financial performance at 40-year and 60-year crediting periods also indicates the negative NPV of the project (**Table 21**). The IRR of 40-year, 60-year, and 100-year horizons show that the AR project may not be profitable beyond 4% discount rate. The inclusion of carbon value marginally increases the tolerance for discount rate increase. This low return on forestry investment over a long period highlights the uneconomic nature of AR projects, which can not be justified primarily on the financial criteria. The low returns also highlight the low priority of the AR projects in the Moldova's public investments.

Performance with carbon and without carbon revenue

Table 21 presents the NPV and IRR of with carbon and without carbon project scenario at 20-year, 40-year, 60-year and 100-year periods. A comparison of the NPV and IRR of the AR project taking into account the CDM revenue from the sale of CERs from the carbon sequestered in the project shows that the financial performance of the project continues to be negative at the Moldova's bank lending rate of 15% and as well as at even the lower 10% interest rate. The analysis of IRR values shows the very low rate of return from the AR project. However, the revenue from the sale of carbon credits offsets the negative NPV by 25% to 30%. Considering the significance of the AR project in restoring the degraded lands, the carbon value is expected to play a positive role in encouraging the AR activity as the discounted revenue from AR project activity is unlikely to cover the discounted costs over the crediting period and project period.

Table 21: NPV and IRR of the project scenario taking into account revenues without carbon and with carbon at different time horizons

NPV/IRR	With Carbon	Without Carbon
Project horizon 100 years		
NPV (15%) (USD)	-7,521,322	-9,588,324
NPV (10%) (USD)	-5,961,204	-9,274,582
IRR	6.3%	5.0%
60 years - 3nd Crediting Period		
NPV (15%) (USD)	-7,528,761	-9,595,763
NPV (10%) (USD)	-6,090,450	-9,403,827
IRR	5.8%	4.1%

40 years - 2nd Crediting Period		
NPV (15%) (USD)	-7,547,291	-9,614,293
NPV (10%) (USD)	-6,213,264	-9,526,642
IRR	5.6%	3.7%
20 years - 1st crediting period		
NPV (15%) (USD)	-8,150,027	-10,190,638
NPV (10%) (USD)	-8,546,567	-11,792,823
IRR	negative	negative

Note: Project horizon is the project operating period, which coincides with the longest rotation length of the species type in the project.
Source: Calculations based on the project data

Sub-step 2d. Sensitivity analysis

Sensitivity analysis is conducted to examine the influence of timber price, project cost and carbon price. An increase in timber price has positive influence on the investment in AR project. However, there needs to be significant increase in timber price to reverse the overall negative return.

Plantation activities are labour intensive; therefore, change in labour cost can have a major impact on the project performance. A 10% increase in project cost has greater impact on NPV and IRR than that of a 10% increase in timber price as costs incur at the beginning of the project and timber revenue accrues late in the project period.

Increase in carbon price is expected to have positive impact on the project investment. However, carbon price needs to be doubled from \$3.5/t CO_2 to US\$ 7/t CO_2 in order to turn the negative IRR into positive over a 20-year crediting period. Therefore, higher price of carbon could have positive impact on the return from the AR activity.

Step 3: Barrier analysis

The following barriers relevant to the project context are considered in evaluating the additionality.

i) Investment barriers
- Large investment is concentrated in the early stages of the project, whereas the revenue from thinning and non-timber products could only start after 5-year period.

ii) Barriers due to prevailing practices.
- As degraded lands are under the control of Moldsilva or the local councils, the lands are used as common pool resources. Inadequate institutional arrangements limit the AR activity on land degradation.

iii) Technical/operational barriers.

- The improvement of degraded lands requires sound knowledge of restoration ecology, nursery and silvicultural practices of the species considered for AR, which can only be promoted by implementing suitable training programs.

- Lack of awareness of the environmental impacts of soil erosion and information barriers inhibit the local communities to actively participate in the management of degraded lands. The training and outreach programs implemented could generate awareness on the benefits of AR activities.

Step 4: Registration of the project as CDM activity

As the starting date of the project activity is before the date of validation, evidence on the role of the CDM in the decision to proceed with the project activity will be presented at the time of validation.

The CDM registration of the project is expected to generate additional revenue to Moldsilva and local councils from the sale of tCERs. The project has already been successful in improving skills and capacity of personnel by organizing training programs and conferences on forest management and generating awareness on the sustainable land management. Several training programs have been conducted to train the project personnel on aspects related to project management, monitoring and community awareness. The training and outreach programs organized under the project are as follows:

2001: National level workshops and training programs were organized to plan the design of the project.

2002 & 2003: National and forest enterprise level training programs have been organized to strengthen the implementation of the project.

2004: **Four** technical meetings were organized involving the representatives of forest enterprises to share on their information.

2005: **Three** technical meetings involving the representatives of territorial divisions of Moldsilva were organized to share experiences from the project implementation. A seminar on the implementation of national forestry strategies/programs was held in May 2005 with focus on the communication and outreach to local councils.

2006: An international conference was held to share the project experience among the participants from Albania, Belarus, Moldova and Romania.

C.7. Estimation of the *ex ante* baseline net GHG removals by sinks:

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The project takes into account the two possible land uses in the baseline scenario - (*i*) degraded bare lands and (*ii*) degraded lands on which small rates of planting occurred prior to the project (pre-project AR activity undertaken historically) that could be expected to continue in the absence of the project.

(a) Verifiable changes in carbon stocks in the carbon pools

(i) Degraded bare lands and degraded lands with isolated vegetation

Based on the results of baseline study, for degraded bare lands or for degraded lands with sparse non-woody vegetation, the *baseline net GHG removals by sinks* are set to zero for the crediting period as

these are expected to show a steady decline in the carbon stock as confirmed from the data analysis of the baseline study (Annex 3 on Baseline Information).

The trends in the carbon pools of degraded lands show a declining trend in the above ground biomass; declining or low steady state soil carbon and litter; and absence of deadwood component in the project area. Therefore, the net GHG removals in the baseline scenario are expected to decline over time or remain in a low steady state depending on the nature and intensity of land use.

The annual and cumulative change in the carbon stocks of the bare degraded lands is summarized in **Table 22**.The calculations show negative trend in the net baseline GHG removals for the degraded bare lands or degraded lands with isolated vegetation highlighting the continued degradation of these lands in the absence of restoration measures.

Table 22: Baseline GHG removals in the degraded lands (t CO_{2e})

Year	**Annual estimation of baseline net anthropogenic GHG removals by sinks – degraded lands - (tonnes of CO_2 e)**
2002	-4,686
2003	-12,495
2004	-16,897
2005	-20,336
2006	-22,340
2007	-22,229
2008	-21,631
2009	-20,997
2010	-20,733
2011	-20,296
2012	-20,098
2013	-19,764
2014	-19,835
2015	-19,595
2016	-19,196
2017	-19,406
2018	-19,064
2019	-18,933
2020	-18,701
2021	-18,772
2022	-18,532
Total estimated baseline net GHG removals by sinks (tonnes of CO2 e)	**Negative**

As all pools in the degraded lands under the baseline scenario are expected to decline, it is conservative to set the net change in the carbon stocks to zero. The cumulative loss of carbon in terms of the GHG is estimated at 394,534 t CO2e over 20 year period. Considering the negative net baseline GHG removals

by sinks expected during the crediting period, the net baseline GHG removals by sinks is assumed **zero** for the crediting period as per the equation B.1 of the methodology AR AM002.

$$\Delta C_{BDL\,ijk,t} = 0$$

where:

$\Delta C_{BDL,\,ijk,t}$ = average annual change in the carbon stocks of bare lands or degraded lands with sparse pre-existing vegetation in stratum *i* substratum *j* species *k* in t CO_2 yr^{-1} set to zero

i stratum of the baseline 1,2,3…*i*

j substratum of the baseline 1,2,3…*j*

k species of the baseline 1,2,3,...*k*

t 1 to length of crediting period

(ii) *Degraded lands with pre-project AR*

The pre-project AR rate is calculated as per the steps outlined in the AR AM0002. The pre-project planting data during 1992 to 2001 was used to calculate the percent of available degraded area planted – degraded land planted area during 10-year period from 1992 to 2001 relative to the degraded land available at the national level. The pre-project AR rate is presented in **Table 23**.

Table 23 (a): Rate of AR activity under the baseline scenario during 1994-2001 (ha)

Reference year	Area (ha) afforested during the pre-project period
1992	682.2
1993	514.3
1994	452.1
1995	426.1
1996	282.1
1997	204.0
1998	186.1
1999	165.1
2000	61.3
2001	226.6
Average annual pre-project AR undertaken in the country over 10-year period prior to the project	319.9
Total area of degraded land (ha) available for restoration through afforestation and reforestation activity at the national level in 2002	85,700
Annual pre-project AR rate (average annual pre-project AR area /Total area of degraded land available at the national level). This annual pre-project AR rate is applied to the area under project to calculate the baseline AR relevant for the project.	0.373%
Area afforested under the project out of the total available degraded	20,289.91

land of 85,700ha at the national level in 2002	
Average annual rate of pre-project AR applicable as the baseline AR to the project context	0.373% of 20,289.91ha = **75.7 ha**

Table 23 (b) Pre-project afforetation/reforestation in hectares applicable as the baseline AR rate each year during the crediting period

Year	Annual baseline AR rate applicable to the project (ha)
2002	75.7 ha
2003	75.7 ha
2004	75.7 ha
2005	75.7 ha
2006	75.7 ha
2007	75.7 ha
2008	75.7 ha
2009	75.7 ha
2010	75.7 ha
2011	75.7 ha
2012	75.7 ha
2013	75.7 ha
2014	75.7 ha
2015	75.7 ha
2016	75.7 ha
2017	75.7 ha
2018	75.7 ha
2019	75.7 ha
2020	75.7 ha
2021	75.7 ha
2022	75.7 ha

Pre-project AR undertaken as part of the baseline is estimated using equation B.2 of the methodology AR AM002 as below.

$$\Delta C_{BAR_{ijk,t}} = [\Delta C_{BAR\_LB\_Tree_{ijk,t}} + \Delta C_{BAR\_S_{ijk,t}}]$$

where:

$\Delta C_{BAR_{ijk,t}}$ = average annual change in the carbon stocks of pre-project AR attributable to stratum *i* sub-stratum *j* species *k* in t CO_2 yr^{-1}. (Considering the small amounts of pre-project AR activity, the sum of changes in the carbon stock of non-tree biomass - $\Delta C_{BAR\_NT_{ijk,t}} = 0$,

dead wood - $\Delta C_{BAR\_DW_{ijk,t}} = 0$, and litter - $\Delta C_{BAR\_L_{ijk,t}} = 0$ are expected to increase, therefore it is conservative to set them to zero

$\Delta C_{BAR\_LB\_Tree_{ijk,t}}$ average annual change in the carbon stocks of living tree biomass pools (above-ground and below-ground tree biomass) of the pre-project AR attributable to stratum *i* sub-stratum *j* species *k* in t CO_2 yr^{-1}

$\Delta C_{BAR\_S_{ijk,t}}$ average annual change in the carbon stocks of soil pool of the pre-project AR attributable to stratum *i* sub-stratum *j* species *k* in t CO_2 yr^{-1}

As per the baseline approach 22(a) adopted in the AR AM0002, the estimated *ex-ante* net baseline GHG removals by sinks are frozen for the crediting period. The baseline net GHG removals of the pre-project AR are summed over the period corresponding to the project scenario to maintain consistency between the baseline net GHG removals by sinks and the actual net GHG removals by sinks.

The baseline net GHG removals shall be estimated using equation B.3 of the approved methodology AR AM0002 as follows.

$$\Delta C_{BSL,t} = \sum_i \sum_j [\sum_k \Delta C_{BAR\ ijk,t} + \Delta C_{BDL\ ijk,t}]$$

where:

$\Delta C_{BSL,t}$ = baseline net GHG removals by sinks in year *t* in t CO_2e yr^{-1}

$\Delta C_{BAR_{ijk,t}}$ = average annual change in the carbon stocks of pre-project AR attributable to stratum *i* sub-stratum *j* species *k* in t CO_2 yr^{-1}.

$\Delta C_{BDL,\ ijk,t}$ = average annual change in the carbon stocks of bare lands or degraded lands with sparse pre-existing vegetation in stratum *i* substratum *j* species *k* in t CO_2 yr^{-1} set to zero

Table 24 presents the annual and cumulative estimates of baseline GHG removals by sinks.

Table 24: Baseline GHG removals by sinks from the pre-project AR activity (t CO_{2e})

Year	Annual baseline GHG removals from the pre-project AR activities
2002	0
2003	-440
2004	-195
2005	182
2006	649
2007	1,060
2008	1,681
2009	2,372
2010	3,136
2011	3,956

2012	4,825
2013	5,722
2014	6,629
2015	7,536
2016	8,434
2017	8,469
2018	9,364
2019	10,253
2020	11,172
2021	12,123
2022	12,399

Strict demarcation of pre-project AR in the baseline strata is not possible when data represents the regional or national level pre-project AR rate. The average annual GHG removals by sinks from the pre-project AR are estimated by multiplying mean carbon stock per ha of the species and average annual pre-project AR that is applicable as the baseline for each year of the AR activity under the project.

As the species used in the AR are common to the baseline and project scenarios. The methods and equations outlined for *ex ante* estimation of carbon stock changes in tree biomass and soil in the Section 7 (a.1.1) are used to estimate the net baseline GHG removals by sinks.

The baseline net GHG removals of the pre-project AR should be summed over the period corresponding to the project scenario to maintain consistency between the baseline net GHG removals by sinks and the actual net GHG removals by sinks. **Table 25** presents the baseline net GHG removals by sinks.

Table 25: Baseline net GHG removals by sinks (t co_{2e})

Year	Baseline GHG removals from bare lands and degraded lands (t CO_2 e)	Annual net baseline GHG removals from pre-project AR activities (t CO_2 e)	Baseline net anthropogenic GHG removals by sinks (t CO_2 e)
2002	*0*	0	0
2003	*0*	-440	0
2004	*0*	-195	0
2005	*0*	182	182
2006	*0*	649	649
2007	*0*	1,060	1,060
2008	*0*	1,681	1,681
2009	*0*	2,372	2,372
2010	*0*	3,136	3,136
2011	*0*	3,956	3,956
2012	*0*	4,825	4,825
2013	*0*	5,722	5,722
2014	*0*	6,629	6,629
2015	*0*	7,536	7,536

2016	*0*	8,434	8,434
2017	*0*	8,469	8,469
2018	*0*	9,364	9,364
2019	*0*	10,253	10,253
2020	*0*	11,172	11,172
2021	*0*	12,123	12,123
2022	*0*	12,399	12,399
Estimated baseline net GHG removals by sinks (t CO2 e)			109,962
Total number of crediting years		20	
Annual average baseline net GHG removals by sinks over the crediting period (t CO2 e)			5,498

Note: As per the methodology AR AM 0002, for the years in which the baseline net GHG removals by sinks represent negative values, they are assumed to be zero. This contributes to the conservative estimation of net anthropogenic GHG removals by sinks.

C.8. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:

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The baseline information includes data and information on plot-wise land use of the past and prevailing patterns of land use. Additionally, the baseline information also covers the following elements.

- Information on project area, project boundary, plot size, ownership, accessibility and resources
- Stratification of the project area; and
- Collection of baseline data and its analysis.

Data of completion of Baseline study: 16.05.2003

The persons/team preparing the baseline study: Gerald Kapp (Team Leader), Alexander Horst, Lutz Horn, Marten von Velsen-Zerweck – GFA Terra Systems; Dumitru Galupa, Ion Talmaci and Liliana Șpitoc – State Forest Agency, Moldsilva; Paul Grigoriev – independent biodiversity expert, Canada, Tudor Danii – Independent Service in Sociology and Information "Opinia".

Name	Specialty	Contact
Dr. Gerald Kapp	Forestry	gkapp@gfa-terra.de
Alexander Horst	Forestry	alexander-horst@gmx.de
Dr. Paul Grigoriev	Biodiversity	pg@econexus.com
Dumitru Galupa	Forestry and biodiversity	icaspiu@starnet.md
Lutz Horn	Agricultural economics	lutz_horn@compuserve.com
Dr. Tudor Danii	Sociology	tudan_opinia@mdl.net
Ion Talmaci	Forest economics	iontalmaci@mail.ru
Liliana Spitoc	Pedology	lspitoc@yahoo.com
Dr. Marten von Velsen-Zerweck	Forest Management	velsen@nserve.net

Reviewers of the baseline study:

Dr. Rama Chandra Reddy, Dr. Benoit Bosquet and Dr. Johannes Heister; Carbon Finance Unit, the World Bank

SECTION D. Estimation of *ex ante* actual net GHG removals by sinks, leakage and estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period

D.1. Estimate of the *ex ante* actual net GHG removals by sinks:

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a. Verifiable changes in carbon stocks in the carbon pools

For the scenario 5 (restoration of degraded lands through afforestation and reforestation activities), which is identified as the project scenario in section C.6 above case, the veriable changes in the carbonb stocks are assessed and *ex ante* estimation of net changes in actual GHG emissions by sinks is undertaken. The AR AM0002 provides for two options – empirical based method and model based approach for the ex ante estimation of carbon stock changes The version 2.0 of the CO_2FIX model[17] is used for *ex ante* estimation of carbon stock changes. The CO2FIX uses yield models of species and sequence of thinning and final harvest for projecting carbon stock changes. The CO2FIX model simulates the carbon sequestration dynamics of single species and multi-species stands on a per hectare basis at annual intervals. The yield tables of the species are used as inputs to the model along with the parameters selected for the allocation of biomass to various tree compartments. Carbon stocks are calculated as a balance between growth and loss of biomass from turnover, mortality and harvest. The outputs of per hectare CO2FIX models are transferred to the Excel Spreadsheets for further calculations of the GHG removals by sinks and for conducting the financial analysis of the project.

a. 1 Establishment of initial parameters in the CO2FIX model

The parameters chosen reflect the species characteristics in terms of growth and management regime represented through thinning and harvest and variables related to climate, soil, etc. The initial parameters are the initial values of carbon stocks of individual pools at year 0. Initial parameters need to be specified for each module. The parameters related to climate and soils can be selected from the region in which the project is located. The parameterization of CO2FIX model takes into account the variability in carbon stocks through variables of climate, soil, species characteristics, and management regime. As the model relies on data from yield tables that are managed under a silvicultural regime, yield parameters adequately represent the stand growth. In addition to stem volume, carbon content of dry matter and basic wood density are used as inputs for each stand model.

The steps in the parameterization of the CO2FIX model are outlined below.

Step 1: The factors influencing the carbon stocks are captured using the data and parameters from the respective yield tables of species, local studies, official publications, peer reviewed literature on vegetation, soil and climate of the region.

Step 2: The mean, median, and range considered for each parameter in the CO2FIX model is based on the local studies and literature relevant to the region.

[17] The documentation on the model is available at http://www2.efi.fi/projects/casfor/.

Step 3: The model projections are compared with the actual data to assess the robustness of the parameters.

Step 4: The CO2FIX manual is consulted for implementing the model and for its parameterization.

The results of the CO2FIX model are compared with the published data and further refinements to the parameters are implemented for realizing the projections. The biomass allocation coefficients (F) for foliage, branches and roots are expressed as a function of species growth rates and age. As with the stem growth rates, the biomass allocation parameters are refined based on the data from scientific and peer reviewed literature. The guidance of the user's manual of the CO2FIX model was followed in collecting the relevant data and for setting model parameters for ex ante projections. The initial parameters of the CO2FIX model used in the *ex ante* projections are summarized in the spreadsheet format is presented as **Annex 8**.

a. 2. Estimation of carbon stock changes in tree biomass

The Ukranian and Romanian yield tables of species that applicable to Moldovan context are used to estimate the ex ante carbon stock changes of biomass[18].

The yield tables report only merchantable stem volume and exclude information on branch and leaf biomass. The steps used in the estimation of carbon stock changes with the merchantable stem volume data are outlined below.

Step 1: The stem volume estimates from yield tables are collected and incorporated under the species files in the CO2FIX model.

Step 2: The biomass allocation coefficients of foliage (Ff) and branch (Fb) that are functions of stand age used as the parameters in the CO2FIX mode. The coefficients reflect the growth characteristics of species or species groups. The parameters on foliage and branch components are collected from ecological studies, research studies, and published literature. The CO2FIX manual also provides guidance on the sources of data and steps to be followed in the choice of initial parameters.

$$\Delta C_{AB\_Tree,ijk} = \left[G_{AB\_Stem,ijk} + G_{AB\_Branch,ijk} + G_{AB\_Foliage,ijk} \right] \bullet CF_k$$

where:

[18] Giurgiu, V. 1990. Ecuatia de regresie a volumului la arborii forestieri din Romania. Revista Padurilor 105 (3-4):145-150.
Giurgiu, V., Decei, J. and Armasecu. S., 1973: Biometria Arborilor Si Arboretelor Din Romania - Table Dendrometrice-. Editura "CERES", Bucuresti
Gosudarstvennyi Komitet SSSR po lesnomu hozeastvu. 1987. Normativno-spavochnye materialy dlea taksatstyi lesov Ukrainy I Moldavii. Kiev "Urojai"

$\Delta C_{AB\_Tree,\ ijk}$ = above-ground tree biomass increment in stratum *i* sub-stratum *j* species *k* in t.d.m. ha^{-1}

$G_{AB\_Stem,\ ijk}$ = stem biomass increment in stratum *i* sub-stratum *j* species *k* in t.d.m. ha^{-1}

$G_{AB\_Branch,\ ijk}$ = foliage biomass increment ($G_{AB\_Stem,\ ijk}$ * Ff) in stratum *i* sub-stratum *j* species *k* in t.d.m. ha^{-1}

$G_{AB\_Foliage,\ ijk}$ = branch biomass increment ($G_{AB\_Stem,\ ijk}$* Fb) in stratum i sub-stratum j species *k* in t.d.m.ha^{-1}

CF_k = carbon fraction for species k, dimensionless

Step 3: The model projections are compared with the biomass estimates from local studies on similar species types, including data from secondary studies and published literature so as to demonstrate the validity of the parameters.

Step 4: The projections of CO2FIX model are in the time steps of 1 year and take into account growth and loss of tree biomass during the year from harvest and disturbance. The growth parameters reflect the annual increases and losses of above-ground tree biomass.

$$\Delta C_{AB\_Tree,\ ijk} = A_{ijk} \bullet \sum_i \sum_j \sum_k \left(\Delta C_{AB\_Tree\_Growth,\ ijk} - \Delta C_{AB\_Tree\_Loss,\ ijk} \right)$$

where:

$\Delta C_{AB\_Tree,\ ijk}$ = annual change in the above-ground tree biomass in stratum *i* sub-stratum *j* species *k* in t C

$\Delta C_{AB\_Tree\_Growth,\ ijk}$ = annual growth in tree biomass in stratum *i*, sub-stratum *j* species *k* in t C. ha^{-1}

$\Delta C_{AB\_Tree\_Loss,\ ijk}$ = annual loss in tree biomass in stratum *i* sub-stratum *j* species *k* in t C. ha^{-1}

A_{ijk} = area of stratum *i* substratum *j* and species *k* in ha

The parameterization of the model assumes that the harvested biomass from thinning and harvest is subtracted from existing biomass and slash and deadwood from thinning and harvest are added to the soil module and are expected to decompose over time.

$$\Delta C_{AB\_Tree\_Loss,ijk} = \Delta C_{AB\_Tree\_Harvest,ijk} + \Delta C_{AB\_Tree\_Dist,\ ijk} \ )$$

$\Delta C_{AB\_Tree\_Harvest,\ ijk}$ = annual change in the loss of tree biomass from harvest in stratum *i* sub-stratum *j* species k in t d.m. ha^{-1} yr^{-1}

$\Delta C_{AB\_Tree\_Dist,\ ijk}$ = annual change in the loss of tree biomass from disturbance in stratum *i* sub-stratum *j* species *k* in t d.m. ha^{-1} yr^{-1}

a.3. Estimation of carbon stock changes in below-ground biomass

In the CO2FIX model, the relation between below-ground biomass and above-ground biomass is expressed as follows.

$$C_{BB_{ijk}} = [C_{AB\_Stem_{ijk}} \bullet R_{T,kF}]$$

where:

$C_{BB,ijk}$ = below-ground biomass of stratum *i* sub-stratum *j* species *k* in t.d.m. ha^{-1}

$C_{AB\_Stem,ijk}$ = carbon stock of stem biomass of stratum *i* sub-stratum *j* species *k* in t C ha^{-1}

$R_{T,k,F}$ = root biomass as fraction of stem biomass for species *k*, dimensionless

a.4. Estimation of carbon stock changes in non-tree shrub biomass

The shrub biomass is estimated by modelling the non-tree woody perennial species as a cohort of species *k*. The data on shrubs are collected from local studies and used to parameterize the shrub growth in order to estimate shrub biomass and its projected carbon stock change.

a.5. Estimation of carbon stock changes in deadwood

Mortality is estimated as a function of tree age or as a function of relative biomass (ratio of standing biomass to maximum stand biomass). The model also takes into account the decomposition fraction in modeling deadwood component. In the model, the deadwood is included under the coarse woody litter (stems and stumps) and to a lesser extent under short fine woody litter (fine and coarse branches, coarse roots). The data on natural mortality found in the literature and research studies and yield tables is used to parameterize the mortality variable as a fraction of the standing biomass in the **Biomass** main menu under **Mortality** tab of the model.

a.6. Estimation of carbon stock changes in litter

The data on litter estimates from literature are used to parameterize the CO2FIX model. Data on litter is either directly input into the model or estimated using the biomass module through biomass turnover, natural mortality, management mortality, and logging slash.

a.7. Estimation of changes in soil organic carbon

As noted in the monitoring plan, the sampling survey on the plantations in vicinity of the degraded sites of the project indicated that soil organic carbon which be reversed and actually increase under the AR activity. Therefore, the carbon stock changes in the soil are modeled using the CO_2FIX model.

CO2FIX model Yasso sub-model to simulate soil carbon dynamics taking into account decomposition and dynamics of soil carbon to calibrate the total stock of soil carbon. It uses parameters on soil, deadwood and litter and climate. The climate parameters used are the effective temperature (degree days above zero) over the year (°C d), precipitation (mm), and potential evapo-transpiration (mm). The soil module takes into account the non-woody litter (foliage and fine roots), fine woody litter (branches and coarse roots) and coarse woody litter (stems and stumps) components that undergo decomposition over time. The fractionation of litter determines the rate of decomposition in each time step as influenced by climate variables.

Assessment of uncertainty in the CO2FIX model

The parameters of the model take into account the variability of growth rates in species, carbon content, and humus decomposition, and multiple runs capture the uncertainty in the carbon pools. The scenario analysis of CO2FIX model can be considered robust in assessing the variability. The over or underestimation of actual net GHG removals can be minimized by correct identification of the site productivity of lands and by using the yield models that closely represent the site quality and species growth rates under the project scenario.

The CO_2FIX model usually makes conservative estimation of carbon stocks in the above-ground biomass and litter. As parameters for the CO_2FIX model are selected based on the data from project area, yield tables, and Good Practice Guidelines on LULUCF, the *ex ante* estimates are conservative. In order to account the risks from unanticipated events such as drought, pests, and fire, illegal felling and grazing, a 5% allowance is made to account for these risks. Therefore, the risk adjusted *ex ante* actual net GHG removals by sinks under the project estimates of the CO_2FIX model are conservative. Calculations of the actual net GHG removals by sinks are presented in **Annex 9b.**

a.7 Calculation of the carbon stock changes based on the CO2 FIX model output

Table 26 presents with and without risk adjusted *ex ante* GHG removals by sinks. The risk adjusted *ex ante* carbon stock changes are used in the calculation of the actual net GHG removals by sinks.

Table 26: Estimation of the project carbon stock changes (t CO_{2e})

Year	Estimated annual change in carbon stocks of the project	Annual Change in the carbon stocks of the project with 5% risk adjustment
2002	0	0
2003	9,913	9,418
2004	30,930	29,383
2005	62,675	59,541
2006	100,117	95,112
2007	124,378	118,159
2008	155,168	147,409
2009	180,004	171,004
2010	208,345	197,928

2011	240,047	228,045
2012	264,715	251,480
2013	282,346	268,228
2014	291,468	276,895
2015	298,552	283,625
2016	298,755	283,818
2017	230,393	218,873
2018	225,370	214,102
2019	222,336	211,219
2020	230,383	218,864
2021	278,187	264,278
2022	236,757	224,919
Estimated project carbon stock change (t CO2 e)	**3,970,839**	**3,772,297**
Total number of crediting years	20	20
Annual average project carbon change over the crediting period (t CO2 e)	**198,542**	**188,615**

b. GHG emissions by sources

As per the methodology AR AM0002, four categories of emissions, i.e., emissions from fossil fuels, emissions from the loss of non-tree biomass, emissions associated with biomass burning and emissions from fertilizer application are examined for the project context.

b.1 Calculation of GHG emissions from burning fossil fuels

The fossil fuels that are expected to be consumed by the machinery and transport vehicles in the project activities are used to calculate the GHG emissions as per the approved methodology AR AM0002. The emission factors for fossil fuels are used to calculate the emissions.

b.2 Calculation of the decrease in carbon stock in living biomass of existing non-tree vegetation

The degraded lands contain small quantities of non-tree vegetation. Based on the local studies the peak biomass of the degraded lands was estimated at 2.4 tonnes/ha. A portion of this herbaceous non-tree vegetation is expected to disappear in the site preparation activities or due to competition from the species planted. The biomass of herbaceous vegetation was estimated based on the area likely to be affected in the site preparation taking into account the spacing adopted for the plantation. Considering that manual and mechanical methods were used in the site preparation. It is assumed that 40% of the non-tree biomass (0.96 tonnes /ha) is lost in site preparation.

b.3 Calculation of emissions from biomass burning

As national regulation of the Republic of Moldova prohibits the burning of the biomass in the afforestation and reforestation activities, therefore the emissions from biomass burning are not relevant for the ex ante estimation purposes. However, any natural occurrences of fire will be monitored during the project implementation and recorded.

b.4 Calculation of nitrous oxide emissions from nitrogen fertilization practices

As **no** fertilizers are used in the project, therefore the nitrous oxide emissions are not relevant for the project activity. **Table 27** presents the increase in emissions from the AR project.

Table 27: Increase in emissions from the AR project

S. No	Year	Emissions from Fossil fuel combustion (t CO_2-e.yr^{-1})	Emissions from loss of biomass in site preparation (t CO_2-e.yr^{-1})	Emissions from biomass burning (t CO_2-e.yr^{-1})	Nitrous oxide emissions from fertilizer application (t CO_2-e.yr^{-1})	Total project emissions (t CO_2-e.yr^{-1})
0	2002	3,996	9,313	0	0	13,310
1	2003	6,094	8,973	0	0	15,067
2	2004	6,772	8,132	0	0	14,904
3	2005	7,214	7,473	0	0	14,687
4	2006	4,609	1,819	0	0	6,428
5	2007	2,374	0	0	0	2,374
6	2008	1,163	0	0	0	1,163
7	2009	356	0	0	0	356
8	2010	75	0	0	0	75
9	2011	155	0	0	0	155
10	2012	112	0	0	0	112
11	2013	108	0	0	0	108
12	2014	92	0	0	0	92
13	2015	24	0	0	0	24
14	2016	204	0	0	0	204
15	2017	203	0	0	0	203
16	2018	186	0	0	0	186
17	2019	171	0	0	0	171
18	2020	41	0	0	0	41
19	2021	124	0	0	0	124
20	2022	0	0	0	0	0
	Total					**69,784**

c. Estimation of actual net GHG removals by sinks

In order to calculate the actual net GHG removals by sinks, the project emissions are subtracted from the project carbon stock changes. The difference between the actual net GHG removals by sinks and baseline net GHG removals by sinks and leakage is used to calculate the net GHG removals by sinks.The total risk adjusted GHG removals by sinks over 20-year crediting period are estimated at 3,502,835 t CO_2e. **Table 28** presents the actual net GHG removals by sinks from the project.

Table 28: Actual net GHG removals by sinks from the project

S.No	Year	Annual risk adjusted carbon stock change (t CO_2-e.yr^{-1})	Project emissions (t CO_2-e.yr^{-1})	Actual net GHG removals by sinks (t CO_2-e.yr^{-1})
0	2002	0	13,310	-13310
1	2003	9418	15,067	-5649
2	2004	29383	14,904	14479
3	2005	59541	14,687	44854
4	2006	95112	6,428	88683
5	2007	118159	2,374	115785
6	2008	147409	1,163	146247
7	2009	171004	356	170648
8	2010	197928	75	197852
9	2011	228045	155	227889
10	2012	251480	112	251367
11	2013	268228	108	268121
12	2014	276895	92	276802
13	2015	283625	24	283601
14	2016	283818	204	283614
15	2017	218873	203	218671
16	2018	214102	186	213915
17	2019	211219	171	211048
18	2020	218864	41	218823
19	2021	264278	124	264153
20	2022	224919	0	224919
	Total	**3,772,297**	**69,784**	**3,702,513**

D.2. Estimate of the *ex ante* leakage:

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The ex ante estimation of leakage is done taking into account the mean distance travelled by project staff outside the project area and as well as the distance of the distance of nursery for transporting seedlings and the distance to market for the transport of forest products such as timber and fuelwood are used to calculate ex ante estimates of leakage. The IPCC emissions factors for gasoline (2.49 kg CO_2 /litre) and diesel (2.64 kg CO2/liter) are used in the calculation of leakage emissions. **Table 29** presents the leakage emissions associated with the project. Calculations of leakage emissions are presented in **Annex 9c.**

Table 29: Annual and cumulative leakage emissions associated with the project

Year	Annual leakage emissions (t CO_2-e.yr^{-1})
2002	115
2003	115
2004	115
2005	115

2006	298
2007	290
2008	291
2009	267
2010	154
2011	521
2012	478
2013	427
2014	375
2015	150
2016	743
2017	740
2018	685
2019	635
2020	205
2021	493
2022	493
Estimated leakage (t CO2 e)	7,705
Total number of crediting years	20
Annual average leakage over the crediting period (t CO2 e)	385

SECTION E. Monitoring plan

E.1. Monitoring of the project implementation:

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The monitoring plan follows the provisions of the Section III of the approved methodology AR AM0002. The monitoring steps and procedures of the methodology are applied to the project context.

E.1.1. Monitoring of forest establishment and management:

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Forest establishment:

The monitoring of the forest establishment will cover site preparation, planting and establishment of the forest as per the guidelines of AR AM0002.

Monitoring of site preparation and planting activities

- The monitoring of site preparation activities cover the identification and recording of the area under site prepration, amount of vegetation affected. These data form the basis for calculation of project emissions from the loss of biomass in site preparation
- Information on planting schedule, location, area, species planted will be recorded in plot journals and archived in the project database
- Information on the age class-wise area planted in each stratum and sub-stratum are confirmed through field surveys.
- Information on species composition and characteristics of planted species and as well as pre-existing vegetation, if any observed on the strata are recorded;• The spacing adopted and characteristics of the stand models are recorded in the project database;
- Survival rates of planted trees and shrubs are counted during the three months of the planting and replanting is done fill the gaps and the area and location of supplemental plantings undertaken to fill the gaps and recorded in the project database and identified on the strata maps;

Monitoring of post-planting activities to demonstrate the forest establishment

- Information on drainage, frost, and other climatic extremes that can impact stand establishment and stand growth will be recorded; surveys are conducted annually for first 3-years to evaluate the survivals rates and to fill the gaps and survival rates of planted stock should be established by undertaking surveys during the initial establishment period.
- Final survival check is conducted in the permanent sample plots at the end of third year of the plantation and survival percent estimated from the surveys conducted at the end of 3 rd year and recorded in the project database. The survival percent established after the 3rd year will be updated and reported for verification purposes.
- The number and periodicity of weeding and tending practices and the frequency of the use of herbicides will be monitored and recorded.

- If plantings on certain lands within the project boundary fail after 3rd year the information will be documented and excluded from project *ex post* carbon calculations.
- Information on the occurrence of droughts and floods and other emergencies will be monitored and recorded and the area affected by them will be taken into account the ex post calculations of the carbon stock changes.
- In case of fires, the causes, area affected, season, and duration of fire occurrence shall be also recorded and the emissions associated with the burning of biomass shall be calculated and accounted as part of project emissions.

ID number [19]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[20]	Recording frequency	Number of data points / Other measure of number of collected data	Comment
E1.2.1	Survival percent	percent	m	At the end of 3rd year	100%	The survival percent calculated from the permanent sample plots at the end of 3rd year is recorded
E.1.2.2	Plantation failures after year 3	Area in ha	m	At 5 year intervals	100%	Plantation failures due to natural (drought, flooding, fire etc) or anthropogenic reasons are recorded, area is deducted in the ER calculations and reported at the subsequent verification.
E.1.2.3	Natural and anthropogen -ic events	Alphanumeric	m	Quarterly - After the start of the project	100%	The natural and anthropogenic events occurring within and outside the boundary that influence the project and project boundary

Forest Management:
The monitoring of forest management activities will be implemented as per the guidelines of the AR AM0002 to demonstrate the forest management. Activities proposed to be monitored are outlined below.

[19] Please provide ID number for cross-referencing in the PDD.

[20] Please provide full reference to data source.

- Information on silvicultural management activities such as thinning, tending, harvesting, and other silvicultural operations that influence the GHG removals by sinks will be monitored and the information collected is recorded in the project database.
- Biomass removed in the disturbance associated with silviucultural activities such as thinning and harvesting will be monitored and recorded;
- Quantity of fossil fuels used in silvicultural operations, transport of equipment and personnel and other management activities carried out in the project boundary will be monitored and recorded and the quantity of fossil fuels used in the operations will be calculated and archived;
- As the project does not use fertilizer, GHG emissions fertilizer application will not be monitored and the emissions from this source are treated as zero in the project database.
- Information on the occurrence of fires or other natural or human induced disturbances and the area and biomass affected shall be recorded and reported;
- Deviations in the forest management activities implemented in the field and the ones outlined in the project design document will be monitored, and reasons for deviations will be recorded.

Table 30 illustrates the information to be collected on the forest management activities in order to calculate the carbon stock changes in the aboveground and below ground tree biomass.

Table 30: Information on the forest management activities to calculate the carbon stocks in the biomass

Stand ID: Quercus rubra species stratum								**Remarks**
	Quercus_rich soil			**Quercus_poor soil**			**Biomass burning from natural fires**	**Management measures that influence carbon stock changes**
Stand age	**Stand volume V_{ijt}**	**Thinning or harvest H_{ijt}**	**Fuel-wood FG_{ijt}**	**Stand volume V_{ijt}**	**Thinning or harvest H_{ijt}**	**Fuel-wood FG_{ijt}**		
	M^3ha^{-1}		m^3ha^{-1}	m^3ha^{-1}	m^3ha^{-1}	m^3ha^{-1}	$tNha^{-2}$	
1								
2								
3								
...								
Crediting period								

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Project Boundary:
Project boundary represents the boundaries of discrete land parcels on which project activities are implemented. The provisions of AR AM0002 on monitoring of the project boundary will be fully complied during the project implementation and monitoring of the project boundary will be conducted and relevant data are collected and archived in the project database and will be made available at the time of verification. The steps proposed to be implemented as part of monitoring are:

- Field surveys will be conducted at periodic intervals to verify that the permanent markers used to delineate the project boundary can be located on the ground;
- The project boundary is delineated using the GPS by measuring and recording the latitude and the longitude of the polygons that represent the geographical positions. Furthermore, field surveys are used to verify that the actual project boundary is consistent with the GPS coordinates and boundaries of the respective sites and species planted on them could be verified from the GPS and the field survey data;
- The information from the monitoring of on the project boundary would ensure that the land use and economic activities that occur outside the project are easily identified;
- Monitoring measures to assess the risk of fire and other natural events that occur within and outside the project boundary will be monitored as per the monitoring provisions on emergencies outlined in the monitoring plan;
- Personnel involved in the monitoring will be trained to identify the changes in the boundary and to record changes in the project database for reporting at the time of project verification.

ID number [21]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[22]	Recording frequency	Number of data points / Other measure of number of collected data	Comment
E.1.1.1	GPS coordinates	numeric	M	At the start of the project and at 5 year intervals	100%	The project boundary in terms of the latitude and longitude of the land parcels are recorded and monitored at 5 yearly intervals. Any changes observed to the project boundary during the field surveys will be recorded and reported to the DOE at the time of subsequent verification.

[21] Please provide ID number for cross-referencing in the PDD.

[22] Please provide full reference to data source.

E.1.2. If required by the selected approved methodology, describe or provide reference to, SOPs and quality control/quality assurance (QA/QC) procedures applied.

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Data *(Indicate ID number)*	**Uncertainty level of data (High /Medium/Low)**	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
E.4.1.1.07 Plot location	Low	Verification of the plot locations through random checks
E.4.1.1.09 No. of Trees	Low	Tree counts are taken on the nested plots. The data collection and recording procedures are randomly verified.
E.4.1.1.10 Diameter at breast height (DBH)	Low	Considering the large number of measurements taken, the measurement error is likely to be small. The random re-measurements are used to verify the prior measurements.
E.4.1.1.12 Tree height	Low	Measurement, data collection and recording procedures are subject to random re-measurements and verification.
E4.1.1.1.13 Merchantable volume	Low	The equations used in the estimation of volume shall be verified
E4.1.1.1.14 Biomass expansion factor (BEF)	Low	Data from available studies is compared to select the representative factors
E.4.1.1.15 Shrub/herb biomass	Low	Sampling, data collection and recording procedures are randomly verified.
E.4.1.1.17 Wood density	Low	Data from literature and local estimates shall be verified.
E.4.1.1.18 Litter	Low	Sampling, data collection, laboratory procedures are randomly verified.
E.4.1.1.19 Below ground biomass	Low	Data from literature and local estimates should be checked.
E.4.1.1.20 Root shoot ratio	Low	Data from literature and local estimates should be checked
E.1.1.21 Standing dead wood	Low	Measurements follow the procedures of live tree measurement. Data collection and recording procedures are verified as per the decomposition classes.
E.4.1.1.22 Lying dead wood	Low	Measurements on line intersect methods shall be verified, data collection and recording procedures are subject to random checks.
E.4.1.1.23 Total deadwood	Low	Calculations shall be verified
E.4.1.1.24 Soil carbon	Medium	Procedures on soil sampling, bulk density sampling and laboratory methods shall be randomly verified.
E.4.1.1.01 Distance travelled	Low	Data from project records shall be verified.
4.1.1.02 Number of vehicle types	Low	Data from project records shall be verified.
4.1.1.03 Vehicle emission factor (EF)		Verification of the emission factors used
4.1.1.04 Fuel consumption per km		Data from project records shall be verified
4.1.1.05 Fuel consumption for in transport	Low	The fuel consumption data from the project records can be verified.

E.2. Sampling design and stratification

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Project stratification

The stratification of the project is based on the species groups used in the project. The strata are further categorized into sub-strata based on the year of planting. The need for *ex post* stratification will be evaluated at each monitoring event based on expected disturbance, management activities that are different from the PDD description or variation in carbon stock change for each stratum and sub-stratum. Changes in the strata will be reported to the DOE for verification. A stratification map is prepared outlining the project boundaries, species composition, and year of planting. The physical features relating to the project boundary and management variables such as thinning and harvesting will be represented on the stratification map. The carbon stock changes in each stratum and substratum shall be monitored by adopting the sampling strategy outlined below.

(b) Sampling

A stratified sampling design is used to estimate the verifiable changes in carbon stocks in the carbon pools of the project and the corresponding sampling error. The monitoring data are based on the record of field measurements at each monitoring interval as per the monitoring frequency adopted for the pool. The nested plot approach is proposed for the measurement of the carbon pools since it permits efficient measurement of tree growth through time (e.g. a representative number of both small and large trees are measured on the same plots. The plot markers of permanent plots will not be prominently displayed to ensure that the sample plots do not receive differential treatment. The GPS coordinates would also be used to identify the plots.

Above-ground tree vegetation: Considering the large covariance between the observations at successive sampling events, permanent sample plots are used to estimate the changes in the biomass pool. Permanent sample plots facilitate the development of plot and management histories as the tree vegetation grows.

Non-tree vegetation: Considering the short duration of non-tree pools, temporary plots within the nested plots will be used and destructive sampling is used to estimate the pool. The number of plots used for measuring the non-tree vegetation will be based on the relative significance of herb and shrub layers and as per the steps and procedures outlined in the approved methodology AR-AM 0002.

Litter: A frame of constant size (e.g. 30 cm radius) is used to sample the litter. The frames can be located at four corners of the larger tree sampling plots to measure the litter biomass and steps and procedures outlined in the approved methodology AR AM0002 and monitoring plan will be used to evaluate the changes in the litter pool.

Soil: Considering the slow changes in the soil carbon, *m*onitoring of changes in the soil carbon will be done between 10 to 20 year intervals. Considering the productivity differences of the lands, the soil monitoring is costly. Therefore, In order to minimize the monitoring costs temporary plots will be used in order to compare the mean stocks of two *independent* temporally-separated pools during the monitoring interval.

Sample frame to target 10% precision level

A precision level of 10% in the mean with a 95% confidence interval is adopted for the estimation of carbon pools. The total error comprises sampling, measurement, model and other errors. Sampling errors account for more than 3/4 of total error. Therefore, in order to achieve a 10% precision level**,** a 7% sampling error needs to be targeted and the remaining 3% error can account other types of errors. By increasing the sample size and the plot size, it is possible to increase the precision and decrease the variability of the estimate. Within the overall precision level of 10%, different precision levels could be defined for individual pools taking into account the variation observed in the respective pools.

(i) Sample size

Using the equation M.1 and M.2 in Section III of the approved methodology is used to calculate the number of permanent sample plots and their geographic allocation. The sample size for subsequent monitoring interval will be modified if variation observed in carbon stock changes after the first monitoring event based on *n* samples. Annex 10 presents the spreadsheet calculations on the sample size requirements for the project.

Sample size for measuring the carbon stock changes in the carbon pools of biomass

The area covered under major species is used to calculate the sample size of the project. The equations M1 and M2 of the approved methodology AR AM0002 are used to calculate the sample size. A sample size of 209 permanent sample plots is estimated as the sample size required for monitoring the aboveground biomass. The sample size estimation assumes a standard deviation of 30% to 40% for Robinia (a major species of the project). Taking in to account lack of empirical data on biomass estimates in the early stages of the species, its fast growth and degraded nature of soils, this assumption is reasonable and conservative as it increases the sample size and reduces the variability in the carbon stock and its change. The sample size estimation procedures of the monitoring plan allows for increasing the sample size taking into account further variability observed in the biomass estimates. **Table 31 (a)** and **Table 31 (b)** present the number of sample plots calculated for monitoring the carbon stock changes in the above ground biomass. The sample size calculations will be revised further based on the availability of the species composition data of the major species groups.

Table 31 (a): Number of sample plots for measuring the changes in living biomass

Stratum no.	Project Stratum	Number of sample plots
1	Pinus_RichSoil	1
2	Pinus_PoorSoil	1
3	Poplar_RichSoil_Age0-3	1
4	Poplar_RichSoil_Age>3	1
5	Poplar_PoorSoil_Age0-3	0
6	Poplar_PoorSoil_Age>3	1
7	Quercus_RichSoil_Age0-3	3
8	Quercus_RichSoil_Age>3	4
9	Quercus_PoorSoil_Age0-3	1
10	Quercus_PoorSoil_Age>3	2
11	Robinia_RichSoil_Age0-3	81
12	Robinia_RichSoil_Age>3	61
13	Robinia_PoorSoil_Age0-3	19
14	Robinia_PoorSoil_Age>3	33
Total		209

Table 31 (b): Number of sample plots for measuring the changes in living biomass by forest enterprise

Forest Enterprise	Robinia sp	Quercus sp	Populus sp	Pinus sp
Şoldăneşti	4			
Tighina	22	2	1	
Pădurea Domnească	2			
Cimişlia	9			
Glodeni	13			
Hânceşti	7			

Nisporeni	6			
Codrii	1			
Comrat	19			
Chişinău	9	1		1
Plaiul Fagului	2			
Ialoveni	7			
Străşeni	4		1	
Silva-sud	15	4	3	
Călăraşi	3			
Iargara	15	1		
Teleneşti	4			
Ungheni	13			
Manta-V	7			
Bălţi	9			
Orhei	7			
Soroca	8	1		
Edineţ	8			
Total	**194**	**10**	**4**	**1**

Sample size for measuring the carbon stock changes in the soil

The rich and poor soils based on the soil productivity criteria are used to calculate the sample plots and their geographic allocation to different forest enterprises. A total of 131 sample plots are estimated in order to measure the carbon stock changes in the soil. **Table 32** presents the number of sample plots calculated for monitoring the carbon stock changes in the soil.

Table 32: Sample plots for assessing the carbon stock changes in the soil

Forest Enterprise	Rich soils	Poor soils
Comrat	7	4
Orhei	4	1
Cimişlia	5	0
Teleneşti	2	1
Hânceşti	2	3
Plaiul Fagului	1	0
Şoldăneşti	2	1
Pădurea Domnească	1	0
Chişinău	4	2
Silva-sud	10	4
Soroca	3	3
Edineţ	4	0
Glodeni	7	2
Iargara	8	2
Străşeni	1	1
Tighina	11	5
Manta-V	3	1
Ialoveni	4	1
Nisporeni	2	2
Bălţi	5	0
Călăraşi	1	0
Codrii	0	1
Ungheni	6	4
Total	**93**	**38**

(c) Allocation of plots

The sample plots will be designated systematically to cover the land parcels. Plots are assigned to forest enterprises and designated systematically by selecting a random start from the list, and consecutively assigning the plots. Within each planting site, plot locations have equal chance of representing the site.

The aboveground biomass and soil carbon sampling require separate monitoring frameworks. The permanent sample plots will be used for aboveground biomass monitoring. Each plot will have its coordinates recorded using a GPS. The plot corners of rectangular plots (5 m x 50m) will be located and the GPS coordinates are noted. Plot markers will not be prominently displayed to ensure that permanent plots do not receive differential treatment from forestry personnel.

Temporary sample plots will be used for monitoring changes in the soil carbon. It is not necessary that the same plots be revisited over time as soil carbon monitoring will focus on comparing the mean stocks of two *independent*, temporally-separated pools, temporary plots can be used. Thus, location of soil carbon plots will not be permanently marked.

During the sample plot establishment the field crew will follow a protocol in which all steps are recorded beginning with the starting point and surveying sample plots recording azimuth, horizontal distance and polygonal layouts and fixed points in the surrounding are recorded.

(d) Plot area

Plot area has major influence on the sampling intensity, stand density, and the resources needed in the field measurement. Therefore, increasing the plot area decreases the variability between two samples, which permits the use of small sample size at the same level of precision. The coefficient of variation of basal area increases as sample plot size decreases below 0.4 ha. Therefore, the plot areas of different strata shall be used to determine the optimum plot area that minimizes the coefficient of variation. The relationship between plot size and sample size is used to determine the sampling strategy that minimizes the overall cost of monitoring.

(e). Plot location

The permanent sample plots will be located systematically with a random start. This has been accomplished with the help of a GPS in the field. The use of geographical position system coordinates and random plot location permits the adequate representation of different sub-strata and strata of the project. The plot locations will be marked using magnetic markers or GPS systems to facilitate easy identification. The plot reference points such as plot centers will be located systematically with a random start using the GPS. The coordinates of GPS for each stratum and sub-stratum will be recorded. If a stratum consists of several dispersed geographic units, the plots will be located using the following the criteria.

- the total stratum area is divided by the number of plots to estimate the average area per plot; and
- the average area per plot shall is used to divide the area of the planting site to estimate the number of plots per each site to the nearest integer value.

E.3. Monitoring of the baseline net GHG removals by sinks, if required by the selected approved methodology:

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As per the approved methodology AR-AM0002, the project does not require monitoring of the baseline.

E.4. Monitoring of the actual net GHG removals by sinks:

>>

Data collection will be organized taking into account the carbon pools, sample frame and the number of plots. **Table 33** (in section E.4.1) outlines data to be collected on the project scenario in order to monitor the changes in carbon pools. Periodic checks of the data will be undertaken to verify the data consistency. The electronic spreadsheet formats will be used to archive the data and errors will be corrected and measurement error will be assessed. Monitoring data will be archived for 2 years following the end of the last crediting period.

The actual net greenhouse gas removals by sinks represent the sum of verifiable changes in the carbon stocks of pools within the project boundary, minus the increase in GHG emissions measured in CO_2 equivalents by the sources as a result of the implementation of the project activity and calculated as per the **equation M. 42** outlined in the approved methodology AR AM0002.

$$\Delta C_{ACTUAL} = \sum_{i=1} \sum_{j=1} \sum_{k=1} \left[\Delta C_{ijk} - GHG_E \right]$$

where:

ΔC_{ACTUAL}	=	actual net greenhouse gas removals by sinks in t CO2e yr^{-1}
ΔC_{ijk}	=	average annual carbon stock change in living biomass of trees for stratum *i* sub-stratum *j* species *k* in t CO_2 yr^{-1}.
GHG_E	=	GHG emissions by sources within the project boundary as a result of the implementation of an AR CDM project activity in t CO2e yr^{-1}

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E.4.1. Data to be collected in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity:

>>

Project data on verifiable changes in the individual carbon pools will be collected as per the steps of this monitoring methodology and procedures of the monitoring plan. The monitoring and data collection procedures will take into account ex post stratification, sampling and measurement procedures on the sample plots as outlined in detail in Annex 4 on monitoring plan. The calculation of the change in the stocks of carbon pools project will be done as per the equations M.4 to M.31 outlined in the Section III of the approved methodology AR AM0002.

The project utilizes data from yield tables and measurement of sample plots and where project specific data are not available, the published data that closely reflects the conditions of the project area will be used in the calculation of the GHG removals by sinks.

Table 33: Data to be collected to monitor the verifiable changes in carbon stock in the carbon pools

ID number [23]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[24]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
E.4.1.01	Stratum	Alpha-numeric		Prior to the project		Stratification criteria are based on physiography, soil, climate & vegetation characteristics
E.4.1.02	Sub-stratum	Alpha-numeric		Prior to the project		The criteria relate to year of planting in each stratum in order to identify age classes and vegetation characteristics
E.4.1.03	Precision level	%	e	Prior to the project	100%	10% precision level adopted for the purpose of QA/QC
E.4.1.04	Standard deviation of each stratum	Number	e	Prior to the project	100%	To estimate the number of sample plots in each stratum & sub-stratum
E.4.1.05	Sample size	Number	c	Prior to the project	100%	Calculated for each stratum and sub-stratum calculated based on equations – M.1 & M.2
E.4.1.06	Plot ID	Alpha-	*c*	Prior to the	100%	Identified and mapped for each stratum and sub-stratum

[23] Please provide ID number for cross-referencing in the PDD.

[24] Please provide full reference to data source.

		numeric		project		
E.4.1.07	Plot location	Alpha-numeric		5 year	100	Plot location is noted using permanent markets or GPS
E.4.1.08	Age of plantation	year	m	5 years	100% sampling plot	From the year of project plating
E.4.1.09	No. of trees	Number	m	5 year	Trees in plots	Trees are counted in the plots of each stratum.
E.4.1.10	Diameter at breast height (DBH)	cm	m	5 years	Trees in sample plots	Measurement of dbh as per at each monitoring event
E.4.1.11	Mean DBH	cm	c	5 years	Trees in sample plots	Calculated using the data on DBH
E.4.1.12	Tree height	dm	m	5 years	100% sample plots	Measured by plot and stratum of the sample frame
E.4.1.13	Merchantable volume	m^3	c	5 year	100% sample plots	Calculated using local allometric equations or by using the data on DBH and height
E.4.1.14	Biomass expansion factor	Ratio	e	5 year	100% of sampling plots	Locally estimated or collected from the published source
E.4.1.15	Shrub/herb biomass	kg	m	5 years	100% sample plots	If herb layer is not significant, it need not be measured. For shrub biomass, local shrub equations shall be developed. Estimated with equation M.16 & M.17
E.4.1.16	Wood density	kg/m^3	e	Prior to sampling	100% sample plots	Locally estimated or compiled from local studies, literature, and GPG/LULUCF
E.4.1.17	Carbon content	Ratio	e			The biomass is multiplied with the default value of 0.5 to convert biomass into carbon.
E.4.1.18	Litter biomass	tonnes C	m	5 years	100% sample plots	Litter sampling technique is used and dry weight is taken and samples. Litter biomass is calculated using equations M.25 & M.26
E.4.1.19	Below-ground biomass	Ratio	e	5 years	100% sample plots	Estimated, using root shoot ratio and above ground tree biomass using equation – M18, M.19 & M.20
E.4.1.20	Root-shoot ratio	Ratio	e	5 year	100% of sampling plots	From local studies or published literature
E.4.1.21	Standing deadwood	tonnes C	m	5 years	100% sample plots	It is measured on the lines of live tree measurements.
E.4.1.22	Lying deadwood	tonnes C	m	5 years	100% sample plots	It is measured using line-intersect method and estimated with equation – M.23 & M.24
E.4.1.23	Total deadwood	tonnes C	m	5 years	100% sample	Calculated with equation – M.21 & M.22

					plots	
E.4.1.24	Soil carbon	tonnes C	m	20 years	100% sample plots Samples taken from plots per stratum	Stratified sampling is used, bulk density and percent carbon derived. It is estimated using equations – M.27 to M.31
E.4.1.25	Area of stratum & sub-stratum	ha	m	5 year	100% of strata and sub-strata	Actual area of each stratum and sub-stratum
E.4.1.26	Sum of carbon stock changes in the biomass	tonnes C	c	5 year	100% sample plots	Calculated using equation M.4 &M.5
E.4.1.27	Sum of carbon stock changes in the soil	tonnes C	c	*10 to 20 years*	100% sample plots	Calculated using equation M.27
E.4.1.28	Sum of changes in carbon stocks CO2e	tonnes CO2e	c	5 years	100% Project data	Calculated using the equation M.5

E.4.2. Data to be collected in order to monitor the GHG emissions by the sources, measured in units of CO_2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary:

>>

The major sources of emissions under the project are from the use of fossil fuels in AR activities, loss of non-tree biomass in site preparation and biomass burning practices. As the project does not use fertilizers, no GHG emissions from this source will be expected. Therefore emissions from this source are ignored in the calculations. Monitoring data on verifiable changes in the project emissions will be collected as per the guidance of the methodology and the operating procedures implemented under the monitoring plan. Calculation of the project emissions will be done as per the equations M.32 to M.38 outlined in the Section III of the approved methodology AR AM0002.

Emissions from the use of fossil fuels

Project emissions associated with the use of fossil fuels in A/R project activities such as site preparation, transportation, and silvicultural activities would be calculated taking into account time of occurrence and duration of activities. The GHG emissions from fossil fuels would be calculated based on the data and information collected on the use of fossil fuels. The monitoring of fossils fuel use and collection of relevant information for calculation of GHG emissions from fossil fuel use would cover the following aspects

- Characteristics of machinery, vehicles and equipment and their periodicity of use in the project boundary.
- Categories of vehicle and machinery used in the project along with technical and operational efficiency characteristics.
- Amount of fuel used in each type of vehicle, machinery and equipment for completing unit project activity
- Quantity of fuel usage in the pre-project activities such as site preparation, nursery and planting stock development and project activities
- Data and information on the fuel use for specific project activities such as thinning, harvesting and other and silvicultural activities by machinery and equipment type
- Assumptions on the machinery and equipment use and default parameter values on GHG emissions from burning fossil fuels

Emissions from site preparation activities

Emissions from site preparation activities would be assessed by monitoring the information of

Step 1: The biomass affected in the site preparation activities would be calculated using sampling methods or estimated taking into account the spacing used in the stand models of AR activities.

- Area affected in the site preparation is assessed using sampling frame and as well as field surveys

- Amount of non-tree biomass associated with the area affected during the site preparation is recorded.

Step 2: Amount of biomass lost is calculated by multiplying the area affected in the site preparation with the biomass of the unit area affected by the fire and the carbon fraction of the biomass.

Emissions from natural fires

In compliance with national policy of Republic of Moldova, no burning of biomass is anticipated within the project boundary. Furthermore, considering the limited combustible material in degraded lands, fire is not likely to be a major source of project emissions. However, as risk of natural fire after the planting activity exists, fire control measures will be implemented and the area affected in the natural fires will be monitored and accounted as part of project emissions. The fire monitoring and fire control measures are outlined in the monitoring plan. As per the AR AM0002, The parameters on the GHG emissions from biomass burning are based on the Tables of Chapter 3 of Good Practice Guidance on LULUCF.

Step 1: The area subjected to biomass burning would be assessed using sampling methods and/or field survey methods and recorded in the project database.

Step 2: The amount of non-CO_2 emissions is assessed based on the CO_2 emissions from biomass burning, therefore, CO_2 emissions from biomass burning would be estimated as precursor to the estimation of non-CO_2 emissions.

Step 3: Data on combustion efficiencies are adopted from the Tables 3A.1.12, 3A.1.14 GPG/LULUCF) and data on emission factors of non-CO_2 gases are adopted from Tables 3.A 15 and 3.A.16 of GPG-LULUCF to estimate the emissions. The mean emission factors of CH_4 (0.012) and N_2O (0.007) that are released from biomass burning should be used.

Step 4: the amount of non- CO_2 emissions from the natural fires are calculated.

ID number [25]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[26]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
E.4.2.01	Diesel / gasoline consumption in AR activities	Liter	M	Annual	NA	Fuel consumption per unit area for site preparation /harvesting
E.4.2.02	Emission factor for diesel	kg/liter	E	At the start of project		National inventory, IPCC default value
E.4.2.03	Emission factor for gasoline	kg/liter	E	At the start of project	NA	National inventory, IPCC default value
E.4.2.04	Area of biomass loss in soil preparation	ha	m	At the start of the project	NA	Area of biomass loss from soil preparation is estimated based on the spacing of the species and method of site preparation. Calculated using equation M.34
E..4.2.14	Mean loss of biomass from natural fires per unit area	tonnes $d.m.ha^{-1}$	m	Annual	NA	Sample survey for strata and sub-strata before the occurrence of biomass burn
E.4.2.17	CO_2 emission from biomass burning due to natural fires	$t\ CO_{2e}\ yr^{-1}$	c	5 year	NA	Calculated using equations M.36, M37 & M.38

[25] Please provide ID number for cross-referencing in the PDD.

[26] Please provide full reference to data source.

E.5. Leakage:

>>

E.5.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed A/R CDM project activity:

>>

The major form of leakage under the project is due to the fossil fuel emissions associated with the transportation of personnel and products associated with the project to areas outside the project boundary. Which is calculated from the data collected on the project activities. The leakage from transport of project staff for activities associated with project and transport to areas outside the project boundary is calculated by monitoring the project activities that involve staff travel and product transportation to areas outside the rpoejct boundary. The project transport activities such as movement of nursery inputs, planting material from nursery to planting sites, translocation of labour, transport of harvested products to markets and for other end uses outside the project boundary are monitored and accounted. The leakage will be calculated as per the equations M.43 to M.44 outlined in the Section III of the approved methodology AR AM0002.

The fossil fuel emissions are proposed to be estimated based on the numbers of vehicles, distance traveled, fuel consumption, and emission factors. The data required for the estimation of leakage such as the distance traveled by the project to areas outside the project each year and amount of fossil fuels consumed in the transportation of the project personnel would be collected from the project monitoring data. The data on the quantity of the thinned wood, distance traveled to the market for the sale of thinned wood, and the quantity of fossil fuels consumed in the travel would be collected from the project records. The annual leakage associated with the transportation of project personnel and products to areas outside the project would be calculated using the steps are outlined below.

*Step 1***:** Collection of information on the distance traveled using different types of vehicles and their fuel consumption.

Assumptions with regard to distance of travel and use of vehicle types

Number of land parcels	Travel for field surveys and inventory (km) per parcel	Fuel consumption in field surveys and inventory (litres/km)	Travel related to protection & operations (km per parcel)	Fuel consumption in field surveys and inventory (litres/km)	Travel associated with project management & monitoring (for total project per year)	Fuel in project management & monitoring consumption (litres/km)
2472	15	0.13	15	0.13	100,000	0.1

Vehicel types used in the transport of personnel and products is expected to include include passenger cars and large commercial vehicles such as buses, trucks and tractors

Parameter values to calculating leakage from personnel and product transport.

Fossil fuels	Emission factors (kg/litre) CO2e
Diesel	2.63
petrol	2.40

The additional parameter from local studies, IPCC default factors and God Practice Guidance on LULUCF and Energy projects and published literature relevant to the project context would be used as required.

*Step 2***:** Adoption of emission factors for different types of fuel types

*Step 3***:** Estimation of CO2 emissions using bottom-up approach outlined in Good Practice Guidance for energy sector (IPCC 2000)

Monitoring of leakage prevention measures

The project is not expected to result in leakage from the displacement of pre-project grazing and other economic activities as the project design incorporated measures to enhance the socioeconomic status of communities and ensure that the pre-project activities such as grazing are not displaced to areas outside project. In order to ensure that pre-project grazing and other economic activities are not displaced, the project implemented socioeconomic measures outlined below, which would be monitored during the project implementation period.

- Implementation of livestock improvement and pasture management programs to improve livestock and pasture productivity and to avoid the displacement of low productive livestock.
- Benefit-sharing arrangements in the project area to ensure legally binding commitments of local stakeholders to prevent leakage from grazing and economic activities
- Assistance to livestock holders and improvements to the livestock/pasture management are intended to prevent leakage
- Implementation of participatory land-use planning is intended to avoid land-use conflicts resulting from grazing and other forms of leakage
- Incentives to households to pursue improved land use alternatives on the existing lands
- Imparting training in skill development programs to promote the alternative livelihood opportunities

ID number [27]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[28]	Recording frequency	Number of data points	Comment
4.1.01	Distance travelled	Kilometres	e	Annual		Monitoring data on the distance of travel per vehicle type
4.1.02	Number of vehicle types	Number	m	Annual		Based on the annual project records
4.1.03	Vehicle emission factor (EF)	Kg/km	e	Annual		Based on IPCC emission factors
4.1.04	Fuel consumption per km	Litre km^{-1}	e	5 years		Estimated from the monitoring data on the vehicle type and fuel type used
4.1.05	Fuel consumption for road transportation	litre	c	Annually		Calculated based on the project monitoring on the transport of products to and from project
4.1.06	Leakage associated with transportation					Calculated using equation M.43&M.44

E.5.2. Specify the procedures for the periodic review of implementation of activities and measures to minimize leakage, if required by the selected approved methodology:

>>

The project monitoring shall record the amounts of the fossil fuel use in the project related transportation to areas outside the project. The quality control and quality assurance will be implemented as per the standard operations procedures and the recommendations of the monitoring plan.

[27] Please provide ID number for cross-referencing in the PDD.

[28] Please provide full reference to data source.

E.6. Provide any additional quality control (QC) and quality assurance (QA) procedures undertaken for data monitored not included in section E.1.3:

>>

N.A. See section E.1.2

E.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

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Operational and management arrangements would include the following elements:

A. Moldsilva will be responsible for coordinating the project implementation;

B. Project Steering Committee will coordinate the activities of Ministries of Ecology and Natural Resources, Finance, Economics, Agriculture, Environmental NGOs, local and regional authorities, academia. The Project Implementation Unit (PIU) will serve as the secretariat for the Committee. The tasks of the committee would include dissemination of information on project implementation and best practices, coordination involving Moldsilva, local authorities and Ministry of Ecology on project financing and supervision.

C. Project Implementation Unit is responsible for day to day activities of the project implementation and coordination on the project monitoring plan, including verification and reporting. The PIU will ensure the implementation of the Emission Monitoring Plan (EMP) and will annually monitor the project progress and measure the impact of project activities against the baseline survey undertaken during project preparation. The PIU will undertake a systematic analysis of the project activities and the results of the monitoring activities will be fed back into the implementation process.

The Project Implementation Unit will be responsible for the following activities:

- Sustainability of the project planting activities through strengthening of the forestry management practices;
- Project co-ordination and knowledge management of project activities.
- Inventory and mapping of every sector with the use of GPS and GIS;
- Supervision of projects stipulations, plantation technique and technologies.
- Establishment of polygons and methodologies concerning the necessary measurements within the projects.
- Carrying out of project monitoring at initial phase, and after that in year V, X and XV;
- Verification of inventories of plantations;
- Preparation of annual reports;
- Formulation of recommendations for re-addressing and improvements of works (reparation, maintenance, assurance of integrity etc.);
- Preparation of recommendations concerning the management of new created communal forests;
- Preparing and carrying out workshops, training within the project.

Detailed procedures on the procedures of monitoring are outlined in section 12, Annex 4 on Monitoring Plan.

E.8. Name of person(s)/entity(ies) applying the monitoring plan

>>

The team comprising the following persons prepared and reviewed the monitoring methodology:
Dumitru Galupa, Liliana Spitoc, and Ion Talmaci, Moldsilva, Moldova
David Shoch and Sandra Brown, Winrock International, Ecosystem Services Unit, Washington DC
Dr. Rama Chandra Reddy; Dr. Benoit Bosquet and Dr. Johannes Heister; Carbon Finance Unit, the World Bank

SECTION F. Environmental impacts of the proposed A/R CDM project activity:

F.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

>>

The measures implemented as part of the project are expected to lead to several positive environmental impacts. The following measures implemented in the project are illustrative of the actions that enhance the positive environmental impacts.

- The tree species planted in the southern dry parts of the country are expected to survive and coppice better in the events of drought and natural fire occurrences. The *Quercus s, Robinia* sp and their associate species included in the plantation design generate significant biomass and enrich the soils.

- Increased biomass and litter levels reduce the run offs and improves the water holding capacity of lands and thereby contributing to the rapid rates of nutrient cycling and organic matter accumulation.

- Natural risks such as fire and pest management are addressed through a management plan. The management plan prescribes measures to avoid risk of natural fires to the afforested sites. The species mix of planting activity is expected to reduce fire and pest risk. Training and awareness generation activities proposed under the project are to limit the risks. Additionally, the risk adjustment to the calculation of GHG removals by sinks also lead to the conservative estimates of actual net GHG removals by sinks.

- The care employed in site preparation will lead to small amount of biomass and soil loss in the site preparation activities.

- The unregulated insecticides Karate and Dimilin 25 EK used in the project target a narrow range of pests and do not affect other species. Nevertheless, the persistence of chemicals, and their potential dispersal beyond project sites will be kept in view and remedial actions implemented.

- The major species types are grown mixed with associated species to improve the diversity of areas planted.

- It is planned to conduct selective thinning in order to limit the impact of canopy opening on the soils.

Analysis of the project demonstrated its positive environmental impacts, which are outlined below.

- The project is expected to conserve significant quantities of top soil and reduce severe forms of erosion.
- The project will regenerate soil profile and improve organic accumulation by 3-5 t/ha/year
- The project will mitigate the occurrences of landslides, thereby preventing the adverse impacts on the productivity of adjoining lands.
- Run off on lands is expected to decline and moisture holding capacity is expected to improve

- Productivity of agricultural lands adjoining the degraded lands is expected to increase over medium to long-term.
- The planting of native species will enhanced floral diversity. The herbaceous vegetation is also expected to increase the habitat diversity, species dispersal, and diversity.

Scoring the environmental impacts

The comparative assessment of environmental impact scores of the baseline and project scenarios helps to implement the specific measures to enhance positive impacts and minimize the negative impacts. With this objective, the baseline and project scenarios are scored on an ordinal scale of 0 to 3 in order to evaluate these scenarios on the environmental criteria.

Potential environmental impacts under the baseline scenario

The environmental impacts of the baseline scenario summarized in **Table 34** shows that the negative impacts of degraded lands strongly reflected on the soil, water, biodiversity and the landscape and will result to large GHG emissions over time. In the absence of interventions, negative impacts, the unsustainable land use is expected to continue and expand further resulting in more adverse impacts on the land and water resources.

Table 34: Potential environmental impacts of the baseline scenario

Land use category	Soil	Water	Climate	CO_2	Flora	Fauna	Landscape
Landslides	-3	-3	0	-2	-1	0	-3
Ravines	-3	-3	0	-2	-3	+1	-3
Other degraded lands	-3	-3	0	-1	-3	0	-2
Degraded arable lands	-3	-2	0	0	0	0	-1
Degraded pastures	-1	-1	0	0	0	0	0
Glades and open places	-1	-1	0	-1	-1	-1	+1
Subtotal-degraded lands	**-9**	**-9**	**0**	**-5**	**-7**	**+1**	**-5**
Subtotal-pastures	**-5**	**-4**	**0**	**-1**	**-1**	**-1**	**0**
Baseline impacts	**-14**	**-15**	**0**	**-6**	**-8**	**0**	**-5**

Note: Likely impacts were evaluated on a scale of +3 to -3; where +3 refers to major positive impact and –3 refer to major negative impact.
Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Potential environmental impacts under the project

The environmental impacts of the project are expected to be positive in terms of stabilizing slopes, preventing run off and improving water retention capacity. The project is expected to have positive impacts on the local livelihoods of local communities by ensuring the supplies of forest products. The higher levels of biodiversity in the afforested areas are expected to support the recreational activities on the project sites.

Water: The project impacts are expected to be positive in terms of rise in water table, decrease in run off, and improvement in water quality.

Climate: Planting activity will improve the microclimate and reduce the wind speed as the planted sites as windbreaks. The increase in the net anthropogenic GHG removals by sinks neutralizes the GHG emissions from degraded lands.

Landscape: Planting activity will also result in the decrease of landslides and gully formation, improve the diversity of landscape, promote the connectivity of forest patches, and improve the dispersal of flora and fauna. The afforestaion activities will improve the employment opportunities through nursery and plantation works and collection of non-timber forest products, thereby reducing the pressure on adjoin ing lands.

The **Table 35** below shows short term and long term impacts of the project scenario. All project impacts over the medium-term (5 years) and long-term (project period) are expected to be positive. The positive impacts of the project are particularly strong considering the impact of A/R activities on the several components of ecosystem such as soil, water, flora, and fauna.

Table 35: Short term and long term environmental impacts of the project

Activity	**Soils**		**Water**		**Climate**		**Flora**		**Fauna**		**Landscape**	
	ST	LT	ST	LT	*ST*	*LT*	ST	LT	ST	LT	ST	LT
1. Soil preparation	-1	+2	-1	0	0	0	-1	0	-1	0	-1	0
2. Planting	+3	+3	0	+1	+2	+2	+3	+3	+1	+3	0	+3
3. Maintenance	0	0	0	0	0	0	0	0	0	0	0	0
4. Replanting	+1	+1	0	+1	+1	+1	+1	+1	0	+1	0	+1
5. Disease control	-1	0	-1	0	0	0	-1	0	-1	0	0	0
6. Harvesting	0	0	0	0	0	0	0	0	0	0	0	0
7. Wood transport	0	0	0	0	0	0	0	0	0	0	0	0
Project impacts	+2	+6	-2	+2	+3	+3	+2	+4	-1	+4	-1	+4

Note: Likely impacts are evaluated on a scale from –3 to +3, where +3 refers to major positive impact and –3 refer to major negative impact. No road construction is planned. ST = short term (< 5 years), LT = long term (≥ 5 years).
Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

The monitoring procedures would ensure that the herbicides/weedicides used in the project would not have persistence as the herbicides/weedicides would be systemic and specifically targeted the weeds without leaving residues. Furthermore, the project monitoring teams would be trained in the correct methods of application and doses of herbcides in order to avoid the chances any unintended contamination or persistence effects.

Biodiversity impacts of the project

The study to analyze the biodiversity impacts of the project conducted by the Project Implementation Unit found that the project has significant positive impacts on the biodiversity in terms of increasing the floral and faunal diversity and enhancing the habitat diversity. The comparison of the Flora and Fauna columns of Table 35 and Table 36 indicate that on the long-term environmental impacts of the baseline scenario are negative, where as the long-term environmental impacts of the project scenario are significantly positive.

The biodiversity monitoring procedures outlined in detail in Annex 4 – Monitoring Plan for flora and Avifauna would be implemented during the project implementation and the findings on the biodiversity impacts of the project would be recorded in the project database and reported.

Environmental management measures proposed for implantation under the project

A set of measures presented in **Table 36** have both short term and long term relevance in terms of enhancing the positive environmental impacts. The measures are expected to be implemented by Moldsilva, Ministry of Ecology and Natural Resources and local councils. Measures relating to planting activity are to be implemented during initial years, whereas measures relating to soil and water conservation, tending and biodiversity conservation will be implemented throughout the crediting period.

Table 36: Measures preventing the occurrence of adverse environmental impacts

S. No	Measure	Years	Agency(ies)	Financing
1.	Planting activities: (a) soil preparation; (b) planting; (c) protection; (d) thinning and harvesting	1-5	FE, Moldsilva	Moldsilva
2.	Use soil conservation (contour ploughing, conservation tillage) & minimal mechanical preparation	1-5	FE	Moldsilva
3.	Use soil and water conservation measures to reduce erosion and prevent landslides	1-20	Moldsilva, MENR, FE, LC	Moldsilva,
4.	Use mixtures of trees and shrubs; increase habitat diversity by promoting shrubs and grasses	1-5	FE, Moldsilva	Moldsilva, MENR
5	Create forest margins and undergrowth using *Rosa canina*, *Prunus spinoza* etc. for food & shelter for fauna	1-5	FE	Moldsilva
6.	Carry out tending activities in late fall and winter that will cause less disturbance to fauna ;	5-20	FE	Moldsilva
7.	Close afforested sites to limit grazing pressure and hold consultations with stakeholders	1-5	FE	Moldsilva
8.	Connect afforested lands to an ecological network with natural habitats and protected areas	1-5	FE, LC	Moldsilva, MENR
9.	Promoting awareness generation, community participation and information dissemination	1-5	FE	Moldsilva MENR

FE – Forest Enterprise; MENR Ministry of Ecology and Natural Resources; and LC - Local Councils
Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Transboundary environmental impacts of the project

The project parcels cover small patches of land, e.g., more than two-thirds of the project area is covered under land parcels that are less than 20 ha. Considering the small size of the land parcel parches, no transboundary environemnatl impacts of the project are anticipated.

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>>

No negative impacts are anticipated from the project. Therefore, no environmental impact assessment (EIA) beyond the project study is warranted. The Republic of Moldova regulation and legal procedures do not require an EIA as part of the afforestation and reforestation activities. However, the project has conducted the EIA in 2003 and will be repeated as necessary.

The environmental due diligence requirements were completed by undertaking following activities.

- The Environmental Management Plan (EMP) was published in the local press and posted on the MECTD and Regional Environmental Centre before the signing of the Emissions Reductions Purchase Agreement (ERPA) in July, 2003.

- The Environmental Assessment report was posted on the MENR and Regional Environmental Centre websites in July, 2003.

- A report on the project baseline study was published by the Ministry of Ecology and Natural Resources in September 2003.

- Summary of the project and its Environmental Assessment was disseminated to NGOs, academia and state institutions.

- Moldova Forestry Institute in association with the Biodiversity Office of the Ministry of Ecology and Natural Resources organized a special project presentation on the environmental impacts of the project.

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2. above:

>>

The EIA was conducted in 2003 and further impact assessments will be conducted as necessary.

SECTION G. Socio-economic impacts of the proposed A/R CDM project activity:

The project is expected to reduce landslides, improve the productivity of degraded lands and will ensure the supply of fuelwood, timber, and non-timber products and employment opportunities to local communities. The timber supplies from the project will contribute to stable timber and fuelwood prices. The non-timber benefits such as medicinal plants, bee-keeping, fruits and berries (e.g. walnut), mushrooms, vines for basketry, game (rabbits, deer) and hunting leases are expected to improve near term revenue of the local councils. In the long run, additional benefits could result from tourism and recreation.

The project is expected to improve the management of communal lands and promote sustainable rural livelihoods. The mayoralities would be able to supply forest products from the project areas to poor and vulnerable groups (e.g. pensioners and female-headed households) at low cost.

The project will have positive impacts on the neighboring agricultural lands in terms of yield improvement and water holding capacity. In addition, site preparation, planting, weeding, tending, protection, thinning, and harvesting activities are the major sources of employment to local people.

The project design incorporated measures to enhance the socioeconomic status of communities and to ensure that their livelihoods are not affected and the pre-project economic activities are not displaced to areas outside project. The socioeconomic measures and programs implemented based on the feedback from public consultations at the level of local council, mayoralitiy, forest enterprise, judet, and national government contribute to the prevention of economic activity displacement. Therefore, no leakage from activity displacement is expected from the project. The socioeconomic measures outlined below are expected to enhance the positive socioeconomic impacts and as well as prevent the displacement of economic activities to outside the project.

Compensation of stakeholders and economic incentives

- Households affected by the project activities, e.g. the herders whose traditional grazing rights are restricted \afforested are expected to receive assistance from the project entity under a Japanese Grant of US$ 920.000 so that the rotational grazing is adjusted such that it is not shifted to areas that were not used for the purpose. The assistance is expected to contribute to livestock and pasture improvement programs and compensate households to pursue alternative activities and strengthen training programs for skill development in order to promote the alternative livelihood opportunities.

- Incentives to local communities to promote the management of afforested areas and other degraded public lands so that a good balance between economic and environmental benefits will enhance the protection of afforested areas.

Legal and institutional issues:

- The benefit-sharing arrangements of the afforestated areas organized in a way that ensure the legally binding commitments of the stakeholders;

- Amendments to the provisions of Forest Code increase the community and private sector participation in the forest management process;

- Strengthened institutional capacity of local councils and Moldsilva promotes the role of stake holders in the management of afforested areas;

Capacity and technical assistance:

- Harmonizing the planting activities with agricultural operations is intended to generate temporary employment opportunities to rural communities;

- Assistance to livestock holders and improvements to the livestock/pasture management are intended to prevent leakage;

- Development of integrated and participatory land-use planning is intended to avoid land-use conflicts;

Training local communities in forest management and soil conservation activities is intended to promote the long-term commitments of local communities to soil and water conservations measures.

G.1. Documentation on the analysis of the major socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

>>

The project will have positive impact on the local communities and their livelihoods and will generate additional income and employment. The plantation activities will be the major sources of fuel-wood and timber supplies and local population is expected to benefit from the increased availability of fuelwood. Up to 4 m³/ha/yr of fuelwood and timber is expected to be harvested sustainably from the areas planted under oak and associate species, and 8 m³/ha/yr fuelwood and timber from areas planted under *Robinia* and its associated species. The income from selling fruits of *Rosa canina* is expected to be in the range of 139-417 US$/ha/yr. The socio-economic benefits of short rotation species will higher than those of the long-rotation species.

The following socioeconomic indicators will be used to assess the socioeconomic impacts of the project.

- The number of seasonal and temporary jobs in seed collection, protection, and plantation created per year as a result of project activity.
- Number of permanent jobs created over the project period.
- Number of community forestry contracts signed between the project entity and local councils.
- Fuel wood supplied by the project entity to the local communities from afforested sites.
- Area under the control of the project entity on which grazing is permitted from year 10 onwards.
- Area of adjacent lands affected by the land slides and the population affected in the land slides.
- Number of communal groups of forest users or forest management committees trained in the soil conservation and forest management activities.

G.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socio-economic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to supporting documentation:

>>

The project sites were selected with the involvement of democratically elected local councils. During field visits, it was confirmed that only degraded lands with limited forage value will be made available to the project. Therefore, the project is not likely to displace community grazing. The findings of the socio-economic study also highlight the project's positive impacts in this regard.

The project helped to initiate consultations among stakeholders to improve the project impacts. The discussions on the following aspects helped to resolve stakeholder concerns.

- Land ownership of the afforested sites within the project;
- Socioeconomic impacts of the project in terms of supplies of fuelwood to local communities;
- Awareness to project activities among stakeholders, institutions, and local communities;
- Perceptions and impacts of changes in grazing regime;

- Awareness and information campaigns on the project benefits and the need to improve community awareness to soil conservation and forest management activities.

The project lands form small fraction of the area available for planting and the project land parcels are dispersed throughout the country. As a result, grazing and fodder is not likely to change after the planting. The local councils propose to improve the management of pastures so that fodder requirements are met from the existing lands. Therefore no leakage for fodder use is expected from the project.

G.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section G.2 above:

>>

Socioeconomic programs implemented serve to prevent leakage and address the issues related to income generation, employment opportunities and alternative grazing regimes. In this context, the financial assistance under the Government of Japan's grant of US $ 920,000 supports the income generation and natural resource management activities of the forest enterprises and contributes to the prevention of leakage. The grant supports the management of community pastures and forests through small grants under the following components

Improvement in natural resources management through training of local authorities and forest personnel in the management of pastures and forests in the southern, central and northern regions of the country, inventory of existing pastures and forests and measures to enhance their productivity and strengthening the role of rural communities' in the forest planning and management, including the development of private sector role in the management of degraded lands.

Investments carried out under the Small Grants Program (SGP) promote the integrated management of communal pastures and forests are intended to promote the capacity of local communities to improve the management of communal pastures and forests management. The small grants program will assist in the purchase of the seedling material, consulting services, training and capacity development of producers associations.

The actions to addresses the barriers in communication and dialogue among the stakeholders; information on the submission of applications for small grants offered, support to communication capacity of Moldsilva and organization of seminars in different regions helped to raise the awareness on to the restoration of degraded lands.

SECTION H. Stakeholders' comments:

H.1. Brief description of how comments by local stakeholders have been invited and compiled:

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The Republic of Moldova's Forest Code, Nr.887-XIII, 21.06.96, Art. 23 notes that the citizens and public associations have the right to obtain from the forestry and environmental authorities information on the condition of forestry and hunting funds, planned and implemented measures on the use of those funds, to propose and to carry out, in accordance with the legislation, measures on the use and the guard of those funds.

Law on the environmental protection Nr.1515-XII, 16.06.93, Art. 30. recognizes the right of all persons to have a) full, operative and free access to the information on environmental condition and population

health; b) the right to participate in disputes on draft laws, different economic programs or other related activities.

In compliance with the above national laws and regulation and CDM rules, stakeholder consultations were undertaken in the design of the project and continued during project preparation and implementation. The stakeholder consultations were in the form of formal and informal meetings and workshops. Consultations were helpful in obtaining stakeholder comments. The following consultations highlight the issues discussed in the consultations.

- February – March 2002 – consultations involving mayoralties and representatives of the state forest enterprises on issues related to land transfer.
- March – May 2002 – consultations involving the local communities and the representatives of Moldsilva (Mr. A.Ciobanu – deputy director general, Mr. P. Rotaru, Head of Forest Fund and Production Direction).
- November 22-23 2002 - presentation on the Moldova Soil Conservation Project at the Scientific Conference on Sustainable Development of the Forest Sector in Moldova.
- December 2002 – workshops involving the judet councils, mayoralties and sectors of Cahul, Calarasi, Chisinau, Drochia, Edinet, Falesti, Floresti, Glodeni, Hîncesti, Orhei, Rezina, Riscani, Singerei, Soldanesti, Soroca, Tighina. The participants included the representatives of Biodiversity Office (Mr. A. Teleuta), Moldsilva(Mr. P. Rotaru – Head of Direction, Mr. D. Galupa – Director Forest Research and Managemnt Institute), and state forest enterprises (Directors, Chief Forestry Engineers, Heads of forest districts).
- During 2003 to 2006, regular stakeholder consultations on project activities and implementation progress were undertaken at the local council, district and national levels. The detailed list of stakeholder consultations is archived in the project database.

H.2. Summary of the comments received:

>>

The following comments were received as part of consultation process.

- Participation of local communities in the selection of species for planting
- Procedures followed in the harvest and of non-timber forest products such as fruits, berries, hazelnuts, walnuts, medicinal plants, haymaking, and bee keeping.
- Permission for collection of fodder in the project area and measures to mitigate the risk of illegal grazing.

H.3. Report on how due account was taken of any comments received:

>>

Moldsilva provided detailed replies to the public and stakeholder comments and implemented measures the following measures to address the public comments and feedback received from the consultation process.

- Fodder collection and hay making in the afforested areas is permissible as per the forest code and regulations on haymaking and grazing are provided for areas under the forest fund.
- As per the provisions of Article 59 of the Forest Code, the grazing of cattle and other domestic animals on lands from the forest fund and in forest protection belts is prohibited. Therefore, grazing will not be allowed in the project area.

- The preferences of local people will be given priority in the planting activities. For example, community preferences for species such as *Rosa canina, Crataegus monogyna, Malus sylvestris, Prunus avium, Sambucus nigra, Cornus mas* are taken into account.
- As per Article 32 of the Forest Code, communities have access to the areas of forest fund for recreational purposes and harvest of non-timber products such as fruits, berries, walnuts, mushrooms etc.
- In areas that are not the habitats of the threatened species, collection of fruits, berries, walnuts, mushrooms, medicinal plants is permitted.
- The local communities can get temporary employment in planting activities.
- The communities also identified the improved recreation value of the forest created under the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

Organization:	**Prototype Carbon Fund, The World Bank**
Street/P.O.Box:	1818H St
Building:	
City:	Washington, DC
State/Region:	District of Columbia
Postfix/ZIP:	20433
Country:	USA
Telephone:	202-458-1873
FAX:	202-522-7432
E-Mail:	jchassard@worldbank.org
URL:	www.carbonfinance.org
Represented by:	Ms. Joelle Chassard
Title:	
Salutation:	Ms.
Last Name:	Joelle
Middle Name:	
First Name:	Chassard
Department:	Environment Department
Mobile:	
Direct FAX:	202-522-7432
Direct tel:	202-458-1873
Personal E-Mail:	jchassard@worldbank.org

Organization:	**State Forest Agency "Moldsilva"**
Street/P.O.Box:	Bd. Stefan cel Mare, 124
Building:	
City:	Chisinau
State/Region:	MD 2001
Postfix/ZIP:	
Country:	Republic of Moldova
Telephone:	373-22-277 349
FAX:	373-22-220 748
E-Mail:	Moldsilva@mdl.net
URL:	
Represented by:	Anatol Popusoi
Title:	Director General
Salutation:	Mr.
Last Name:	Popusoi
Middle Name:	

First Name:	Anatol
Department:	
Mobile:	
Direct FAX:	373-22-220 748
Direct tel:	373-22-277 349
Personal E-Mail:	Moldsilva@mdl.net

Organization:	Ministry of Spatial Housing, Spatial Planning and the Environment
Street/P.O.Box:	Rijnstraat 8, 2515 XP Den Haag
Building:	
City:	The Hague
State/Region:	
Postfix/ZIP:	
Country:	The Netherlands
Telephone:	+31-70-339-3456
FAX:	
E-Mail:	
URL:	http://international.vrom.nl
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	van Hagen
Middle Name:	
First Name:	Ferry
Department:	
Mobile:	
Direct FAX:	
Direct tel:	+31-70-339-3456
Personal E-Mail:	ferry.vanhagen@minvrom.nl

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding is expected from the Official Development Assistance and the Parties to the Annex I of the Kyoto Protocol for undertaking the project.

Annex 3

BASELINE INFORMATION

In accordance with the approved methodology AR-AM0002, the baseline corresponds to lands that are in severe state of degradation. These lands are categorized under degraded lands, pastures, glades, arable lands and abandoned agricultural lands. They lack natural regeneration, woody vegetation and manifest severe forms of soil erosion and landslides. As part of the baseline study, baseline information has been collected and analyzed to assess the baseline scenario. The baseline assessment was undertaken in the following steps.

1. Identification of carbon pools, measurement and analysis of data
2. Analysis of the status of carbon pools
3. Assessment of carbon balance and projection of carbon pools
4. Evolution of the baseline scenario

1. Identification carbon pools and their measurement

In order to conservatively estimate the carbon pools under the baseline scenario, the carbon pools are identified and measured using the steps outlined below.

- The project area was categorized in to degraded lands and pastures. These were further categorized into humus rich and humus poor sites and the information on land use, plot size, ownership, and accessibility classes was collected and evaluated.
- The ecological and socioeconomic assessment was undertaken by a group of experts from forestry, soil science, agricultural economics, biodiversity, and sociology on several aspects of land use and to collect detailed information on the factors influencing the carbon pools.
- A sample frame was designed taking into account the land-use, humus class, plot location, plot size, ownership, and accessibility.
- The carbon pools in the baseline scenario were identified and stratified sampling with a maximum possible tolerable error of 10% with 95% confidence interval was adopted to estimate the sample size.
- The carbon pools rich and poor soils were identified and measured and all carbon pools of the rich and poor soil strata are summed to calculate the total carbon stocks.
- Analyses of soil carbon was done in the local laboratory in Chisinau and further counter-checks of the standard soil samples was done at the two University soil laboratories in Göttingen and Freiburg in Germany.

Carbon pools in the baseline scenario

As the lands under the baseline scenario are largely degraded and lack woody vegetation, the above ground carbon pool is close to zero. The only notable carbon pools that could be observed were litter and soil. Accordingly, the samples were chosen for measurement.

Measurement of carbon pools

The sample plots chosen were systematically measured to quantify the soil and litter carbon pools.

Soil carbon
From each selected site, 10 soil samples were taken along a diagonal line at 100 m interval toward the relief change. For a group of 20 samples, one replicate sample and one standard reference sample was included. Samples were taken with a soil corer to a depth of 30 cm and collected in labelled cloth bags. For the determination of bulk density, 1 sample in three replications per site was taken in a depth of 17-22 cm, using standard bulk density cylinders of known volume.

Litter
Litter samples were collected using a standard frame of 50x60 cm. A total of 3 samples per each plot were collected. All litter down to the top of the mineral soil, including all dead plant material was collected, labelled in cloth bags, and sent to laboratory for analysis.

Analysis of data collected on carbon pools

The soil and litter samples were analyzed in the laboratory. Litter and soil bulk density samples were oven dried and weighed. The soil bulk density was then calculated as the dry mass divided by the volume of the core for a depth of 30 cm. Soils for carbon analysis were air dried, sieved trough a 2 mm mesh, and mixed sample was analyzed. Soil and litter carbon were determined with the Tiurin method[29].

For the reference sample check the result is as follows (carbon content in %):
C-content (Chisinau lab): 2.63 (mean of 4 samples)
C-content (Göttingen lab): 2.75 (difference to Chisinau lab: +4.4%)
C-content (Freiburg lab): 2.83 (difference to Chisinau lab: +7.1%)

The Moldovan method tends to *underestimate* the real carbon content (by about 5%), which is a conservative estimate.

[29] The Tiurin Method is based on the oxidation of soil humus carbon with excess of potassium bichromatum according to the formula:
$3\ C + 2\ K_2Cr_2O_7 + 8\ H_2SO_4 = 2\ Cr_2(SO_4)^3 + 2\ K_2SO_4 + 8\ H_2O + 3\ CO_2$,
where $3\ C0 + 4\ CrVI \rightarrow 4\ CrIII + 3\ CIV$.
Oxidation takes place in acid medium and is accompanied by reduction of hexavalent chrome in trivalent. Excess of bichromatum in the solution after acidification of humus is titrated with a solution of Mohr's salt:
$K_2Cr_2O_7 + 7\ H_2SO_4 + 6\ FeSO_4 = Cr_2(SO_4)^3 + 3\ Fe_2(SO_4)^3 + K_2SO_4 + 7\ H_2O$,
where $2\ CrVI + 6\ Fe^{2+} \rightarrow 2\ CrIII + 6\ Fe^{3+}$.
The difference of mg eqv. of bichromatum before and after acidification indicates organic carbon content in soil.

2. Analysis of the status of carbon pools

Analysis of carbon pools was done to assess the status of biomass and soil carbon pools.

Biomass carbon pools

The carbon accumulation in vegetation is close to zero in degraded lands and pastures as demonstrated by the absence of vegetation or its scatted nature. The land use has significantly diminished and the soil productivity due to uncontrolled grazing. Thus, according to information from the Moldovan Ministry of Agriculture, the average annual productivity of these lands is about 1 ton of dry mass/ha or 0.45 t C/ha. The litter sampling (14 sites) has provided even smaller amounts of litter (0.1 t C/ha). Under extensive pasture, annual herbs and grasses may not be able to increase the biomass on these lands.

Soil carbon

The assessment of soil carbon in the baseline follows the step 3a of the section II. 4 of AR AM0002 As per this step**,** historical and existing land use of the baseline scenario was analyzed taking into account the factors influencing the land use. For this purpose multiple sources of data were collected using sampling methods, archival sources, cadastral information and land management records prior to the A/R CDM project were used. These are used to demonstrate the decline in soil carbon under degraded lands as outlined below.

The soil sampling based on 14 sites revealed that the difference between the soil carbon (0-30 cm) averages of *degraded lands* (73 t/ha) is not different from the average soil carbon of *pasture lands* (86 t/ha), taking into account the size of the standard errors of the mean (9.95 and 9.41 respectively).

Significantly different soil carbon contents were however detected between the means of the subgroups "*humified and moderately humified soils*" (97 t/ha) and "*slightly humified soils*" (54.5 t/ha). These groups were also more homogeneous with small standard deviation of the means. The mean of soil carbon over 14 sites was estimated at 79 t/ha with a standard error of 6.93 t/ha. The eroded soils on steeper slopes were found to have significantly low humus content.

The soil carbon pool (basically litter and humus) has inflows (through plant growth) and outflows (through mineralization (dehumification) and erosive displacement of soil with its carbon). Under the prevailing circumstances of unsustainable use, the *soil carbon inflows through pasture plant growth* will at best remain constant. Its rate can be estimated, according to the data of the Ministry of Agriculture and Alimentary Industry (pasture productivity 0.45 t C/ha/yr) and assuming 50% is lost through animal feeding), to be around 0.225 t C/ha/yr.

Soil carbon outflows occur at a higher rate: As per **Table A1** the annual losses of soil carbon vary on slopes of 2-8° inclination from 0.69-0.87 t C/ha/yr. This contains a share of 0.23-0.35t C/ha/yr from the dehumification process[30].

Table A1: Loss of soil, organic matter, and carbon from lands through erosion

[30] Using a conversion factor of 1.724 for 0.4-0.6 t of humus loss/ha/yr gives the values of 0.23-0.35t C/ha/yr. The forest carbon model CO2FIX calculates a similar mineralisation loss of 0.11-0.27 t C/ha/yr. .

Slope (°)	Grade of erosion	Dehumification (t/ha/yr)	Loss of soil through erosion (t/ha/yr)	Loss of humus through erosion (t/ha/yr)	Total loss of organic carbon (t/ha/yr)
0	no erosion	0.6	0	0.00	0.35
1-2	slight	0.6	10	0.35	0.55
2-4	little	0.5	20	0.70	0.69
4-6	moderate	0.4	30	0.90	0.75
6-8	strong	0.4	50	1.10	0.87
8-10	excessive	0.3	60	0.90	0.69

Source: Sistemul informational privind calitatea invelisului de sol al Republicii Moldova(banca de date), Chisinau, Pontos, 2000; Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

The most likely development of soil carbon on the project sites is therefore an annual decrease of 0.2-0.7 t C/ha, depending on the actual site conditions, especially slope and grazing pressure. In the CO2FIX carbon model, a conservative approach was used with an average initial carbon stock of 78.7 t/ha, annual mineralization carbon losses of 0.1-0.3 t/ha, losses to light erosion (0.35-0.4 t/ha) and carbon inflows from grass & herb growth (0.225 t/ha). The predicted carbon losses over 20 years are about 8 t/ha (Table A2). In 100 years the forecasted soil carbon stock of the baseline reaches a value of 48 t/ha and the initial soil will have lost then 30 t/ha of C.

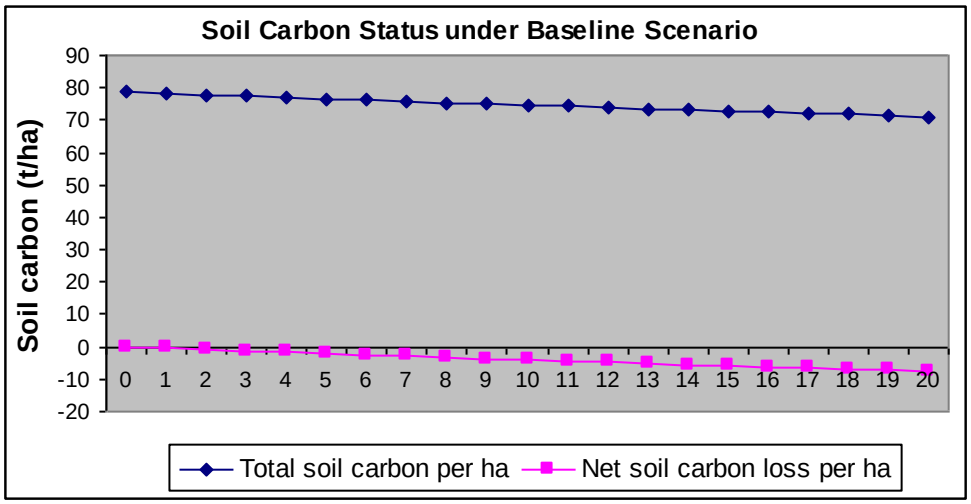
Table A2: Soil carbon development predictions over 20 years.

Years	Soil Carbon with mineralization losses (t/ha)	Annual loss of C due to soil erosion on 2-4° slope (t/ha)	Annual C gain through grass & herb growth (t/ha)	Total Soil Carbon (t/ha)	Net Soil carbon loss compared to initial C value (t/ha)
0	78.7	-0.40	0.225	78.70	0.00
1	78.5	-0.40	0.225	78.30	-0.41
2	78.2	-0.40	0.225	77.85	-0.85
3	77.9	-0.40	0.225	77.42	-1.29
4	77.7	-0.40	0.225	77.00	-1.70
5	77.5	-0.40	0.225	76.59	-2.11
6	77.3	-0.40	0.225	76.20	-2.50
7	77.0	-0.40	0.225	75.81	-2.89
8	76.8	-0.40	0.225	75.43	-3.27
9	76.6	-0.40	0.225	75.05	-3.65
10	76.4	-0.40	0.225	74.68	-4.02
11	76.2	-0.40	0.225	74.31	-4.39
12	76.0	-0.40	0.225	73.94	-4.76
13	75.9	-0.40	0.225	73.57	-5.13
14	75.7	-0.40	0.225	73.22	-5.48
15	75.5	-0.40	0.225	72.85	-5.85
16	75.3	-0.40	0.225	72.50	-6.20
17	75.1	-0.40	0.225	72.14	-6.56
18	75.0	-0.40	0.225	71.80	-6.90

19	74.8	-0.40	0.225	71.44	-7.26
20	74.6	-0.40	0.225	71.10	-7.60

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Figure: A1 Soil carbon status under baseline scenario



Based on the assessed carbon status of the carbon pools, two approaches are used to estimate the carbon balance:
a) Carbon balance and dynamics based on the field data
b) Carbon balance and dynamics based on cadastre information

Carbon balance and dynamics based on field data

The projection based on the measurements of carbon pools in the field plots, the carbon status of vegetation and soil in the different land-use classes and its likely development is projected (Table A3):

Table A3: Carbon stocks and dynamics

Land-use class	Area (ha)	Carbon in vegetation (t C/ha)	Soil carbon (C t/ha)	Total Carbon stock (t)	Carbon Dynamics (t/ha/yr)
Degraded lands	**4610.81**			**356286.62**	
Humified and moderately humified soils (Rich Soils)	2683.65	0,1	96.9	260,314.05	-0.6
Slightly humified soils (Poor Soils)	1927.16	0,1	49.7	95972.57	-0.5
Pastures	**15679.1**			**1387556.81**	
Humified and moderate humified soils (Rich soils)	11659.97	0,2	96.5	1127519.09	-0.5

Slightly humified soils (Poor Soils)	4019,13	0,2	64,5	260,037.71	-0.4
Totals	***20289.91***			***1743843.4***	

Source : Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

Carbon balance and dynamics based on cadastre information

The cadastre information and the average carbon content in each land use is used to assess the carbon balance and its likely evolution Table A4 presents the carbon balance and dynamics based on cadastre information. The main carbon losses that will occur as a result of diminishing soil fertility are due to soil erosion process. Thus, according to this methodology it is established that the annual soil losses through erosion constitute on average 1.5 t of fertile soil on pastures and 1.6 tons on degraded lands.

The share of carbon in humified and moderate humified soils (average humus content – 2.5%) constitutes in average 14.5 kgC/1t of fertile soil, but in slightly humified soils (average content of humus – 1.5%) – 8.7 kgC/1t of fertile soil. In case of pastures, the annual losses of carbon from erosion from 1 ha of humified and moderate humified soils will constitute 21.8 kg, and for slightly humified soils – 13.1 kg. For degraded lands the corresponding losses on humified and moderate humified soil will constitute 23.2 kg, and on slightly humified soils – 13.9 kg.

Table A4: Total soil carbon stocks and dynamics

Land-use class	Area (ha)	Carbon in vegetation (t C)	Soil carbon (t C)	Annual carbon loss (t C/yr)
Degraded lands	**4610.81**	**0,0**	**355825.5**	**-10391.0**
Humified and moderately humified soils (Rich Soils)	2683.65		260045.7	-9962.0
Slightly humified soils (Poor Soils)	1927.16		95779.9	-429.0
Pastures	**15679.1**	**141111.9**	**1384421.0**	**-4602.8**
Humified and moderate humified soils (Rich Soils)	11659.97	104939.7	1125187.1	-3813.0
Slightly humified soils (Poor Soils)	4019.13	36172.2	259233.9	-789.8
Totals	***20289.91***		***1740246.5***	***-14993.8***

Source: Project Implementation Unit, Moldova Soil Conservation Project, Moldsilva, Chisinau.

The results of the two approaches are relatively similar in that the soil carbon levels predict reduced carbon stocks over long term.

Assessment of change in soil organic carbon

As per the section II.5 of the AR AM0002 methodology, two categories of land use was evaluated for soil organic carbon under the baseline scenario, i.e., (*i*) degraded lands and (*ii*) degraded lands on which small rates of planting was undertaken in the baseline scenario (AR activity implemented prior to the project).

(i) Degraded lands

The sampling procedures outlined in Annex 3 of the PDD under the baseline information demonstrated a continuous decline in soil organic carbon and as well as the baseline net GHG removal by sinks. Therefore, the *baseline net GHG removal by sinks for these lands is* set to zero as per the **Equation B.1** of the AR AM002. This is done to establish the degraded status of lands under the project and not for the quantification purpose.

(*ii*) Degraded lands on which small rates of pre-project planting

The share of pre-project planting is insignificant in relation to the total available degraded land (average annual rate of 75.7 ha or 0.373% of available degraded land was planted annually during the 10-years prior to the project). Furthermore, pre-project planting was scattered throughout the country, precluding a strict demarcation of pre-project AR strata under the baseline.

To calculate the change in soil carbon pool for areas corresponding to pre-project strata, the methods outlined in the *ex-ante* estimation of changes in soil organic carbon under the section II. 7 (a.5) of AR AM002 were considered to establish the parameters. The variables influencing soil carbon such as soil depth, bulk density, and concentration of soil organic carbon in areas representing the pre-project was collected.

The parameters of *ex ante* estimation were used as the initial parameters for soil carbon under the CO_2FIX model. As the soil carbon dynamics in planted areas is dependent on deadwood, litter, soil and climate, these parameters were collected from several sources. The information on average climate parameters such as effective temperature (°C), precipitation (mm), and evapo-transpiration (mm) during the year for Moldovan national context was taken into account. The parameters influencing the soil organic carbon in areas corresponding to pre-project planting were used in the CO2FIX model to calculate the change in soil carbon as outlined in **Equation B.3**.

Considering the very small proportion of annual pre-project planting and slow rate of change in the soil organic carbon, the baseline net GHG removals by sinks was found to be insensitive to the small changes in soil carbon attributable to the pre-project AR activity and it was found that change in the sol organic carbon of pre-project activity planting does not alter the net negative change in the carbon pools of the baseline.

3. Carbon balance in the baseline scenario

The analysis of carbon balance in the baseline taking into account the changes in different carbon pools indicated a negative change in the carbon stocks of different pools. The baseline scenario was examined in the context of available data and the likely development of baseline carbon stocks depends on the following factors.

- The available data *on carbon stocks* in the project sites, including information from cadastre, soil type and plot size, biomass productivity and soil and litter carbon sampling data from field studies.
- The results of baseline study on the baseline development are consistent with the data from published literature on mineralization and erosion processes.

Based on the specified error margins on field data and data from literature, the results on the baseline assessment are robust and the possibilities that the actual baseline carbon stock differing the baseline study estimates are small.

4. Evolution of the baseline scenario

The assessment that the decline in carbon pools in the baseline scenario and net negative GHG removals in the baseline is conservative, transparent and is expected to be relevant for the first crediting period. At the end of the first crediting period, a similar study to assess the baseline could serve as the basis for the next crediting period.

Annex 4

MONITORING PLAN

Enclosed as separate document

Annex 5

LIST OF LAND PARCELS OF THE PROJECT AND THEIR CHARECTARISTICS

Enclosed as separate document

Annex 6

LAND USE OF THE PROJECT LAND PARCELS

Enclosed as separate document

Annex 7

EVIDENCE DEMONSTRATING CONSIDERATION OF THE CDM IN UNDERTAKING THE PROJECT

Enclosed as separate document

Annex 8

PARAMETERS USED IN *EX ANTE* ESTIMATION OF THE ACTUAL NET GHG REMOVALS BY SINKS

Enclosed as separate document

Annex 9a

SPREADSHEETS SHOWING *EX ANTE* ESTIMATION OF THE BASELINE GHG REMOVALS BY SINKS

Enclosed as separate document

Annex 9b

SPREADSHEETS SHOWING *EX ANTE* ESTIMATION OF THE ACTUAL GHG REMOVALS BY SINKS, AND LEAKAGE

Enclosed as separate document

Annex 9c

SPREADSHEETS SHOWING *EX ANTE* ESTIMATION OF LEAKAGE EMISSIONS

Enclosed as separate document

Annex 10

SPREADSHEET SHOWING SAMPLE SIZE CALCULATION

Enclosed as separate document

Annex 11

SPREADSHEETS SHOWING CALCULATIONS FOR INVESTMENT ANALYSIS

Enclosed as separate document

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History of the document

Version	Date	Nature of revision
04	EB35, Annex 20 19 October 2007	• Restructuring of section A; • Section “Monitoring of forest establishment and management” replaces sections: “Monitoring of the project boundary”, and “Monitoring of forest management”; • Introduced a new section allowing for explicit description of SOPs and quality control/quality assurance (QA/QC) procedures if

		required by the selected approved methodology; • Change in design of the section "Monitoring of the baseline net GHG removals by sinks" allowing for more efficient presentation of data.
03	EB26, Annex 19 29 September 2006	Revisions in different sections to reflect equivalent forms used by the Meth Panel and assist in making more transparent the selection of an approved methodology for a proposed A/R CDM project activity.
02	EB23, Annex 15a/b 24 February 2006	Inclusion of a section on the assessment of the eligibility of land and the Sampling design and stratification during monitoring
01	EB15, Annex 6 03 September 2004	Initial adoption