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

CONTENTS

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

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

>> **Moldova Community Forestry Development Project**

Document version no.1; Date: March, 2010

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

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Soil erosion and landslides are major limiting factors from the economic and environmental point of view for land use in 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 Community Forestry Development Project is implemented as an AR CDM project. The purpose of the project activity is to create new community forests on the area of 10588.61 ha by means of afforestation of eroded and unproductive lands, application of agro-forestry practices, creation of forest protection belts, that will enhance GHG removals by sinks, improve forest and pastoral resources at local and regional level, provide wood to the local population, and contribute to local and regional sustainable development.

In conformity with the approved methodology AR-AM0002 (version 03), 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 of 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, flooding, loss of fertility, and decline in natural regeneration, disruption of hydrological cycle and are subject to increased drought risk[1]. Several anthropogenic and natural causes are responsible for land degradation as documented in the literature[2].

To demonstrate compliance with applicability conditions of AR-AM0002 (version 03), the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" was applied to demonstrate that all project lands are considered degraded or degrading. In accordance with the tool, the degraded/degrading status is demonstrated on project lands by one of the following criteria:

Stage 1: classification as "degraded" under national land classification system (Article 2 of the Law on Improvement of Degraded Lands through Afforestation (nr. 1041-XIV, 15.06.2000, administered by Moldsilva) and with no land management interventions put in place to reverse conditions since the "degraded" determination was made.

[1] A detailed categorization of degraded lands is represented as per Article 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.

Stage 2: "direct visual field evidence," documented by photographs and baseline study measurements, of degradation indicators including severe soil erosion and landslides and/or decreases in organic matter or vegetation cover. Soil erosion and landslides are common features throughout the project area. The **Figure 1** below demonstrates typical landslide activity on lands in the project area. Soil erosion was 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. Furthermore, re-establishment of vegetation on eroded sites is unlikely; the baseline study documented on project sites (a) lack of on-site seed banks; (b) the absence of external seed sources; and (c) absence of sprouting. The trends in the carbon pools of degraded lands show a declining trend in the above ground biomass, including woody shrubs; declining or low steady state soil carbon and litter; and absence of deadwood component in the project area

Figure 1: Status of degraded lands

Further detail and documentation demonstrating degraded status of project lands is provided in section A.4 and in Annex 3 (results of baseline study measurements). Appendices 5 and 6 present the list of land parcels and their degradation status in 1995 and 2005.
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 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.

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 311 local councils that represent the rural communities in the country.

From the total project afforestation area of 10588.61 ha, 10035.83 ha (94.8%), are property of communities and 534.78 ha (5.2%) are managed by other possessors. 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 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 requirements of rural communities. As native species often require better soil conditions, their share could be increased in the subsequent crediting periods on the lands restored using naturalized species.

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 Sustainable Development of Forestry Sector (no. 350-XV din 12.07.2001), National Strategy and Action Plan for Biodiversity Conservation (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 10588.61 ha** of degraded lands. The project contributes to **sustainable development** in several ways such as restoration of degraded lands, prevention of soil erosion, increase in forest cover, improvement soil productivity and increase in the supply of fuelwood, timber, and non-timber products to meet the needs of rural communities as well as replenishment of carbon stocks on degraded lands and 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 93% 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 restoration of soil productivity and accrual of above-and below-ground carbon pools.

- ***Biodiversity conservation***: Biodiversity benefits 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 total investments required for the project implementation during the period 2006-2035 is estimated as US$ 28.2 million. This sum will be provided by the Agency Moldsilva (80%) and by 311 communities (20%, in kind). The scheduled project crediting period will be for 30 years (2006-2035).

A.3. Project participants:

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Moldsilva, Forest Agency of Moldova and World Bank's BioCarbon Fund are the project participants in implementing the project. **Table 1** presents details of the project participation. Letters of Approval for the project are provided by the host country, Republic of Moldova and the Annex I country, Government of Spain, which will be submitted for 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, Forest Agency, a public entity of the Republic of Moldova	No
Government of Spain	International Bank for Reconstruction and Development as trustee of the BioCarbon 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.

The BioCarbon Fund of the World Bank supports projects implemented in compliance with the Clean Development Mechanism (Art. 12) of the Kyoto Protocol. The fund promotes implementation of projects that enhance GHG removals by sinks and purchases the resulting Certified Emission Reductions as per Emission Reduction Purchase Agreements with the project entities.

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 I, II, III and IV. The poor site quality (I-II site classes occupy only 3% from the total area) reflects their high degree of 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, Gleditsia triacanthos* mixed with native species. The long-term experience (more than 50 years) 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 31-year rotation. Three rotations of Robinia are expected to be implemented during the project. The areas planted with native poplar species (*Populus alba, P.nigra)* are to be managed under 40-year rotation, and areas planted with hybrid poplar will be managed under 11-year rotation.

On partially degraded sites, native species such as Oak (*Quercus sp.*), Poplar (*Populus alba, P. nigra*) are chosen as lead species. At the same time on some sites in the flood-plain the intensive crops of hybrid poplar are established. 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 2006 and 2008. 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:

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

A.4.1.1. Host Party(ies):

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Republic of Moldova

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

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All districts of the country, except Transnistria

A.4.1.3. City/Town/Community etc:

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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 10588.61 ha spread over 961 sites in 311 communities (local councils, municipalities), spread over 21 forest enterprises in different parts of the country. The planting sites range from 1 ha to more than 50 ha. Average size of a site constitutes 11 ha. Here, it is necessary to mention that in the process of project sites locating with the support of GPS, sites located adjacent to each other were merged in a single polygon. As a result 788 polygons were obtained, and the calculated average area of a polygon is 13.4 ha. **Table 2** presents the details on number of planting sites and their area.

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

S. No.	Area of planting site (ha)	Number of sites		Area	
		no.	percent (%)	ha	percent (%)
1	<4.9	356	37.0	938.86	12.6
2	5-9.9	240	25.0	1651.26	8.9
3	10-14.9	138	14.4	1612.76	15.2
4	15-19.9	78	8.1	1295.16	12.2
5	20-29.9	73	7.6	1683.79	15.9
6	30-49.9	56	5.8	2073.34	19.6
7	>50	20	2.1	1333.44	15.6
Total general		**961**	**100.0**	**10588.61**	**100.0**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau*

The project areas and project boundary confirms to the guidelines outlined in the Section III.1 of the approved methodology AR-AM0002 (version 03). 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.

1) Lands with strong and excessive superficial erosion;
2) Lands with depth/linear erosion – surface erosion, ravine and gully erosion;
3) Lands affected by active landslides, crumbling, wash-out etc;
4) Sandy soils exposed to wind and water erosion;
5) Stony soils and lands with the deposition of sediment;
6) Lands with the excess humidity; and
7) Low or unproductive lands.

Information highlighting degraded status of project lands is presented in **Annex 6**. The cadastral and land use information in 1995 and 2005 for the project area shows that the productivity of areas decreased over the period.

The project area falls under the categories of pastures, glades, degraded lands, and abandoned arable lands and these 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

Nr.	Forest enterprises	Degraded lands, ha				Pastures, ha			Total, ha
		Vineyards	Degraded arable lands	Eroded lands	**Sub-total**	Pastures	Glades and open grounds	**Sub-total**	
1.	Balti		34,3	112,2	146,5	272,3	17,6	289,9	436,4
2.	Calarasi			200,6	200,6	31,2		31,2	231,8
3.	Chisinau		12,55	532,46	545,01	176,71		176,71	721,72
4.	Cimislia			16,2	16,2	665,23		665,23	681,43
5.	Comrat			95,9	95,9	314		314	409,9
6.	Edinet			149,7	149,7	281,4		281,4	431,1
7.	Glodeni		18	213	231	119,3		119,3	350,3
8.	Hincesti			241,02	241,02	299,33		299,33	540,35
9.	Ialoveni (Rezeni)		6	11	17	573,7	8,1	581,8	598,8
10.	Iargara			195,8	195,8	756,96	141,38	898,34	1094,14
11.	Manta-V			15	15	381,91		381,91	396,91
12.	Nisporeni		44,9	149,2	194,1	72,8		72,8	266,9
13.	Orhei			134,2	134,2	2,5	6,8	9,3	143,5
14.	Padurea Domneasca			107,1	107,1				107,1
15.	Plaiul Fagului		5,2	3,4	8,6	55,51		55,51	64,11
16.	Silva-Sud		100	89,74	189,74	758,43		758,43	948,17
17.	Soroca	10	85,06	472,39	567,45	374,95		374,95	942,4
18.	Straseni			147,09	147,09	30,05		30,05	177,14
19.	Telenesti	3,69	177,87	24,23	205,79	84,49		84,49	290,28
20.	Tighina		344	461,78	805,78	385,86		385,86	1191,64
21.	Ungheni			306,46	306,46	176,86	81,2	258,06	564,52
Total:		**13,69**	**827,88**	**3678,47**	**4520,04**	**5813,49**	**255,08**	**6068,57**	**10588,61**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

In terms of land ownership and management, the project lands can be categorized into two categories – lands of the local councils; and the lands managed by other possessors.

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.

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	68 565	114 390	65 395
Major crops	Cereals, vegetables, sunflower	Cereals, grapes, sunflower, fruits, vegetables	Cereals, grapes, fruits, berries, sunflower
No. of cattle (as of 01.04.2008)	110,226	73,293	44,916
No. of sheep and goats (as of 01.04.2008)	227,667	212,383	424,248
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, overgrazing, lack of firewood	Forest degradation; illegal logging, landslides, lack of firewood	Drought, overgrazing, lack of forest protection belts, lack of firewood
Area to be afforested under the project	2267,3	3599,12	4722,19

***Source**: National Statistics Bureau of the Republic of Moldova*
Project Implementation Unit, Moldsilva (ICAS), 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):

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Republic of Moldova is situated in the South-eastern Europe between 45°28' – 48°30' Northern latitude and 26°30' – 30°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 917 communities and 60 towns. The average population density of the country is 118 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 2** 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 2: 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, which should be considered conservative as many more landslides went unreported.

Table 5: Landslide activity

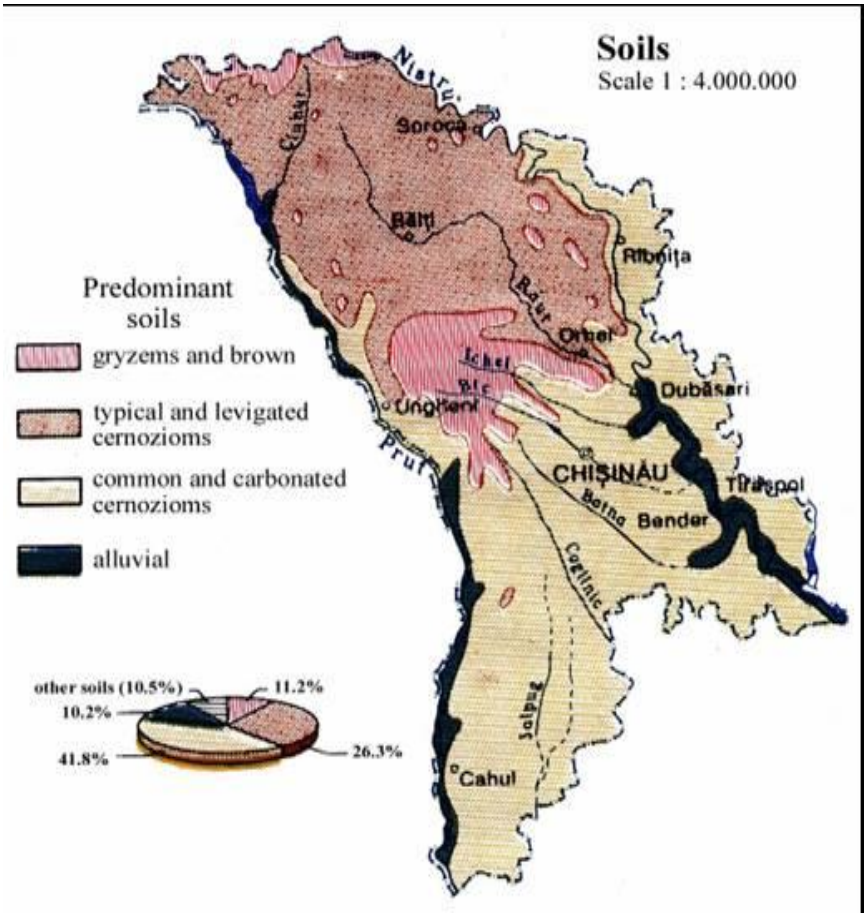
	1995	1996	1997	1998	1999	2000	2001
No. of activated land slide reports	13	57	121	126	268	98	65
Administrative regions	*8*	*10*	*14*	*14*	*14*	*12*	*5*

***Source**: Project Implementation Unit, Moldsilva (ICAS), 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 3** presents the distribution of soil types by the country's territory and **Table 7** contains soil types met on the project sites. Lands that were covered with forest and/or steppe vegetation in the past have been subjected to wind and water erosion, landslide, gully and ravine formation. There is a large variation in temperature and precipitation. Average annual temperature is +9.4°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 3: 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. **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.

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

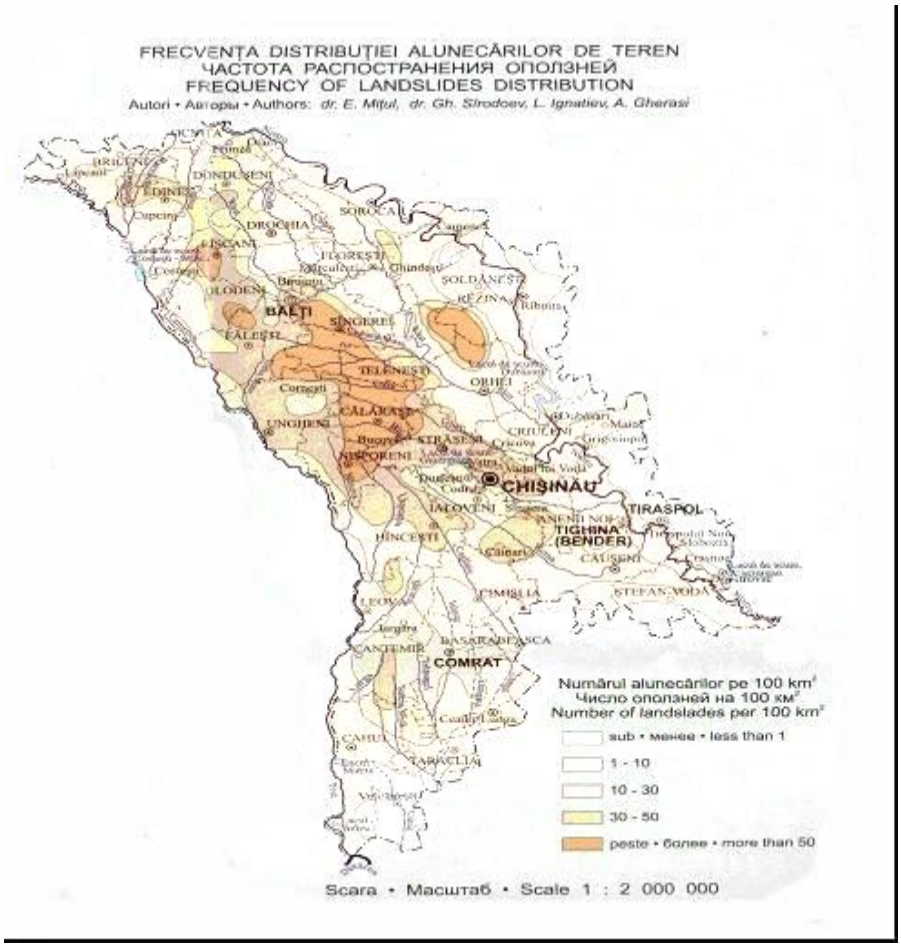
Slope(°)	Magnitude of erosion	Dehumific-ation, t/ha/year	Loss of soil through erosion, t/ha/year	Loss of humus through erosion, t/ha/year	Total loss of organic carbon, t/ha/year
0	no erosion	0.6	0	0.00	0.35
1-2	slight	0.6	10	0.35	0.55
2-4	little	0.5	20	0.70	0.69
4-6	moderate	0.4	30	0.90	0.75
6-8	strong	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, Moldsilva (ICAS), Chisinau.*

The geology and soil type are the major factors that contribute to mass movement of soil and land slides. **Figure 3** 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.

Figure 3: Distribution of landslides



Seventeen types of soils were identified during the description of initial conditions of lands under the project **(Table 7)**. The chernozom (75%) forms the largest soil type. About 65% from the project area is affected by strong and excessive erosion. More details about the soil types and erosion are included in the project database.

Table 7: Status of erosion process on the project sites

Soil type	Code soil type	Total area, ha	Repartition by the level of erosion and other adverse factors									Share, %
			S_1	S_{1-2}	S_2	S_{2-3}	S_{2-4}	S_3	S_{3-4}	S_4	Other factors	
Typical cernoziom	1201	3909.21	1143.56	688.4	1700.54	218.91		150.3			7.5	36.9
Cernoziom pseudorendzinic	1205	262.7						262.7				2.5
Gley cernoziom	1207	936.81	184.21	103.7	437.36	17.9		184.14			9.5	8.8
Carbonate cernoziom	1221	1004.08	129.34	57.08	749.48	43.42		8.76		16		9.5
Meadow cernoziom	1222	11.5	3.5								8	0.1
Alkalized cernoziom	1301	1181.64	401.71	174	450.69	81.24					74	11.2
Podzol cernoziom	1401	426	112.7	47.5	119.3	46.5					100	4.0
Cernoziom podzol salt	1407	170	3		84.7			82.3				1.6
Forest grey soil	1601	96		16.9	71	8.1						0.9
Forest dark grey	1609	50.4	20.3	13.2	16						0.9	0.5
Forest light grey	1610	16.7	8		3.7						5	0.2
Brawn podzol	2201	14		6	8							0.1
Soils damaged by landslides	9000	833.28	93.53	28.6	465.3	122.18		106.8	16	0.87		7.9
Alluvial soil	9501	112	24.6	0.88							86.52	1.1
Erodisoils	9601	1084.74		138.9	11.1	640.99	81	198.05		14.7		10.2
Degraded soils	9801	479.55				465.55		14				4.5
Total		**10588,61**	**2124.45**	**1275.16**	**4117.17**	**1644.79**	**81**	**1007.05**	**16**	**31.57**	**291.42**	*100.0*
Share, %		*100.0*	*20.1*	*12.0*	*38.9*	*15.5*	*0.8*	*9.5*	*0.2*	*0.3*	*2.8*	

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chişinău*

Table 8 summarizes information on degraded lands of the project affected with erosion and other adverse factors. 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

	S_1* moderate	**S_2**** strong	**S_3 ***** very strong	**S_4** excessive	**Other** adverse factor	**Total**
Area, ha	3399,6	5762	1104,1	31,57	291,42	10588,61
No. of parcels	304	545	80	6	26	961
%	*32,1*	*54,4*	*10,4*	*0,3*	*2,8*	*100,0*

* include S_1-S_2, ** includes S_2-S_3, *** includes S_2-S_4 and S_3-S_4.

***Source**: Project Implementation Unit, Moldsilva, Chisinau.*

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

Figure 5: Distribution of ravines

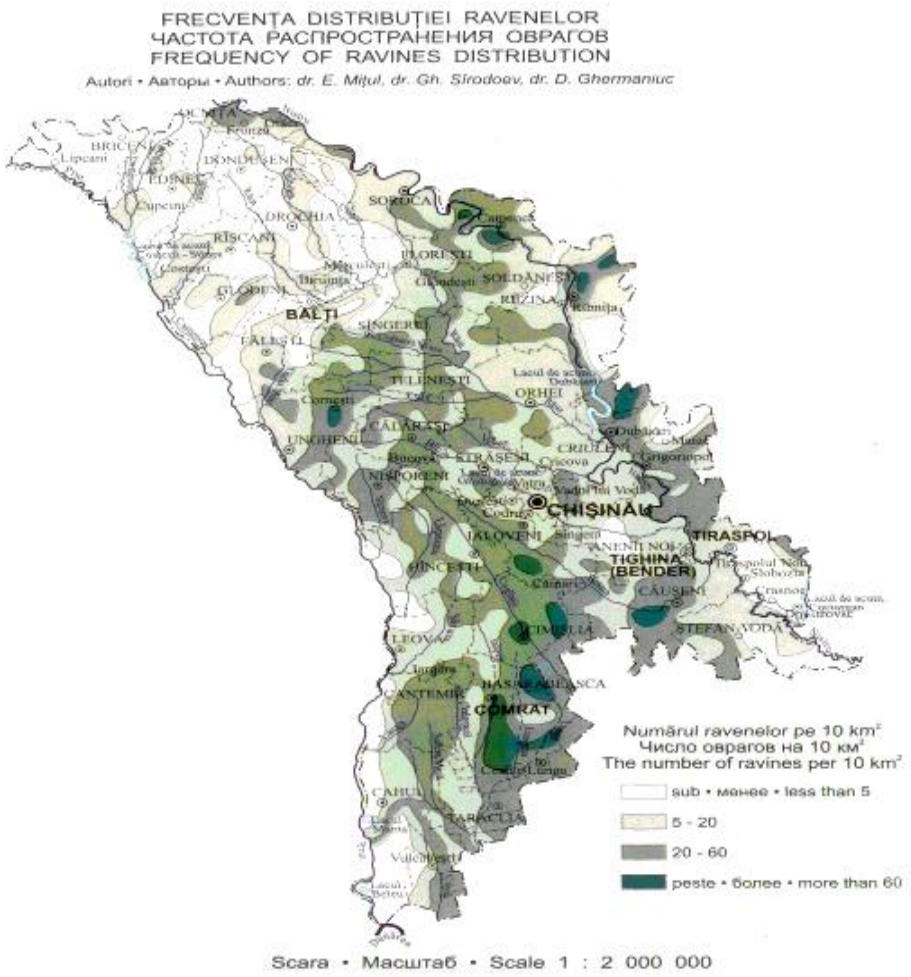
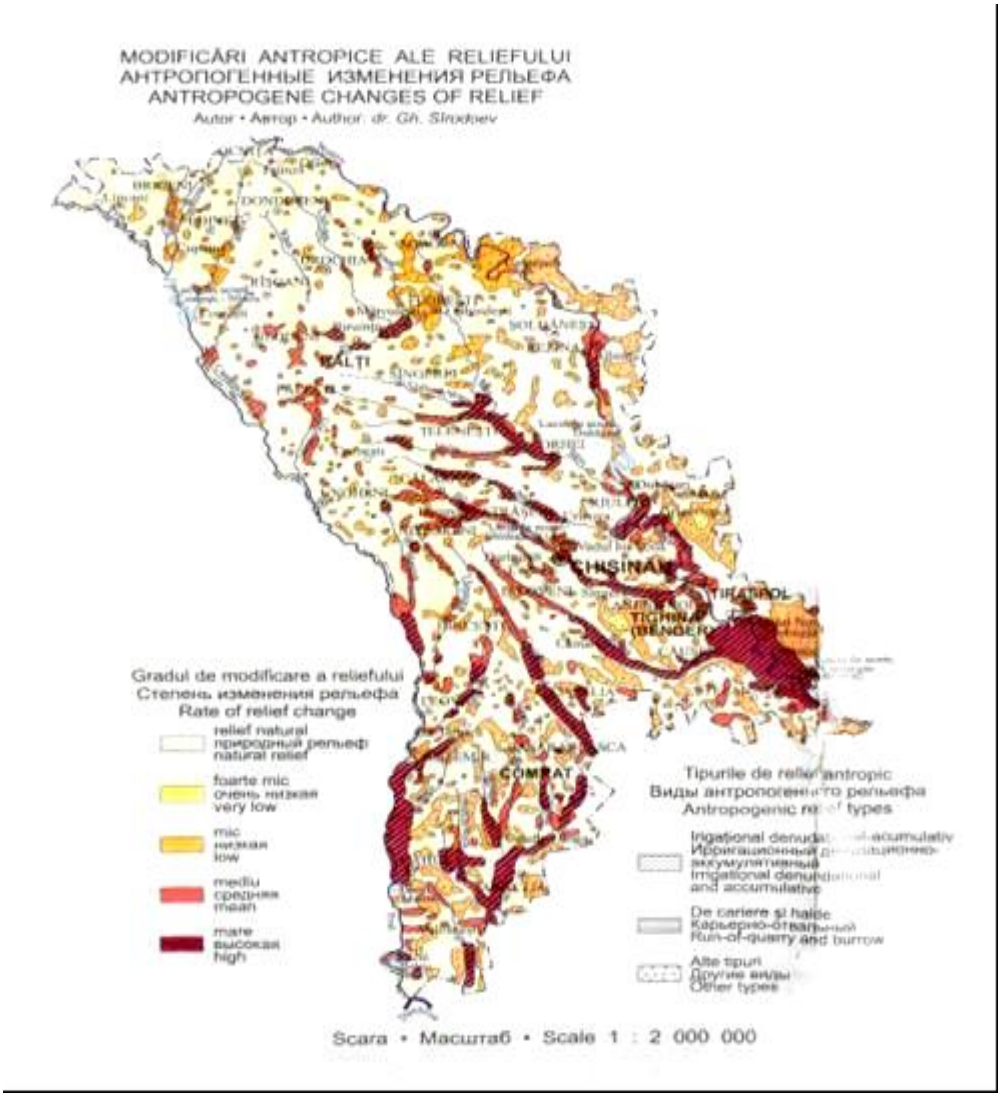


Figure 6 highlights anthropogenic influence on land use and relief. Taking into account the information from Figures 4 to 6, it is clear that the geographic and anthropogenic factors together contribute to landslides in the north and the central regions and to severe soil erosion in the southern region.

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

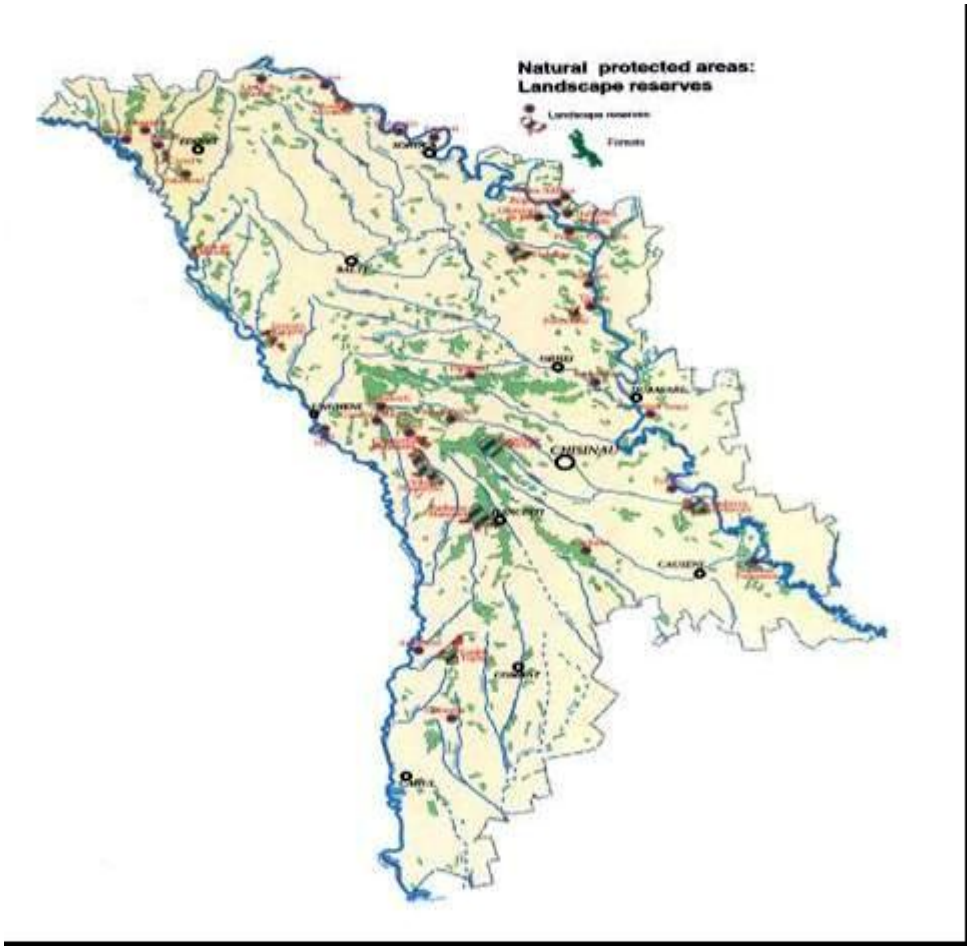


Ecosystems

Based on ecosystem diversity, the three bio-geographic regions (the broadleaf Central 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 region, which has undergone significant fragmentation due to conversion to other land use categories 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 resistant to adverse factors (grazing, salinization, carbonates etc.) 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 *Quercus petraea, Quercus robur and Fagus sylvatica* vegetation. The *southern zone* is a dry steppe characterized by downy oak (*Quercus pubescens*) mixed with pedunculate oak (*Quercus robur*). Downy oak (*Quercus pubescens*) predominate on the South and South Western slopes at low elevations.

In the northern zone, primary floral 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.*

The floral species found on pastures in the central zone are: *Festuca sulcata;Stipeta ucraini, S. lessinae, S. pennatae, S. tirsi, S. pulcherrimae, Fistuceta valesiaci,* and *S. herbosum*.

The floral species found on pastures in 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 (pastures and degraded lands)

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 to be associated with the pasture lands and one threatened species is associated with the degraded lands. In case of mammals, two threatened species of rodents, *Spermaphilus citellus* and *S. suslica* 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 9 and Table10 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.

It should be mentioned that during the field phase of the Baseline Study (spring and early morning 2008) fauna species form the category of endangered species have been not registered.

Invertebrates 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, Populus 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 31 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 for fuelwood, timber, and non-wood forest products are taken into account.

5. Low fodder collection costs to the local communities from fodder available in the established 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 that are effective in restoring degraded lands, 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 robur, Q. petraea, Q. rubra, Fraxinus spp., Carpinus, Tilia spp., Acer spp., Cornus mas, Prunus spp., Pyrus spp., Corylus avelaana, Viburnum spp., Sambucus nigra;*

- Robinia-group: *Robinia pseudoacacia, Gleditsia triacanthos, Sophora japonica, Ulmus spp., Acer spp., Cornus mas, Corylus mas, Prunus spp., Rosa canina, Ribes spp., Crataegus spp.;*

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

- Populus hybrid-group: *Populus nigra hybrid*

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

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

Quercus robur – is spread throughout the Republic of Moldova. At early stages (the first 5-10 years) it grows slowly, then grows at a moderate growth until the rotation period and is resistant to cold. It grows well on fertile soils and soils with low humidity and is also resistant to drought. Its timber has wide range of uses (construction, furniture, crafts, etc.).

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 25-35 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 to endure droughts. The history of its introduction in Moldova during more than one hundred years has shown that it is a pioneer and nonaggressive species with strong ability to adapt to degraded lands. Plantations of *Robinia* in Moldova (more than 130 thousand ha) are the main sources of fuelwood supply.

Gleditschia triacanthos – is a fast growing and drought resistant tree species that is well adapted to saline and calcareous soils. Its wood is used to meet small timber needs, temporary constructions and fuelwood.

Populus nigra – is a fast growing soft wood tree species widely grown in 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 and 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 and contribute to the improvement of soil fertility.

The project AR activity has been completed from 2006 to 2009. The details of the AR activity by forest enterprise are presented in **Table 11**. The forest enterprise Soroca has the largest area afforested under the project, whereas Plaiul Fagului has the least area represented under the project.

Table 11: Area afforested under project from 2006 to 2009

Nr.	Forest enterprises	Year of planting				Total
		2006	2007	2008	2009	
1	Balti	77	157.8	125.8	75.8	436.4
2	Calarasi	61.5	56.5	62.2	51.6	231.8
3	Chisinau	188.38	229.97	220.38	82.99	721.72
4	Cimislia	38.4	202.74	256.11	184.18	681.43
5	Comrat	40	206.9	149	14	409.9
6	Edinet	116	166.3	69.5	79.3	431.1
7	Glodeni	201.1	149.2			350.3
8	Hincesti	182.71	149.16	144.18	64.3	540.35
9	Ialoveni	111	165.7	175.3	146.8	598.8
10	Iargara	267.3	406	285.38	135.46	1094.14
11	Manta-V	228.22	125.56	43.13		396.91
12	Nisporeni	93.8	100.3	72.8		266.9
13	Orhei	37	105	1.5		143.5
14	Padurea Domneasca	31.5	52.6	23		107.1
15	Plaiul Fagului	19.61	27.9	16.6		64.11
16	Silva-Sud	92	466.77	226	163.4	948.17
17	Soroca	278.35	349.91	269.93	44.21	942.4
18	Straseni	90.44	31.7	49	6	177.14
19	Telenesti	42.85	72.35	156.25	18.83	290.28
20	Tighina	212.26	511.6	408.64	59.14	1191.64
21	Ungheni	244.49	127.79	64.04	128.2	564.52
Total		**2653.91**	**3861.75**	**2818.74**	**1254.21**	**10588.61**

***Source**: Project Implementation Unit, Moldsilva (ICAS), 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[3] and silvicultural practices implemented by Moldsilva on the degraded lands[4].

The project adopted scientific methods in delineating project boundary and site preparation, improved seed, nursery technologies and planting methods, silvicultural operations, integrated soil and water conservation, and 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

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

[4]The forest management and silvicultural expertise of Moldsilva during the last 50 years contributed to successful plantations of over 300,000 ha and helped in increasing the forest cover from 6% to 10.7%.

not be used in the site preparation. Mechanical preparation is selectively used for sites with heavy weed infestation and to 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, and where vegetation conditions permit, native species such as *Quercus sp* are planted. On poor lands, locally adapted fast growing, non-native and naturalized species such as *Robinia and Gleditschia* are used. The past experience has demonstrated that the successful establishment of locally adapted species for land reclamation stabilizes the soils prior to the establishment of native species that require better soil conditions. The fast growing locally adapted 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 species diversity of the project.

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 have been used in the production of nursery stock. Standard operational procedures have been followed in collection of seed and planting stock development.

Nursery technology and improved practices: To improve the germination of seed and establishment of seedlings, seeds are subjected to scarification 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 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, Ulnus, 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 out 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[5]. To ensure high survival rates, gaps are planted in the second and third years.

Short and long rotation species: The project activities use short rotation and long rotation species. *Robinia* is a short rotation species *used in* plantings during the last 5 decades. 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

[5] 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
Quercus robur (50-75%), Fraxinus	Secondary (25-12%) *Acer platanoides* *Acer campestre* *Pyrus communis* *Prunus avium* *Malus sylvestris* *Fraxinus excelsior* *Tilia cordata* *Carpinus betulus* Shrubs (25-13%) *Corylus avellana* *Cornus mas* *Viburnum opulus* *Vibirnum lantana* *Sambucus nigra*	Glades; waste grounds; degraded pastures; and 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 with manual or mechanized weeding practices • Completion of plantation in 2 to 3 years using gap filling • Pest and weed control measures
Populus nigra/alba, salix (75%)	Secondary (12%) *Acer platanoides* *Tilia cordata* *Ulmus glabra* *Alnus glutinosa* *Fraxinus excelsior* Shrubs (13%) *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 (75%)	Secondary (25%) *Acer platanoides* *Acer campestre* *Pyrus communis* *Prunus avium* *Malus sylvestris* *Fraxinus excelsior* Shrubs (25%) *Cotinus coggygria* *Crataegus monogyna* *Ligustrum vulgare* *Rosa canina*	Landslides; ravines; glades and waste lands;	• Active landslides • 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 seedli per 1 ha • Planting of 1-2 year seedlings with the h of Kolovos spade • Tending through manual weeding • Completion of plantation in 2-3 years through gap filling
Gleditsia triacantos, *Sophora japonica (50%)*	Secondary (25%) *Acer campestre* *Malus sylvestris* *Pyrus communis* *Ulmus glabra* Shrubs (25%) *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 6,0 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

Species group	Secondary tree species and shrubs	Land use category	Soil conditions and relief	Forest activities	
Quercus rubra (50%)		Secondary (25%) *Acer campestres* *Acer platanoides* *Malus sylvestris* *Pyrus communis* *Ulmus spp.* Shrubs (25%) *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 600 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 (65%)		Secondary (18%) *Pyrus communis* *Acer tataricum* *Acer platanoides* Shrubs (17%) *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 Koleso spade on 600 beds per 1 ha at 4 seedlin per bed of main species, 2 secondary species, and bushes • Tending activities using manual wedding • Completion of gap filling in 2-3 years
Populus hybrid, 100%			Glades and waste lands, flood-plains, degraded arabele lands	•	• Mechanized site preparation • Plantation of 110 seedlings/ha in pits 60cmx60cmx60cm • Tending through manual and mechanize weeding • Completion of plantation in 2-3 years through gap filling • Irrigation or artificial flooding • Pest and weed control measures

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

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

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The project has organized training programs and conferences to generate awareness on the sustainable land management and forest 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:

- Carbon Finance Document (CFD) has been presented at the technical meeting with Chief forest engineers and engineers for forest fund from 21 forest enterprises, December 19, 2007, Vadul-lui-Vodă.
- 2006-2008: Forest enterprise level training programs have been organized to strengthen the implementation of the project.
- 2008: Technical meetings with the executors of the field work have been organized to train them on the use of GPS devices and digital photos, as well as on the completion of field worksheets and other technical issues.
- 2008: Technical meetings involving the representatives of territorial divisions of Moldsilva and local councils were organized to discuss the importance of planting of forest crops on degraded lands, how to ensure sustainable management of new created forests and involvement of local population in this process.

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 other land-based economic activities;
- Assistance to livestock holders and improvements in livestock and pasture management activities are intended to prevent leakage;
- Implementation of participatory land-use planning intended to avoid land-use conflicts associated with grazing and other forms of land use;
- Imparting training in skill development programs to promote alternative livelihood opportunities;
- Incentives to households to pursue improved land use alternatives.

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 10588.61 ha, about 94.8% of area is under the control of local councils, the remaining area are managed by other possessors. 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. After termination of contracts, management activities will be continued by 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 Decisions nr. 246 and dated 03.05.1996/ nr. 1451 as of 24.12.2007 on the approval of Regulations on the assignment, change the destination and exchange of lands and as per the procedure outlined below:

- Formation of commission for identifation of degraded lands owned by local councils to improve it through afforestation (the participants are representatives of local public bodies, environmental bodies and regional forest structures and various land owners). The result the commission's work is a document containing information on characteristics of selected land (owner, category of use, fertility, etc.).

- Based on this document, the owner of land (in the project case - the democratically elected local council) develops a decision on the allocation of land for afforestation and future property regime.

- When transmitting the land under the management of Moldislva, should be a land file. After receiving the necessary permits, the Government issued a decision on final approval of transmission.

In cases when the land remain the property of the local council, a contract with the Agency Moldsilva to be signed that will organize and carry out planting, protection and care of forests until canopy closure stage according to the management plan. At the termination of contracts, forest plantation will be returned to the local council. The local community must commit to maintain forest over 100 years. **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:

- 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 of 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

Owbership	Planting year	Total area, ha	Tree species group		
			Populus	*Robinia*	*Quercus*
Local communities	2006	2321.41	2	2289.41	30
	2007	3727.35	3.5	3704.39	19.46
	2008	2741.36	104	2600.87	36.49
	2009	1245.71	12.94	1148.17	84.6
Subtotal		*10035.83*	*122.44*	*9742.84*	*170.55*
Other possesors	2006	332.5		318	14.5
	2007	134.4		131.8	2.6
	2008	77.38		62.48	14.9
	2009	8.5		8.5	
Subtotal		*552.78*		*520.78*	*32*
TOTAL PROJECT		**10588.61**	**122.44**	**10263.62**	**202.55**

* Note: For the purpose of CER estimation, 0.52 ha of *Pinus* is included in *Quercus*, because the productivity of these species is relatively identical.

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

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

>>

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 conform to the definition of afforestation and the degraded sites that have not been planted after 31 December 1989 conform to the definition of reforestation. No prior natural regeneration has also been witnessed on any of the project sites[6].

[6] 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.

Furthermore, Republic of Moldova has defined the criteria for "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 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[7].

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

a) Baseline field 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 that do not meet, and are incapable of attaining, the 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, matched to GPS coordinates of the project lands, 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, matched to GPS coordinates of the project lands, demonstrate that the project lands to be afforested have been without forest for the last 50 years and that project lands to be reforested have been without forest since 1989.

A.8. Approach for addressing non-permanence:

>>

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

[7] 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.

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

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

The project addresses non-permanence by use of species with rotation periods longer than the operational length of the project and crediting period. The planting activity involves species of different rotation lengths. The short rotation species such as *Robinia* will be replanted and regenerated at the end of their rotation. The adoption of long rotation species such as *Quercus,* and 100-year operational period of the project ensures the permanent vegetative cover of lands as a result of the afforestation activities.

Adoption of 30-year crediting period and generation of the **temporary Certified Emissions Reductions** (**t-CER**) reflects the project entity's commitment to address permanence. Therefore, project design, crediting period and institutional and contractual arrangements involving Moldsilva and local councils and regulatory framework address the issues of non-permanence. Agency Moldsilva (through its territorial structures - forest enterprises) and local councils entered into contractual arrangements (the length of contracts is 5-10 years) to improve degraded lands though afforestation. According to the provisions of the cpntracts, local councils are obliged to "… allot through the decision of Local Council lands for afforestation and to maintain these lands as forested area ***during next 100 years***."

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

Table 14 presents the estimates of ex ante net anthropogenic GHG removals by sinks of the AR CDM project. Thus, according to the data from relevant table, the total actual net anthropogenic GHG removals by sinks over 30-year crediting period are estimated as **3 806 353 tCO_2e.**

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

Year	Estimation of baseline net GHG removals by sinks (t CO_2e)	Estimation of actual net GHG removals by sinks (t CO_2e)	Estimation of emissions (tCO_2e)	Estimation of net anthropogenic GHG removals by sinks (tCO_2e) D=B-(A+C)
	A	B	C	D
2006	2	7 743	0	7 741
2007	396	29 397	0	29 000
2008	1 002	57 348	0	56 347
2009	1 786	84 926	0	83 140
2010	2 725	105 200	0	102 475
2011	3 785	121 097	0	117 312
2012	5 085	137 114	0	132 028
2013	6 552	140 288	0	133 735
2014	8 169	142 642	0	134 473
2015	9 935	162 166	0	152 231
2016	11 845	176 438	0	164 593
2017	13 639	190 385	0	176 746
2018	15 616	195 125	0	179 509
2019	17 600	163 964	0	146 364
2020	19 568	194 094	0	174 526
2021	21 425	196 756	0	175 331
2022	23 441	198 034	0	174 593
2023	25 461	144 571	0	119 110
2024	27 493	115 704	0	88 211

2025	29 533	137 773	0	108 239
2026	31 529	166 301	0	134 772
2027	33 550	189 083	0	155 533
2028	35 400	187 721	0	152 321
2029	37 389	185 676	0	148 286
2030	39 365	150 809	0	111 444
2031	41 329	179 054	0	137 725
2032	43 173	180 034	0	136 862
2033	44 977	175 959	0	130 981
2034	46 733	171 260	0	124 526
2035	48 446	166 641	0	118 196
Total	**646 950**	**4 453 302**	**0**	**3 806 353**

Note: As per the methodology AR-AM0002 (version 03), 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.
***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

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

>>
The project is financed and implemented by the Forestry 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:

>>
The starting date of the project is 1 November 2006. The project is eligible as an early start project. The crediting period of 30 years (30-yr-00-mm) has the starting date on 1 November 2006 and will end on 31 October 2035.

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

>>
100 years.

Considering the project includes *Quercus robur* and associate species, which will be managed under the long rotation of 100 years or more, the operational life time of the project will extend beyond the crediting period of 30 years under the CDM regulations, and will include additional 70-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 fixed crediting period for AR CDM projects.

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

>>

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

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

>>

The crediting period of 30 years (30-yr-00-mm) under the crediting period option has the starting date on 1 November 2006 and will end on 31 October 2035.

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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Approved A/R methodology AR-AM0002 (version 03): Restoration of degraded lands through afforestation/reforestation[10] is applied to the proposed project.

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 (version 03) to the project context is demonstrated by showing that the project meets all applicability conditions of the methodology AR-AM0002 (version 03) 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.

The implementation of the project does not lead to displacement of pre-project activities to areas outside the project boundary. The leakage prevention initiatives implemented in the project also ensure that pre-project activities are not displaced in the foreseeable future as well.

- 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 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.

(i) 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 and categorization as

[10] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_521G64I2VT53AZ88A9YHXZWNX9ZBUB

degraded.

As per the Article 2 of the Law on Improvement of Degraded Lands through Afforestation (nr. 1041-XIV, 15.06.2000) the 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 lands are categorized as degraded lands:

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 sediment;
f) Lands with the permanent excess humidity; and
g) Low or unproductive lands.

(ii) The degraded status of lands is assessed for the lands included in the project. The Appendices 5 and 6 present 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 period.

(iii) 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. The evidence from the baseline line study demonstrated (a) the lack of on-site seed pool 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. Therefore, natural regeneration is not likely to occur on the project lands.

- 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 of 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 forbids grazing on the lands of the 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) Classification of the project sites by soil types and level of erosion demonstrates that about 65% of the project area is affected by strong to excessive erosion and does not support significant vegetation and has marginal relevance for grazing. Therefore, closure of these sites is not expected to lead to a significant shift in grazing pressure on adjoining lands.

(iv) The leakage prevention activities included in the project to improve pasture management, programs to reduce less productive livestock under a Japanese PHRD Grant for Moldova Community Support Programm for Sustainable and Integrated Forest Management and Carbon Sequestration through Forestation are aimed at preventing the shift 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.

(i) Historical and existing patterns of the land use in Moldova highlight the demands on the land use and the resulting loss of productivity over past several decades.

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

(iii) Degraded lands have been traditionally used for meeting the needs of the local communities. However, financial constraints of the government and public agencies such as Moldsilva prevent them to invest in the restoration of degraded lands. As a consequence, the continuation of the past land use has contributed to further degradation.

(iv) There has been no continuity in afforestation nationally during the 10 years prior the project start date, indicating low priority for restoration of degraded lands. Average annual rate of pre-project afforestation and reforestation at the national level is used to calculate the pre-project afforestation rate of 1,51% 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 an insignificant role in restoring the degraded lands.

(v) 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, reducing their capacity to recover through natural processes, and could spread the degradation to the adjoining lands. Therefore, likelihood of regeneration of degraded lands through ecological succession appears remote.

(vi) The national and sector policies although highlight the need for restoring degraded lands, the lack of required resources perpetuate the government and public agencies to practice historical land use.

In line with the provisions of the AR-AM0002 (version 03), the project seeks to assess the carbon stock changes in all 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:

>>

AR-AM0002 (version 03) 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	Yes	Dead wood is expected to increase due to implementation of the project activity when compared with the deadwood pool under baseline scenario.
Litter	Yes	Litter is expected to increase due to implementation of the project activity when compared with the litter pool under baseline scenario.
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 (version 03), no project emissions are expected from the project.

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

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

>>

As per the steps of Section II.3 of the approved methodology AR-AM0002 (version 03), the *ex ante* stratification of the project area is done taking into account the 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 (version 03).

Step 1: Information on land use collected from official reports, maps 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 the pre-project 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 and that emphasize the problems linked with land productivity.

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 baseline 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. Furthermore, this pool is expected to be similar between the baseline and with-project case. 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, the soil carbon pool is expected to decline in the absence of organic matter addition from the biomass.

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 baseline 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, five main species *Populus*, *Populus hybrid*, *Pinus*, *Quercus* and *Robinia*, planted either as sole stands or mixed with associated species were recognized. Based on the species typeschosen for planting on rich and poor soils, 5 *ex-ante* project strata (*Pinus* stratum is not categorized separately because of small area (0.52 ha) and is included under the stratum Quercus_Rich

Soils). The stratum *Populus hybrid_Rich Soils* includes 100 ha of *Populus nigra hybrid* and 22.44 ha of *Populus alba/Populus nigra*). The project strata are noted below:

1) *Robinia_Rich Soils/soluri bogate;*
2) *Robinia_Poor Soils/soluri sărace;*
3) *Quercus_Rich Soils/soluri bogate;*
4) *Quercus_Poor Soils/soluri sărace;*
5) *Populus hybrid_Rich Soils/soluri bogate;*

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

Species group	Pasture					
	Total		Inclusive by category of soil fertility			
			Poor soils (humus <2%)		*Rich soils (humus >2%)*	
	Area, ha	Nr. of sites	Area, ha	Nr. of sites	Area, ha	Nr. of sites
Populus hybrid*	5.5	2			5.5	2
Robinia	5939.89	501	1161.12	110	4778.77	391
Quercus**	123.18	26	50.7	7	72.48	19
Total	**6068.57**	**529**	**1211.82**	**117**	**4856.75**	**412**

(b) Degraded lands

Species group	Degraded lands					
	Total		Inclusive by category of soil fertility			
			Poor soils (humus <2%)		*Rich soils (humus >2%)*	
	Area, ha	Nr. of sites	Area, ha	Nr. of sites	Area, ha	Nr. of sites
Populus hybrid***	116.94	4			116.94	4
Robinia	4323.73	416	1519.82	134	2803.91	282
Quercus	79.37	12	48.77	5	30.6	7
Total	**4520.04**	**432**	**1568.59**	**139**	**2951.45**	**293**

(c) Total Project

Species group	Total		Inclusive by category of soil fertility			
			Poor soils (humus <2%)		*Rich soils (humus >2%)*	
	Area, ha	Nr. of sites	Area, ha	Nr. of sites	Area, ha	Nr. of sites
Populus hybrid	122.44	6			122.44	6
Robinia	10263.62	917	2680.94	244	7582.68	673
Quercus	202.55	38	99.47	12	103.08	26
Total	**10588.61**	**961**	**2780.41**	**256**	**7808.2**	**705**

* 5,5 ha *Populus* (PL) rich soils subsumed under *Populus hybrid* (PLH) rich soils
** 0,52 ha *Pinus* (PIN) rich soils subsumed under *Quercus* (ST) rich soils
*** 16.94 ha Populus (PL) rich soils subsumed under *Populus hybrid* (PLH) rich soils
***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

Sub-strata and stand models

The stand models adopted under the project include both sole species plantings and mixtures of main species (*Robinia sp, Quercus sp, Poplar sp, Poplar hybrid and Pinus sp*) and associate species. For the purpose of stratification, sole and mixed stand models are represented under the respective five 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 30 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 (version 03).

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, use 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 the future in the absence of project related interventions.

The provisions of the Tool for demonstration and assessment of additionality of A/R projects (EB 21; Annex 16) were also used to evaluate the alternative uses of degraded lands in the absence of the project interventions.

Step 3: The data and information from official sources, field surveys and interviews are used to demonstrate the lands to be planted 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 are considered to reflect the following that demonstrate 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 is 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 afforestation 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 31 December 2005 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 to 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) 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 (version 03), the following scenarios of land use alternatives are identified.

Listing of scenarios of land use alternatives

Scenario 1: Degraded lands are abandoned (or subject to continued hay collection) and regenerated through natural succession to forest cover.

Scenario 2: Degraded lands that are abandoned (or subject to continued hay collection) will degrade further.

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

Scenario 4: Degraded lands converted to productive agriculture or perennial plantations (orchards or vineyards).

Scenario 5: Degraded lands restored through afforestation and reforestation.

S*cenario 1* is considered unlikely due to the highly degraded status of lands and lack of seed sources, which is elaborated previously.

Scenario 2 is considered most likely. Degraded lands are prone to severe forms of landslides and erosion that result in further degradation, a process that continues without direct intervention. This, and the unlikelihood of Scenario 1, is also supported by demonstrated historic increases in eroded lands in Moldova (Table 17) – i.e. that the condition of such lands is not improving. Between 1996 and 2006 there was a net increase in the area of degraded lands nationally of 1.65% per year; i.e. more land is coming into degraded status than is being restored by pre-project (baseline) afforestation/reforestation activities.

Table 17: Dynamics of eroded lands within agricultural lands in the Republic of Moldova

Degree of soil erosion	Year 1965		Year 1975		Year 1995		Year 2005	
	1000 ha	%	1000 ha	%	1000 ha	%	1000 ha	%
no erosion	*1517.4*	*71.9*	*1457.2*	*69*	*1287.5*	*61*	*1233.3*	*58.4*
slight	302.4	14.3	341.9	16.2	485.3	23	504.8	23.9
moderate	195.6	9.3	213	10.1	244.6	11.6	259.3	12.3
strong	96.2	4.5	99.5	4.7	94.2	4.4	114.2	5.4
Total eroded soils	*594.2*	*28.1*	*654.4*	*31*	*824.1*	*39*	*878.3*	*41.6*
Total studied agricultural lands	**2111.6**	**100**	**2111.6**	**100**	**2111.6**	**100**	**2111.6**	**100**

Source: *Cadastrul funciar al Republicii Moldova, 1965-2005, Chişinău.*

S*cenario 3* is considered unlikely. Although use of engineering structures to stabilize the land slides and to minimize erosion is a possible alternative, it is a 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 has negligible effect on baseline carbon stocks.

Scenario 4 is not feasible due to lack of economic incentives, and is not substantiated by recent demographic and land use trends. Degraded lands tend to be excluded from production or subjected to marginal subsistence use (hay collection). Restoring these sites to productive use requires significant start-up and recurring management costs which result in negative NPV for even long timeframes, thus these alternate land uses are less attractive than continued non-use or hay collection. Available parcels also tend to be small (about 37% of the sites are less than 5 ha) and widely distributed, which makes an organized, productive use at scale difficult. Furthermore, review of cadastral maps and demographic data reveal no historic or recent trends that would validate such a baseline. Since 1990, there has been a 37% decrease in the area of perennial plantations (orchards and vineyards combined) and 4% decrease in all cultivated lands (Table 18), hence there has been no identifiable trend in land use to these uses. Demographic data also show a population exodus, especially from rural areas, meaning less population pressure for agricultural uses.

Table 18: Dynamics of cultivated lands in the Republic of Moldova during 1990-2005

Year	Total perennial plantations (orchards and vineyards)	Total cultivated lands

	thousand ha	percentage in comparison with 1990, %	thousand ha	percentage in comparison with 1990, %
1990	474.1	100.0	2208	100.0
1991	473.5	99.9	2210	100.1
1992	470.8	99.3	2215	100.3
1993	466.0	98.3	2211	100.1
1994	448.4	94.6	2207	100.0
1995	430.7	90.8	2205	99.9
1996	412.6	87.0	2197	99.5
1997	399.1	84.2	2195	99.4
1998	385.8	81.4	2196	99.5
1999	370.8	78.2	2185	99.0
2000	352.3	74.3	2173	98.4
2001	334.9	70.6	2175	98.5
2002	305.7	64.5	2148	97.3
2003	300.8	63.4	2146	97.2
2004	298.0	62.9	2138	96.9
2005	297.8	62.8	2131	96.5

Source: *Cadastrul funciar al Republicii Moldova, 1990-2005, Chişinău.*

Scenario 5 – reforestation through initiative by local councils, is considered unlikely similarly due to investment barriers and lack of economic incentives. Even assuming increasing timber prices, NPVs for reforestation remain negative (Table 19. below). 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. Financial constraints at national and local level (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. Project baseline takes into account the annual rate of reforestation as "business as usual" at national level, which is 1.51% from degraded lands available at the beginning of the project.

Table 19: NPV and IRR for reforestation. Revenues from non-timber forest products and wood products (without carbon revenue).

NPV/IRR		US$/ha at current timber prices	US$/ha with 30% increase in timber prices
30 years	NPV @ 17.12% discount rate	-906	-863
	IRR	negativ	0.6%

The alternatives and their characteristics are summarized below.

Table 20: Alternative land use scenario

Alternative scenario	Baseline	Remarks

1. Abandonment of degraded lands (or continued hay collection) and natural succession to forest	No	Scenario is not likely to be realized due to the highly degraded land conditions and lack of seed sources. Lack of historical trend confirmed from land use data.
2. Abandonment of degraded lands (or continued hay collection) leading to further degradation	Yes	Degraded lands are expected to degrade further due to propensity for landslides and continued erosion in the absence of direct intervention. Historical trend confirmed through field studies and land use data.
3. Use of engineering structures to stabilize the land slides and to minimize erosion	No	Considering the large financial resources required for accomplishing the task, this is an infeasible alternative.
4. Degraded lands converted to productive agriculture or perennial plantations (orchards or vineyards)	No	Unlikely due to investment barriers and lack of economic incentives, and dwindling rural population. Not supported by historical land use trends.
5. Degraded lands restored 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 overcome the investment barriers. Project baseline takes into account business as usual rate of reforestation by Moldsilva.

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 patterns 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 and 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 local councils that oversee the management of 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 conservatively assumed to be **constant.** Following the provisions of approved methodology AR-AM0002 (version 03), the baseline net GHG removals by sinks are set to zero taking into account the data and evidence available from the baseline study.

The application of steps 1 to 5 and the analysis of the alternatives demonstrates that the **scenario 2** conforms 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-LULUCF.

The baseline scenario comprises degraded bare lands affected by severe erosion, ravines or landslides. They cover **4520.04 ha** of the project area and include former arable lands, vineyards and orchards excluded from agricultural production. The pasture lands comprise an area of **6068.57 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 methodology, AR-AM0002 (version 03), two categories of land use were evaluated for soil organic carbon under the baseline scenario, i.e., (*i*) degraded lands and (*ii*) degraded lands on which small rates of planting were 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. This is done to establish the degraded status of lands under the project and not for the quantification purpose. Therefore, the *baseline net GHG removal by sinks for these lands is conservatively* set to zero as per the **Equation B.1** of the AR-AM002, (version 03).

(*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 **160.37 ha** or **1.51%** 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-AM0002 (version 03) 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 were also collected.

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 were found to be insensitive to the small changes in soil carbon attributable to the pre-project AR activity and change in the soil organic carbon 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 to 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 21** presents the rich and poor sites by forest enterprise.

As changes in carbon pools of degraded lands and pasture lands are expected to follow the similar trends and both categories of lands lack either 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 63 tC/ha (> 63 tC/ha)

Stratum representing poor soils

The poor soils have low humus content and are assumed to represent the sites with less than 63 tC/ha (≤ 63 tC/ha).

Table 21: Poor and rich soil strata of the baseline by forest enterprise

No	Forest enterprise	Poor soils (humus <2%)		Rich soils (humus >2%)		Total	
		Area, ha	No of sites	Area, ha	No of sites	Area, ha	No of sites
1	Straseni	65.04	7	112.1	18	177.14	25
2	Soroca	158.21	22	784.19	76	942.4	98
3	Edinet			431.1	50	431.1	50
4	Orhei			143.5	16	143.5	16
5	Nisporeni	75.6	6	191.3	13	266.9	19
6	Iargara	258.3	24	835.84	69	1094.14	93
7	Hincesti	148.12	16	392.23	37	540.35	53
8	Glodeni	232.1	7	118.2	13	350.3	20
9	Calarasi	136.2	20	95.6	14	231.8	34
10	Balti	119	11	317.4	40	436.4	51
11	Manta-V	88.2	3	308.71	13	396.91	16
12	Telenesti	71.07	17	219.21	52	290.28	69
13	Ungheni	233.14	36	331.38	40	564.52	76
14	Silva-sud	309.76	20	638.41	38	948.17	58
15	Ialoveni	196.8	27	402	49	598.8	76
16	Chisinau	201.15	13	520.57	51	721.72	64
17	Tighina	454.42	22	737.22	28	1191.64	50
18	Comrat	16	2	393.9	13	409.9	15
19	Plaiul Fagului	0.6	1	63.51	18	64.11	19

20	Padurea Domneasca	16.7	2	90.4	12	107.1	14
21	Cimislia			681.43	45	681.43	45
Total proiect		**2780.41**	**256**	**7808.2**	**705**	**10588.61**	**961**

***Source**: Project Implementation Unit, Moldsilva (ICAS), 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 and lands that are likely to have small rates of planting (pre-project AR activity undertaken historically) in the absence of the project.

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 (version 03).

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 9.**

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

The most recent version of the CDM Executive Board approved "*Tool for the Demonstration and Assessment of Additionality in AR CDM project activities (version 02)"* (Annex 17, EB35)[11] is used to demonstrate the additionality per 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 on 1 November 2006.

[11] http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v2.pdf

The project complies with the provisions of the tool for the demonstration and assessment of additionality and highlights that the afforestation/reforestation activities in the absence of the CDM is unattractive. 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 guidelines. The sample documentary evidence demonstrating the active consideration of the CDM incentive is listed below and presented in Annex 7.

- PIN for Moldova Community Forestry Development Project was submitted to the World Bank in spring 2006. This fact is also mentioned in the Aide-Memoire of the World Bank supervision mission from October 9 - 15, 2006.
- BioCarbon Fund (BioCF) and the Agency Moldsilva (project entity) signed a Letter of Intent on September 21, 2007 to purchase an agreed amount of Emissions Reductions from Moldova Community Forestry Development Project. The letter confirms the BioCF'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 (Annex 7b).
- Letter dated 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 in Annex 7a).

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 conform to the criteria outlined in the *Procedures to Define the Eligibility of Lands for Afforestation and Reforestation Project Activities*[12] and *Procedures to Demonstrate the Eligibility of Lands for Afforestation and Reforestation Project Activities* (Annex 18, EB26)[13].

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 fell below the forest thresholds as communicated by the Republic of Moldova. The official registries further demonstrate that the project area was not forested at the starting date of the project.

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 6b** presents the sample of cadastral and official data on the land use plans at the project level.

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 **Annex 6a**. The data shows that the productivity of most areas falling under the project decreased over the decade. In addition to this data, the

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

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

analysis of the baseline study and field surveys demonstrate a decline in the productivity of sites 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 conform 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".
- Decision of the Government nr. 618 din 04.06.2007 „On the approval of the list of indicators for each criteria of sustainable forest management";
- Decision of the Government nr. 187 din 20.02.2008 „On the approval of the Regulation on the rent of forest fund with the purpose of game and/or recreation management".

In addition to the national and sector policies, the afforestation and reforestation rate for the period of 10-years from 1996 to 2005 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 1.51% 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 eligibility as the project scenario.

Scenario 1: Degraded lands are abandoned (or subject to continued hay collection) and regenerate through natural succession to forest cover.

Scenario 2: Degraded lands are abandoned (or subject to continued hay collection) and will degrade further.

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

Scenario 4: Degraded lands are converted to productive agriculture or perennial plantations (orchards or vineyards).

Scenario 5: Degraded lands are restored through afforestation and reforestation.

As discussed in detail in Section B.4, the *scenario 2* is identified as the baseline scenario in the baseline study. From the remaining alternatives to the project activity, *scenario* 1, *scenario 3 and scenario 4* are infeasible taking into account the reasons outlined in section B.4. The *scenario 5*, project activity implementation as a non-CDM project is unlikely without additional resources, as the elements of project activity such as investment needs of restoration, institutional arrangements of involving stakeholders, and improvements in the technical capacity of Moldsilva require financial resources to overcome the multiple barriers of the project entity, which prevented restoration of degraded lands in the past.

The lack of investment capacity of the Moldsilva and the local councils and absence of incentives have discouraged investment in the restoration of degraded lands and this situation is likely to continue under the 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 this alternative as the project.

The alternatives and their characteristics are summarized in the **table 20.**

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 and other barriers 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

All baseline scenario alternatives are compliant with existing 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 (version 03) 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 commercial banks was considered for selecting the required rate of return (RRR) on the loan according to the status for the first 10 months of the year 2006[14], being applied as 17.12%. Source – National Bank of Moldova, www.bnm.md.

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, planting, tending, protection, thinning and harvesting and other expenditure incurred on the afforested area. **Table 22** presents the cost estimates of afforestation and reforestation activity per hectare.

Table 22: Cost estimates of the AR activity ($ US/ha)

Activity	Robinia & assoc. sps	Quercus & assoc.sps	Populus & assoc.sps
Site preparation			
Machinery & Manual	656.6	797	688.6
Establishment			
Seedlings	111.9	219	1451
Planting, tending, thinning etc.	564	738	406.1

[14] National Bank of Moldova, http://www.bnm.md/md/avg_rate_credits/2006

Infrastructure			
Transport of seedlings	53	53	53
Guard	92.4	92.4	92.4
Labour			
Skilled labour	29.8	39	12
Unskilled labour	227	625	216.8
Monitoring			
Inventory & monitoring	7.5	7.5	7.5
Validation& verification	7.4	7.4	7.4
Other activities			
Cleaning cutting	*30.8*	*69.7*	-
Final harvest	-	-	1236.7
Total	***1780.4***	***2648.0***	***4171.5***

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

The revenue from forest products during the 30-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 23** presents the revenue per ha from forest products over a 30-year crediting period. Main revenues are coming from wood products.

Revenues from hunting activities are calculated on the basis of Governmental Decision nr. 187 on 20.02.2008 which approved regulations on the lease of forest fund lands for hunting and/or recreational purposes. According to the p. 13 of the regulation, annual payment for the lease of forest lands for mentioned purposes constitutes 315 lei/ha.

Table 23: Revenue from forest products per ha over a 30-year crediting period ($ US/ha)

Product	***Robinia* and assoc. sps.**	***Quercus* and assoc. sps.**	***Populus* and assoc. sps.**
Revenue from wood products			
Sawn timber >14 cm	10.8	41.9	15263.7
Timber for construction 12-24 cm	23	68.9	3077.6
Secondary construction timber <11 cm	147.3	112.9	583.2
Fuel wood	488	505.8	930.7
Branches	71.4	66.3	108.6
Total wood products	***740.5***	***795.8***	***19963.8***
Revenue from non-wood products			
Hunting	978	978	-
Medicinal plants, forest fruits and berries	27	27	-
Total non-wood products	***1005***	***1005***	**-**
TOTAL GENERAL	**1745.5**	**1800.8**	**19963.8**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

Financial analysis is conducted to evaluate the profitability of the project at 30-year interval, which coincides with 30-year crediting period.

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

Performance at 30 years

Financial performance of the project is conducted using average interest rate of 17.12%. The results of the analysis presented in **Table 24** show that the discounted cash flow is negative in all strata with the exception of *Populus hybrid* stratum. Considering that the degraded lands have very low productivity (site production class III and IV, and *Populus hybrid* has I class) and main revenue during the crediting period is limited to thinning, very small returns are anticipated from the project. Only *Populus hybrid* stratum includes revenues from final harvest due to its 11-year production cycle. The negative NPV for the crediting period shows that forestry activity is not a financially profitable option. The exception are intensive hybrid poplar plantations on relatively productive lands land production with relatively small production cycles, but are limited due to both financial aspects, as well as deficit in local quality planting material.

Table 24: Financial analysis of net benefits of reforestation on one hectare of degraded land over 30-year period (without carbon revenue)

Modules	Cash flow, USD per ha/year									NPV per ha (30 years), USD	IRR per ha (30 years), %
	Years										
	1	2	3	4	5	6	7	8	Total for period		
Robinia rich soils	-666	-575	-440	-315	-175	-51	-2	21	-2204	-854	negativ
Robinia poor soils	-989	-730	-610	-401	-187	-90	-6	21	-2992	-1062	negativ
Quercus rich soils	-607	-623	-506	-454	-356	-204	-169	-150	-3069	-1064	negativ
Quercus poor soils	-1048	-721	-587	-714	-480	-213	-131	-182	-4076	-1307	negativ
Populus hybrid rich soils	-1131	-1081	-697	-1607	-360	-90	9	20	-4936	903	22,6

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculations based on the project data*

As the net present value over 30-year period remains negative at RRR 17.12%, analysis was repeated with lower rate of interest such as 10%. However, the performance of the project remains negative even at 10%. Hence the negative economic performance of reforestation without carbon revenues is insensitive to discount rate, and also to timber prices (Table 23).The most likely alternate land use, hay collection, generates net revenue of US$8-103 per ha annually. Assuming initial net revenues of $8 and $83 per ha and an annual 10% decrease in productivity, hay collection generates NPVs (17.12% discount rate) of US$64-668 per ha over a comparable timeframe, still easily exceeding values generated from reforestation. However, costs of land degradation are not considered under hay collection scenarios. Therefore, investment analysis demonstrates that the project is additional from the financial or investment analysis perspective.

Performance with carbon and without carbon revenue

Table 25 presents the NPV and IRR of with carbon and without carbon project scenario at 30-year crediting period. 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 17.12%. The analysis of IRR values shows the very low rate of return from the AR project. 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 25: NPV (17.12% discount rate) and IRR of the project scenario at 30 year crediting period taking into account revenues without carbon and with carbon at different time horizons at US$4/tCO2e

NPV/IRR	With Carbon	Without Carbon
NPV, USD	-7 275 033	-9 595 841
IRR	7.7%	negative

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. 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 on the general project performance. Sensitivity analysis was carried out for two scenarios:

- Increase in carbon price;
- Increase in timber price.

Results of the increase in carbon price up to US$ 7 demonstrate that this is potentially important because it may increase the incentives for investment in afforestation. The impact of increased price is significant, because the IRR for the shorter-term horizons became positive, starting in year 15.

A more than 30% increase in prices of wood products is required to have some positive influence of timber price in counteracting the effect of high project costs, which is considered unrealistic in the medium to long term.

On the contrary, an increase in costs of creating and maintening forests can threaten the sustainability of the project. Current low price of labor may increase in coming years, which could significantly affect the profitability of the project.

Based on sensitivity analysis, it is clear that the project will continue to face unfavourable revenue and cost streams. The revenue from the CERs from the project implemented as CDM project partially alleviates the burden of negative returns.

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. The cost of credit from commercial banks is also significantly high (17.12%) and the commercial banks do not generally lend to afforestation and reforestation activities that means the lack of availability of alternative sources of financing.

ii) Barriers due to prevailing practices.

- As degraded lands are managed by public agencies and the local councils, the lands are used as common pool resources. Inadequate institutional arrangements limit the AR activity on degraded lands. At the majority of local councils (about 90%) there is no special forestry staff that should be responsible for planning, management and other silvicultural activities required for forests and other types of forest vegetation as well as planning of afforestation/reforestation activities. Due to financial and institutional constraints the adequate protection, guard and integrity of forests planted in the pre-project period was not provided that resulted in the loss of forest vegetation on community lands.

iii) Technical/operational barriers.

- The improvement of degraded lands requires sound knowledge of ecology and efficient silvicultural practices, 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 could generate awareness on the benefits of AR activities.

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:

During December 2007 – September 2008, Forestry Agency Moldsilva have organized 4 technical meetings with the participants from the state forest units (Chief forest engineers, engineers for forest regeneration and forest fund, etc); 16 working meetings with the representatives of the local public authorities (raional councils, mayoralties, ecological zonal agencies, etc.). During these meetings were discussed the tasks of different stakeholders in project designing, as well as major related problems and opportunities. More than 100 meetings with local communities have been organized dedicated to the project implementation, responsibilities of communities etc. Minutes of meetings are kept at Project Implementation Units.

Step 4: Common practice analysis

Historically (1946-1991) afforestation and reforestation activities on community degraded lands in Republic of Moldova were a common practice, and starting with 1994 these processes were stopped. Planting activities during 1994-2001 were primarily concentrated on the public lands of the forest fund managed by the Agency "Moldsilva" (cutting areas, degraded standings, forest crops created under the forest canopy etc.). Since 2002 afforestation activities took place on degraded lands being in the public property of of local community. These practices of afforestation of degraded lands owned by local communities were resumed only due to institutional and material capacities of the Agency Moldsilva,

including in the context of applying carbon credits. In the absence of afforestation activities targeted on degraded lands, they continue to degrade and this is a common practice.

As it was confirmed previously (Section C.5) lands included in the projects are degraded and are practically excluded from the general production cycle. These lands practically did not present interest for local population, because essential investments need for the improvement of normal soil fertility and reinclusion of these lands in production cycle and local polulation have not it (or have other priorities).

As conclusion, without A/R CDM project incentives, these lands will remain in the present state or their state will continue to degrade.

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

>>

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

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 26**.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 26: Baseline GHG removals in the degraded lands (t CO_2e)

Calendar year	Annual estimates of net baseline GHG removals by sinks on degraded lands , tCO_2e
2006	-1 703
2007	-6 030
2008	-10 918
2009	-14 058
2010	-14 965
2011	-14 703
2012	-14 269

Calendar year	Annual estimates of net baseline GHG removals by sinks on degraded lands , tCO_2e
2013	-13 881
2014	-13 590
2015	-13 343
2016	-13 156
2017	-12 955
2018	-12 865
2019	-12 806
2020	-12 624
2021	-12 522
2022	-12 417
2023	-12 333
2024	-12 276
2025	-12 230
2026	-12 230
2027	-12 133
2028	-12 088
2029	-12 029
2030	-11 945
2031	-11 888
2032	-11 842
2033	-11 842
2034	-11 842
2035	-11 744
Total net baseline GHG removals, tCO_2e	**Negative**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

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. Considering the negative net baseline GHG removals by sinks expected during the crediting period (30 years), the net baseline GHG removals by sinks is assumed **zero** for the crediting period as per the equation B.1 of the methodology AR-AM0002 (version 03).

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

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 (version 03). The pre-project planting demonstrate that these kinds of activities took place before the project (1996-2005). During 2002-2006 plantings for the whole country include Moldova Soil Conservation Project, also implemented under CDM. The increase in the period 2002-2006 of the share of afforested lands applicable to the calculation of baseline is due to the allocation of lands under the afforestation, which previously have not been covered with forests vegetation. At the same time, planting activities during 1996-2001 were focused primarily on land within the forest fund (cutting area, degraded stands, lost forest crops, forest crops etc.).

For the period 1996-2001 areas applicable to the calculation of baseline have been taken from PDD of Moldova Soil Conservation Project and for the period 2002-2005 have been established additionally.

Pre-project AR undertaken as part of the baseline is estimated following procedures in Section 5 ii of the methodology AR-AM0002 (version 03). The calculation follows Step 1 of the methodology, calculating the average annual area afforested over the pre-project period. Although the methodology further prescribes that pre-project afforestation be also calculated as a percentage of available lands at the outset of the pre-project period (Step 2), and that the higher estimate from either Step 1 or Step 2 is used, data with sufficient resolution (e.g. land transition matrices) required to determine rate via step 2 was unavailable, and hence only Step 1 was used to set the baseline.

Step 2 requires deriving a rate from ha of available (degraded) land tracked from 1996 to 2006. This requires that the 2006 available ha be determined as the amount of the 73700 ha available in 1996 still remaining in degraded status in 2006 (and the inverse used to calculate the pre-project rate). However, the 2006 available ha includes both 1996 available ha not reforested *and* new lands coming into degraded status since 1996, and available land records do not permit these to be separated out. There was actually more available degraded land in 2006 (86832 ha) than in 1996 (73700 ha) (i.e. the pre-project rate would actually be *minus* 1.65% - there was a net increase in available degraded land over the 10 yr pre-project period, which means that more land came into degraded status than came out via afforestation).

Calculations of pre-project afforestation rate are presented in table 27 (a).

Table 27 (a): Rate of AR activity under the baseline scenario during 1996-2005 (ha)

Reference year	Area afforested during the pre-project period, ha
1996	282.1
1997	204.0
1998	186.1
1999	165.1

Reference year	Area afforested during the pre-project period, ha
2000	61.3
2001	226.6
2002	2 606.07
2003	2 870.4
2004	3 234.15
2005	3 314.68
Average annual pre-project AR undertaken in the country over 10-year period prior to the project, ha	1 315.1
Total area of degraded land (ha) available for restoration through afforestation and reforestation activity at the national level in 2006, ha	86 832
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, %	1.51%
Average annual rate of pre-project AR applicable as the baseline AR to the project context, ha (using average annual area=Step 1 of 5 ii from AR-AM0002 (version 03)	160.37

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

Table 27 (b) Pre-project afforestation/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)
2006	160.37
2007	160.37
2008	160.37
2009	160.37
2010	160.37
2011	160.37
2012	160.37
2013	160.37
2014	160.37
2015	160.37
2016	160.37
2017	160.37
2018	160.37
2019	160.37
2020	160.37
2021	160.37
2022	160.37
2023	160.37
2024	160.37
2025	160.37
2026	160.37
2027	160.37
2028	160.37
2029	160.37
2030	160.37
2031	160.37
2032	160.37
2033	160.37
2034	160.37
2035	160.37

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

Pre-project AR undertaken as part of the baseline is estimated using equation B.2 of the methodology AR-AM0002, (version 03) 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}.

$\Delta C_{BAR\_LB\_Tree_{ijk,t}}$ 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}

Increases in non-tree biomass, litter, and dead wood pools are considered to be negligible and is treated as zero.

As per the baseline approach 22(a) adopted in the AR-AM0002 (version 03), 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 (version 03) 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 28 presents the annual and cumulative estimates of baseline GHG removals by sinks.

Table 28: 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, tCO_2e	
	annual	cumulative
2006	2	2
2007	396	399
2008	1 002	1 400
2009	1 786	3 187
2010	2 725	5 912
2011	3 785	9 697
2012	5 085	14 782
2013	6 552	21 334

2014	8 169	29 503
2015	9 935	39 438
2016	11 845	51 284
2017	13 639	64 922
2018	15 616	80 538
2019	17 600	98 138
2020	19 568	117 706
2021	21 425	139 130
2022	23 441	162 572
2023	25 461	188 033
2024	27 493	215 526
2025	29 533	245 060
2026	31 529	276 588
2027	33 550	310 138
2028	35 400	345 538
2029	37 389	382 927
2030	39 365	422 292
2031	41 329	463 621
2032	43 173	506 793
2033	44 977	551 771
2034	46 733	598 504
2035	48 446	646 950
TOTAL	**646 950**	

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

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 applicable as the baseline for each year of the AR activity under the project.

The species used in the AR project activity are common to the baseline and project scenarios. Therefore, 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 29** presents the baseline net GHG removals by sinks.

Table 29: Baseline net GHG removals by sinks (t CO_2e)

Year	Baseline GHG removals from bare lands and degraded lands, tCO_2e	Annual net baseline GHG removals from pre-project AR activities, tCO_2e	Baseline net anthropogenic GHG removals by sinks, tCO_2e
2006	0	2	2
2007	0	396	396
2008	0	1 002	1 002
2009	0	1 786	1 786
2010	0	2 725	2 725
2011	0	3 785	3 785
2012	0	5 085	5 085
2013	0	6 552	6 552
2014	0	8 169	8 169
2015	0	9 935	9 935
2016	0	11 845	11 845
2017	0	13 639	13 639
2018	0	15 616	15 616
2019	0	17 600	17 600
2020	0	19 568	19 568
2021	0	21 425	21 425
2022	0	23 441	23 441
2023	0	25 461	25 461
2024	0	27 493	27 493
2025	0	29 533	29 533
2026	0	31 529	31 529
2027	0	33 550	33 550
2028	0	35 400	35 400
2029	0	37 389	37 389
2030	0	39 365	39 365
2031	0	41 329	41 329
2032	0	43 173	43 173
2033	0	44 977	44 977
2034	0	46 733	46 733
2035	0	48 446	48 446
Estimated baseline net GHG removals by sinks, t CO_2e			**646 950**
Annual average baseline net GHG removals by sinks over the crediting period (30 years) (t CO2 e)			**21 565**

Note: As per the methodology AR-AM 0002 (version 03), for the years in which the baseline net GHG removals by sinks represent negative values, they are assumed to be zero.

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: December 2008

The persons/team preparing the baseline study: Dumitru Galupa (Team Leader), Ion Talmaci and Liliana Şpitoc – ICAS.

Name	Specialty	Contact
Dumitru Galupa	Forestry management and biodiversity	icaspiu@starnet.md
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Reviewers of the baseline study:
David Shoch – international expert - TerraCarbon.

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 (degraded lands restored through afforestation and reforestation), which is identified as the project scenario in section C.6 above case, the verifiable changes in the carbon stocks are assessed and *ex ante* estimation of net changes in actual GHG emissions by sinks is undertaken. The AR-AM0002 (version 03) provides for two options – empirical based method and model based approach for the ex ante estimation of carbon stock changes.

For purposes of ex ante estimation of carbon stock changes, the empirical method is employed, referencing species- and site condition-specific volume growth and yield tables (expressed in total tree aboveground volume including stem, branches and bark) from similar sites in Romania (Giurgiu 1972). Species-specific wood density estimates employed were derived from wood samples collected in Moldova (Kapp et al 2003). Carbon stocks in belowground biomass were estimated applying the root: shoot ratios developed from local species-specific biometric tables[15]. Shrub biomass was estimated by modelling from local studies. Dead wood and litter were not estimated and were conservatively and excluded from ex ante

[15] - Giurgiu V., Armăsescu S. (1972). Biometria arborilor şi arboretelor din România. Editura Ceres Bucureşti M. S. (1985);

- Kapp, G., Horst, A., Galupa, D., Talmaci, I., Spitoc, L., Horn, L., von Velsen-Zerweck, M., Grigoriev, P. and T. Danii. 2003a. Moldova Soil Conservation Project carbon Sequestration and Emission Reductions Study. GFA Terra Systems;

- Kapp, G., Horst, A., Galupa, D., Talmaci, I., Spitoc, L., Horn, L., von Velsen-Zerweck, M., Grigoriev, P. and T. Danii. 2003b. Moldova Soil Conservation Baseline Study. GFA Terra Systems;

- Carlo Calfapietra, Birgit Gielen, Maurizio Sabatti et al. Do above-ground growth dynamics of poplar change with time under CO_2 enrichment? New Phytologist (2003) 160: 305–318; www.newphytologist.com

calculations. Soil carbon sequestration was modeled from chronosequences of sites of known age measured on representative plantings in Moldova (Shoch et al 2003)[16].

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 should be conservative.

Calculations were performed using TARAM v.1.3. Results, in terms of *ex ante* net GHG removal projections, are summarized in the spreadsheet format is presented as **Annex 8**.

a.7 Calculation of the carbon stock changes based on the empirical method

Table 30 presents with 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 30: Estimation of the project carbon stock changes (t CO_2e)

Year of the project implementation	Calendar year	Estimated annual change in carbon stocks of the project
1	2006	7 743
2	2007	29 397
3	2008	57 348
4	2009	84 926
5	2010	105 200
6	2011	121 097
7	2012	137 114
8	2013	140 288
9	2014	142 642
10	2015	162 166
11	2016	176 438
12	2017	190 385
13	2018	195 125
14	2019	163 964
15	2020	194 094
16	2021	196 756
17	2022	198 034
18	2023	144 571
19	2024	115 704
20	2025	137 773
21	2026	166 301
22	2027	189 083
23	2028	187 721

[16] Shoch, D., Brown, S., Galupa, D., Talmaci, I. and L. Spitoc. 2003. Moldova Soil Conservation Project Monitoring Plan.

24	2029	185 676
25	2030	150 809
26	2031	179 054
27	2032	180 034
28	2033	175 959
29	2034	171 260
30	2035	166 641
Estimated project carbon stock change (t CO_2 e)		**4 453 302**
Total number of crediting years		**30**
Annual average project carbon change over the crediting period (t CO_2 e)		**148 443**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

b. GHG emissions by sources

As per the methodology AR-AM0002 (version 03), emissions from fossil fuels, emissions from the biomass loss during site preparation and emissions associated with biomass burning are assessed for the project context.

As per the paragraph 35 of the report of 42nd EB meeting, the Board clarified the guidance on accounting GHG emissions in A/R CDM project activities from the following sources: (i) fertilizer application, (ii) removal of herbaceous vegetation, and (iii) transportation; and agreed that emissions from these sources may be considered as insignificant and hence can be neglected in A/R baseline and monitoring methodologies and tools.

As per the paragraph 37 of the report of EB 44th meeting, the GHG emissions from the sources related to A/R CDM project activities: (a) fossil fuel combustion in A/R CDM project activities; (b) collection of wood from non-renewable sources to be used for fencing of the project area; and (c) Nitrous oxide (N_2O) emissions from decomposition of litter and fine roots from N-fixing trees are insignificant in A/R CDM project activities and may therefore be neglected in A/R baseline and monitoring methodologies.

Hence, emissions relating to (1) fossil fuel consumption related to implementation of the project, (2) removal of herbaceous biomass in site preparation, and (3) fertilizer application are not considered in the project. No woody biomass was removed from project sites in the process of site preparation.

b.1 Calculation of emissions from biomass burning

As national regulation of the Republic of Moldova prohibits burning of biomass in 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.

Table 31 presents the increase in emissions from the AR project.

Table 31: Increase in emissions from the AR project

Project implementation year	Calendar year	Emissions from the biomass loss, $tCO_2e\ yr^{-1}$	Emissions from biomass burning, $tCO_2e\ yr^{-1}$	Total project emissions, $tCO_2e\ yr^{-1}$
1	2006	0	0	0
2	2007	0	0	0
3	2008	0	0	0
4	2009	0	0	0
5	2010	0	0	0
6	2011	0	0	0
7	2012	0	0	0
8	2013	0	0	0
9	2014	0	0	0
10	2015	0	0	0
11	2016	0	0	0
12	2017	0	0	0
13	2018	0	0	0
14	2019	0	0	0
15	2020	0	0	0
16	2021	0	0	0
17	2022	0	0	0
18	2023	0	0	0
19	2024	0	0	0
20	2025	0	0	0
21	2026	0	0	0
22	2027	0	0	0
23	2028	0	0	0
24	2029	0	0	0
25	2030	0	0	0
26	2031	0	0	0
27	2032	0	0	0
28	2033	0	0	0
29	2034	0	0	0
30	2035	0	0	0
Total		**0**	**0**	**0**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

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 total actual net GHG removals by sinks over 30-year crediting period are estimated at **4 453 302 tCO_2e** (**Table 32)**.

Table 32: Actual net GHG removals by sinks from the project

Year of project implementation	Calendar year	Total carbon stock change, $tCO_2e\ yr^{-1}$	Total project emissions, $tCO_2e\ yr^{-1}$	Actual net GHG removals by sinks, t CO_2-e yr^{-1}
1	2006	7 743	0	7 743
2	2007	29 397	0	29 397

Year of project implementation	Calendar year	Total carbon stock change, $tCO_2e\ yr^{-1}$	Total project emissions, $tCO_2e\ yr^{-1}$	Actual net GHG removals by sinks, $t\ CO_2\text{-}e\ yr^{-1}$
3	2008	57 348	0	57 348
4	2009	84 926	0	84 926
5	2010	105 200	0	105 200
6	2011	121 097	0	121 097
7	2012	137 114	0	137 114
8	2013	140 288	0	140 288
9	2014	142 642	0	142 642
10	2015	162 166	0	162 166
11	2016	176 438	0	176 438
12	2017	190 385	0	190 385
13	2018	195 125	0	195 125
14	2019	163 964	0	163 964
15	2020	194 094	0	194 094
16	2021	196 756	0	196 756
17	2022	198 034	0	198 034
18	2023	144 571	0	144 571
19	2024	115 704	0	115 704
20	2025	137 773	0	137 773
21	2026	166 301	0	166 301
22	2027	189 083	0	189 083
23	2028	187 721	0	187 721
24	2029	185 676	0	185 676
25	2030	150 809	0	150 809
26	2031	179 054	0	179 054
27	2032	180 034	0	180 034
28	2033	175 959	0	175 959
29	2034	171 260	0	171 260
30	2035	166 641	0	166 641
Total		**4 453 302**	**0**	**4 453 302**

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau. Calculation based on the project data.*

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

>>

Per EB decision of the paragraph 35 of the report of the 42nd meeting report, fossil fuel emissions from the transport need not be accounted. Therefore, leakage emissions from transport of personnel and products outside the project are excluded from calculations. The project does not lead to the displacement of pre-project economic activities and does not cause any forms of leakage. Therefore leakage is considered **zero**.

SECTION E. Monitoring plan

E.1. Monitoring of the project implementation:

>>

The monitoring plan of the project follows the provisions of the Section III of the approved methodology AR-AM0002 (version 03).

E.1.1. Monitoring of forest establishment and management:

>>

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 (version 03).

Monitoring of site preparation and planting activities

- Monitoring will cover aspects related to site preparation and amount of vegetation affected.
- Information on planting schedule, location, area, species planted will be recorded and archived in the project database
- Information on the age class-wise area planted in each stratum and sub-stratum is confirmed through field surveys.
- Information on species composition and characteristics of planted species and pre-existing vegetation, if any observed on the strata are recorded. The spacing and characteristics of the stand models are recorded in the project database;
- Assesment of planting activities is carried out to confirm the quality of work within two weeks after completion of planting activities.

Monitoring of post-planting activities to demonstrate the forest establishment

- Survival rates of planted trees and shrubs are counted based on annual surveys. The land parcels with low survival rates are replanted till canopy closure stage. The area and location of supplemental plantings undertaken to fill the gaps is recorded in the project database and identified on the strata maps.
- Number and periodicity of tending activities will be monitored and recorded.
- Information on the occurrence of droughts and floods and other emergencies will be monitored and recorded and the area affected by them will be excluded from the ex post calculations of the carbon stock changes.
- In case of fires, their causes, area affected, season, and duration of fire occurrence will be recorded and the emissions associated with the burning of biomass will be calculated and accounted as part of project emissions.

Table 33: Information on forest management activities to demonstrate the forest establishment

ID number[17]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[18]	Recording frequency	Number of data points / Other measure of number of collected data	Comment
E1.2.1	Survival percent	percent	m	Annually till canopy closure stage (3-8 years)	100%	Survival rates of planted stock are established according to technical regulations in force until canopy closure stage.
E.1.2.2	Plantation failures	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	Annually - 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 (version 03) to demonstrate the forest management. Activities proposed to be monitored are outlined below.

- Information on silvicultural activities that influence the GHG removals by sinks will be monitored and recorded in the project database.
- Volume/biomass associated with silvicultural activities (cleaning, thinning, sanitation cutting and harvesting) will be monitored and recorded.
- 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 to the forest management activities outlined in the project design document will be monitored, and reasons for deviations will be recorded.

Table 34 illustrates the information to be collected on the forest management activities.

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

[18] Please provide full reference to data source.

Table 34: Information on the forest management activities to calculate the carbon stocks in the biomass

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

Project Boundary:

Project boundary represents the boundaries of discrete land parcels on which project activities are implemented. The provisions of AR- AM0002 (version 03) on the monitoring of the project boundary will be fully complied during the project implementation. The data on project boundary 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 of project boundary are as below:

- Field surveys will be conducted at the periodic intervals to verify the permanent markers used in delineating 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 could be verified from the GPS and the field survey data;
- The monitoring of the project boundary provides information on 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 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 the purpose of reporting at the time of project verification.

Table 35: Information on the project boundary

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
E.1.1.1	GPS coordinates	numeric	m	At the start of the project	100%	The project boundary in terms of the latitude and longitude of the land parcels are recorded and checked 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.

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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Table 36: Evaluation procedures for QA/QC

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

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

[20] Please provide full reference to data source.

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.4.1.1.15 Shrub biomass	Low	Measurements, 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.2. Sampling design and stratification

>>

(a) 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 the area affected in disturbances, and management activities implemented in 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 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 each 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 woody (shrub) vegetation: Non-tree woody vegetation will be measured within the nested plots to estimate the pool. The number of plots used for measuring the non-tree woody vegetation will be based on the relative significance of the shrub layer and as per the steps and procedures outlined in the approved methodology AR-AM0002 (version 03). Non-tree woody biomass will be estimated applying allometric equations relating measured parameters (e.g. shrub height, crown diameter, or basal diameter) with aboveground biomass, as permitted in AR-AM0002 (version 03).

Litter: A frame of constant size (e.g. 50x60 cm) 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 (version 03) and monitoring plan will be used to evaluate the changes in the litter pool.

Soil: Considering the slow changes in the soil carbon, monitoring 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 to compare the mean stocks of two *independent* temporally-separated pools during the monitoring interval.

Sampling framework 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.

Sample size

Using the equation M.1 and M.2 in Section III of the 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 (version 03) are used to calculate the sample size. A sample size of 51 permanent sample plots is estimated as the sample size required for monitoring the aboveground biomass. The sample size estimation procedures of the monitoring plan allows for increasing the sample size taking into account variability observed in the biomass estimates. **Table 37 (a)** and **Table 37 (b)** present the number of sample plots calculated for monitoring the carbon stock changes in the above ground biomass.

Table 37 (a): Number of sample plots for measuring the changes in living biomass

Stratum no.	Project Stratum	Calculated number of sample plots	Required number of sample plots
1	Populus hybrid_RichSoil	**1**	3
2	Quercus_RichSoil	**1**	3
3	Quercus_PoorSoi	**1**	3
4	Robinia_RichSoil	**30**	30
5	Robinia_PoorSoil	**12**	12
Total		**45**	**51**

Note: for strata *Populus_RichSoil*, *Quercus_RichSoil* şi *Quercus_PoorSoil* number of sample plots was increased to achieve the acceptable data precision.

Table 37 (b): Number of sample plots for measuring the changes in living biomass by forest enterprise

Nr.	Forest enterprise	Inlcuding by strata											
		Robinia rich soil		Robinia poor soil		Populus hybride rich soil		Quercus rich soil		Quercus poor soil		**Total**	
		ha	nr. of sample plots	ha	nr. of sample plots	ha	nr. of sample plots	ha	nr. of sample plots	ha	nr. of sample plots	ha	nr. of sample plots
1	Străşeni	109.10	1	65.04	0	2.00	0	1.00	0	0.00	0	177.14	1
2	Soroca	784.19	3	136.21	0	0.00	0	0.00	0	22.00	1	942.40	4
3	Edineţ	429.10	1	0.00	0	2.00	0	0.00	0	0.00	0	431.10	1
4	Orhei	143.50	1	0.00	0	0.00	0	0.00	0	0.00	0	143.50	1
5	Nisporeni	191.30	1	75.60	1	0.00	0	0.00	0	0.00	0	266.90	2
6	Iargara	821.44	3	245.00	1	0.00	0	14.40	0	13.30	1	1094.14	5
7	Hînceşti	392.23	1	148.12	1	0.00	0	0.00	0	0.00	0	540.35	2
8	Glodeni	118.20	1	227.10	1	0.00	0	0.00	0	5.00	0	350.30	2
9	Călăraşi	95.60	0	136.20	1	0.00	0	0.00	0	0.00	0	231.80	1
10	Bălţi	293.50	1	119.00	1	0.00	0	23.90	1	0.00	0	436.40	3
11	Manta-V	308.71	2	88.20	0	0.00	0	0.00	0	0.00	0	396.91	2
12	Teleneşti	214.69	1	63.60	0	0.00	0	4.52	0	7.47	0	290.28	1
13	Ungheni	324.18	1	224.54	1	0.00	0	7.20	0	8.60	0	564.52	2
14	Silva-sud	525.81	2	278.16	1	103.50	2	9.10	1	31.60	1	948.17	7
15	Ialoveni	401.50	1	185.30	1	0.00	0	0.50	0	11.50	0	598.80	2
16	Chişinău	518.57	2	201.15	0	0.00	0	2.00	0	0.00	0	721.72	2
17	Tighina	722.28	3	454.42	2	14.94	1	0.00	0	0.00	0	1191.64	6
18	Comrat	393.90	2	16.00	1	0.00	0	0.00	0	0.00	0	409.90	3
19	Plaiul Fagului	24.65	0	0.60	0	0.00	0	38.86	1	0.00	0	64.11	1
20	Pădurea Domnească	88.80	1	16.70	0	0.00	0	1.60	0	0.00	0	107.10	1
21	Cimişlia	681.43	2	0.00	0	0.00	0	0.00	0	0.00	0	681.43	2
TOTAL		**7582.68**	**30**	**2680.94**	**12**	**122.44**	**3**	**103.1**	**3**	**99.47**	**3**	**10588.61**	**51**

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 64 sample plots are estimated in order to measure the carbon stock changes in the soil. **Table 38** presents the number of sample plots calculated for monitoring the carbon stock changes in the soil.

Table 38: Sample plots for assessing the carbon stock changes in the soil

Nr	Forest enterpise	Poor soils (humus <2%)		Rich soils (humus >2%)		Total	
		ha	nr. samples	ha	nr. samples	ha	nr. samples
1	Străşeni	65,04	0	112,10	1	177,14	1
2	Soroca	158,21	0	784,19	5	942,40	5
3	Edineţ	0,00	0	431,10	3	431,10	3
4	Orhei	0,00	0	143,50	1	143,50	1
5	Nisporeni	75,60	0	191,30	1	266,90	1
6	Iargara	258,30	1	835,84	5	1094,14	6
7	Hînceşti	148,12	1	392,23	3	540,35	4
8	Glodeni	232,10	0	118,20	1	350,30	1
9	Călăraşi	136,20	1	95,60	1	231,80	2
10	Bălţi	119,00	0	317,40	2	436,40	2
11	Manta-V	88,20	0	308,71	2	396,91	2
12	Teleneşti	71,07	0	219,21	2	290,28	2
13	Ungheni	233,14	1	331,38	2	564,52	3
14	Silva-sud	309,76	1	638,41	5	948,17	6
15	Ialoveni	196,80	1	402,00	3	598,80	4
16	Chişinău	201,15	0	520,57	3	721,72	3
17	Tighina	454,42	1	737,22	6	1191,64	7
18	Comrat	16,00	0	393,90	3	409,90	3
19	Plaiul Fagului	0,60	0	63,51	1	64,11	1
20	Pădurea Domnească	16,70	1	90,40	1	107,10	2
21	Cimişlia	0,00	0	681,43	5	681,43	5
TOTAL		**2780,41**	**8**	**7808,20**	**56**	**10588,61**	**64**

(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 (for aboveground biomass) and centres of circular plots (for soil carbon) 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) Sample 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. 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 GPS 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.

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

>>
As per the approved methodology AR-AM0002 (version 03), 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 40** (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. 35** outlined in the approved methodology AR-AM0002 (version 03).

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

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}

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 Annex 4 on Monitoring Plan. The calculation of the change in the stocks of carbon pools will be done as per the equations M.4 to M.31 outlined in the Section III of the approved methodology AR-AM0002 (version 03).

The project utilizes data from 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 39: Data to be collected to monitor the verifiable changes in carbon stock in the carbon pools

ID number[21]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[22]	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 based on equations – M.1 & M.2
E.4.1.06	Plot ID	Alpha-numeric		Prior to the project	100%	Identified and mapped for each stratum and sub-stratum
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 sample plots	Trees are counted in the plots of each stratum.
E.4.1.10	Diameter at breast height (DBH)	cm	m	5 years	Trees on sample plots	Measurement of dbh as per at each monitoring event
E.4.1.11	Mean DBH	cm	c	5 years	Trees on sample plots	Calculated using the data on DBH

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

[22] Please provide full reference to data source.

ID number[21]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[22]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
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 biomass	kg	m	5 years	100% sample plots	Published data or local shrub equations can be use. Estimated with equation M.15
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. Litter biomass is calculated using equations M.25 & M.26
E.4.1.19	Below-ground biomass	Ratio	e	5 years		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		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 plots	Calculated with equation – M.21 & M.22
E.4.1.24	Soil carbon	tonnes C	m	10 to 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

ID number[21]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[22]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
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	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:

>>

There is no increase in emissions from the project implementation is anticipated.

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:

>>

In line with the applicability of the methodology, no leakage is anticipated in the project from the displacement of economic activities outside the project boundary. Therefore, no monitoring of leakage is required.

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:

>>

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. The following socioeconomic measures act as leakage prevention measures.

- Implementation of pasture management improvement programs to improve pasture productivity and to avoid the damaging of newly created forest through grazing.
- Implementation of participatory land-use planning is intended to avoid land-use conflicts resulting from grazing and other forms of leakage
- Assistance to livestock holders and landowners for the improvement of the livestock/pasture management intended to prevent leakage
- Implementation of agro-forestry practices on afforested lands within the project (grass harvesting and / or growing of agricultural crops between rows of planted trees, collecting of berries and forest fruits, medicinal plants etc.)
- Benefit-sharing arrangements in the project area to ensure commitments of local stakeholders to prevent leakage
- Imparting training in skill development programs to promote the alternative livelihood opportunities
- Incentives to households to pursue improved land use alternatives on the existing lands

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:

>>

Operational and management arrangements would include the following elements:

- Project coordinator, responsible for the coordination of the project implementation and for the negotiations with potential buyers of emission reductions.
- Steering Committee, main tasks of which are the coordination of activities for all stakeholders, inclusive ministries of Ecology, Finance, environmental NGOs etc. Among the important tasks of the Committee will be the dissemination of information on the project implementation, on the best practices coordination of direct involvement of the Agency Moldsilva and local authorities in the project financing, general supervision of the project implementation.
- Project Implementation Unit. PIU is responsible for everyday activities on the project implementation. The most important task is coordination of the implementation of the monitoring plan for carbon sequestration and the preparation of reports, implementation of EMP. Project Implementation Unit can also serve as a secretariat for the Steering Committee. PIU will annually monitor and evaluate project progress and measure the impact of

project activities against the baseline survey undertaken during project preparation. PIU will undertake a systematic analysis of the impact and achievements of project activities and the results of the monitoring activities will be fed back into the implementation process.

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, Ion Talmaci, Liliana Spitoc, Moldsilva (ICAS), Moldova
David Shoch, Terra Carbon
Dr. Rama Chandra Reddy, 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 spp, 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 minimize biomass and soil loss in the site preparation activities.
- The major species types are grown mixed with associated species to improve the diversity of areas planted.

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

- The project is expected to conserve significant quantities of humus 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 locally adapted species enhance 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 scored on an ordinal scale of 0 to 3 to evaluate these scenarios on the environmental criteria demonstrate the positive environmental impacts of the project.

Potential environmental impacts under the baseline scenario

The environmental impacts of the baseline scenario summarized in **Table 40** shows the negative impacts of degraded lands strongly reflected on the soil, water, biodiversity and the landscape are anticipated to result in large GHG emissions over time. In the absence of interventions, negative impacts, and the unsustainable land use is expected to continue and expand further resulting in more adverse impacts on the land and water resources.

Table 40: 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
Subtotal-degraded lands	**-9**	**-9**	**0**	**-5**	**-7**	**+1**	**-5**
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-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, Moldsilva (ICAS), 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 livelihoods of local communities by ensuring the additional 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 adjoining lands.

The **Table 41** 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 project has significant positive impacts considering the influence of A/R activities on several components of the ecosystem such as soil, water, flora, and fauna.

Table 41: 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, Moldsilva (ICAS), Chisinau.*

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 40** and **Table 41** 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 implementation under the project

Project implementation will have mostly positive impact. The negative impacts on soil, water and biodiversity during the site preparation are small and insignifcant. In order to minimize these impacts a number of mitigation measures outlined in **Table 42** are implemented**.**

Table 42: Measures preventing the occurrence of adverse environmental impacts

#	Mitigation measures	Phase	Responsibility
1.	Assessment of afforestation activities with respect to (a) site preparation; (b) planting; (c) maintenance and tree protection; (d) thinning, harvesting and other silbvicultural practices	1-5 years	FE, Moldsilva
2.	Implementation of soil conservation technologies (such as contour plugging, conservation tillage) and soil preparation	1-5 years	FE
3.	Use of mechanical and vegetative structures to reduce erosion and landslides	1-15 years	Moldsilva, MENR, FE, LA
4.	Mixture of locally adaptive species (trees and bushes) that increase habitat diversity	1-5 years	FE, Moldsilva
5	Create shrubs using *Rosa canina*, *Prunus spinoza* etc. for habitat of various fauna species	1-5 years	FE
6.	Carry out tending activities in the periods less disturbing for fauna (late fall and winter);	5-15 years	FE
7.	Creation of green hedge around the afforested sites to reduce access of grazing animals	1-5 years	FE
8.	Connecting afforested lands, natural habitats and protected areas	1-5 years	FE, LA
9.	Disseminating information to local authorities and communities about the project implementation	1-5 years	FE

Note: FE – Forest Enterprise; MENR Ministry of Ecology and Natural Resources; and LC - Local Councils

***Source**: Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

Transboundary environmental impacts of the project

The project parcels cover small patches of land, e.g., more than 80% 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 environmental impacts from 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 2008 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 web pages of the Forest Research and Management Institute before the signing of the Emissions Reductions Purchase Agreement (ERPA) in December 2008.

- The Environmental Assessment report was posted on the web pages of the Forest Research and Management Institute in December 2008.

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

- Forest Research and Management Institute in association with the Regional Environmental Office/Moldova organized a special presentation on the environmental impacts of the project during February 2009.

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 2008 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 additional 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 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. Village Halls 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, mayoralty, forest enterprise 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. those whose traditional grazing rights are restricted \afforested are expected to receive assistance from the project entity under a Japanese Grant “Community Support Program for sustainable and integrated forest management and carbon sequestration through afforestation”of US$ 975.900 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 local communities and their livelihoods and will generate additional income and employment. The plantation activities will be major sources of fuel-wood and timber supplies and that the local population is expected to benefit from the increased availability of fuelwood. Average of 1.3 m^3/ha/yr of fuelwood and timber is expected to be harvested sustainably from the project areas or about 290 thousand m^3 during the whole crediting period. The income from selling medicinal plants and forest fruits is expected to be in on average of 0.9 US$/ha/yr or about 240 thousand US dollars during the crediting period. 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 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.

- Illegal logging and grazing;
- 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 $ 975,900 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.

Improvement in natural resources management through training of local authorities and forest personnel in the management of pastures and forests 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 management, including the development of private sector role in the management of degraded lands.

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

SECTION H. Stakeholders' comments:

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

>>

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 information from the forestry and environmental authorities on the condition of forestry and hunting funds, and measures implemented with the funds in accordance with the legislation.

Law on the environmental protection Nr. 1515-XII, 16.06.93, Article 30 recognizes the right of all persons to have a) full information on environmental conditions and population health; b) the right to participate in disputes on draft laws, 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.

- Carbon Finance Document (CFD) has been presented at the technical meeting with Chief forest engineers and engineers for forest fund from 21 forest enterprises, December 19, 2007, Vadul-lui-Vodă.
- Information of the project implementation has been disseminated to all district (raion) executive committees from the country, Executive Committee of TAU Gagauzia (letter nr. 01-07/067 from 01.08.08).
- The information with regard to the project was disseminated at the meetings with the public local authorities, local councils and local communities during January - September 2008.
- Report on EIA and EMP were posted on the website of the Forestry Research and Management Institute (www.icas.com.md) on December 15th, 2008.
- During December 2007 – September 2008, Forestry Agency Moldsilva has organized 4 technical meetings with the participants from the state forest units (Chief Forest Engineers, Engineers for Forest Regeneration and Forest Fund, etc) and 16 working meetings with the representatives of the local public authorities were organized.
- On February 12, 2009 the workshop organized by the Forestry Research and Management Institute jointly with the Regional Environmental Centre from Moldova (REC Moldova) took place. Representatives from NGOs, academic institutions, education institutions and mass-media participated in the workshop on Environmental Management Plan developed under Moldova Community Forestry Development Project.

H.2. Summary of the comments received:

>>

The following comments were received as part of consultation process.

- The project should consult with local communities in the selection of species for planting.
- Guidelines need to be implemented 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 needs to be provided to mitigate the risk of illegal grazing.

- There is a need for cooperation between Forestry Agency "Moldsilva" and non-governmental organizations in managing communal forests;
- There is a need to ensure the sustainability of newly created forests through cooperation with local population;
- Local population should be provided opportunities to take part in forest management planning and maintenance of community forests and forest vegetation;
- There is a need to disseminate periodic information on the project implementation, as well as on the implementation of other programs promoting forest management.

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

>>

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

- Fodder collection and hay making between trees rows in the afforested areas is permissible as per legislation in force (the Forest Code, Regulations on haymaking and grazing of animals on areas under the forest fund).
- 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, people have free access to the areas of forest fund for recreational purposes and harvest of non-timber products such as fruits, berries, walnuts, mushrooms etc. (with the exception of sectors);
- The local communities can get temporary employment in planting activities.
- Afforestation of degraded lands will improve the landscapes and improve recreation value of forest created under the project.

Annex 1

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

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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

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 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.

- Stratification of the baseline is made under "degraded lands" and "pastures" which are further categorized in "humus rich" and "humus poor" sites based on the soil organic carbon status of the lands;
- A number of samples of grass & herb litter and soil was then taken on the sites to determine the variance of litter and soil carbon;
- Selection of sites (based on the list of sites from Annex 2) was done by the team leader in co-operation with the other staff of the Agency Moldsilva. In the selection the following aspects were taken into account, to get a balanced distribution of the samples: stratification based on land-use and humus classes, location all over the country, plot sizes, ownership, accessibility etc.;
- Analyses of humus and carbon content in a recognized soil laboratory from the Republic of Moldova;
- From the detected carbon levels and their variation the number of samples was calculated to reflect the mean soil carbon content of the baseline area within an error margin of 10% with 95% probability.

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 of these two components.

Measurement of carbon pools

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

Soil carbon

For determination of soil carbon/humus a number of 88 sample plots were selected. These plots were separated into two groups: I group – 10 sectors for detailed analysis and II group – 78 sectors for standard analysis. From each sample plot selected within I group 10 samples were taken for humus analysis (in total 100 soil samples). Samples were takes along a diagonal line every 100 m towards the relief change. For each plot from II group 3 soil samples were taken for humus analysis (in total 234 soil samples).

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. For every 20 sample plots one copy sample and one standard sample were taken. Samples were taken with a soil corer to a depth of 30 cm and collected in labeled cloth bags. For the determination of specific density 1 sample in tree replications per site was taken in a depth of 17-22 cm, using standard cylinders with known volume.

Litter

Litter samples for sample plots from I group were collected using a standard frame 50x60 cm. All litter down to the top of the mineral soils was collected, including all dead plant material. We took up to 3 samples for every plot (total 30 samples). The samples were collected in labeled cloth bags. The fact is that that the most lands were ploughed for planting in previous years and due to severe drought in 2007, amounts of litter were minimal and on some sites it was not litter at all.

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[23].

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

Consideirng the lack of pre-existing vegetation or its highlight degraded statue, the carbon stock of biomass is either absent or very low on the pasture lands and "degraded lands". The pastures in the agricultural use are degraded and their productivity is extremely reduced due to the excessive and uncontrolled grazing of domestic animals (cattle, sheep and goats). Thus, according to information from the Ministry of Agriculture and Food Industry, the average annual productivity of these lands is about 1 ton of dry mass/ha or 0,45 t C/ha. The average of litter sampling (10 sites – 30 samples) demonstrates

[23] 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.

even smaller quantity (0,3 t C/ha). Under increasing pressure from uncontrolled grazing, the annual herbs and grasses will not be able to increase their biomass on these sites in the absence of the project.

Soil carbon

The analysis of 334 soil samples, based on 88 sites (Annex 13b) revealed that the difference between the average soil carbon content (0-30cm) from degraded lands (73.5 t/ha) is not big from the average soil carbon content from pastures (57.1 t/ha), taking into account the size of the standard errors of the averages (7.6 and 6.2 respectively). Significantly different soil carbon contents were however detected between the means of the subgroups rich soils (74.6 tC/ha) and poor soils (34.4 tC/ha). These groups were also more homogeneous with smaller standard deviations of the means. The overall mean of soil carbon over 88 sites is 63.1 t/ha with a standard error of 5.8 t/ha.

Regarding the permanence of the soil carbon, a basic understanding of its dynamic process is essential: The soil carbon pool (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 pasture land the soil carbon inflows through pasture. Its rate can be estimated, according to the above data of the Ministry of Agriculture and Food Industry (pasture productivity 0.45 t C/ha/yr) and supposing that 50% is lost through animal feeding), to be around 0.225 t C/ha/yr.

Soil carbon outflow occur at a higher rate. According to Table A1, the annual losses of soil carbon vary on slopes of $2\text{-}8^0$ inclination from 0,69 to 0,87 tC/ha/year. This contains a share of 0.23-0.35t C/ha/year from dehumification process[24].

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

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, Moldsilva (ICAS), Chisinau.*

Based on the exposed approaches the most likely development of soil carbon on the project lands is an annual decrease of about 0.2-0.7 t C / ha / year. That decrease is dependent on current conditions of land particularly is influenced by grazing intensity and slope gradient. A conservative approach has been used in the calculation process with an initial carbon stock of 63.1 t C / ha, losses from erosion of 0.35-0.4 tC / ha and carbon inflows from the grass and herb growth of 0.225 t / ha. The predicted carbon losses over 30 years are about 5 t/ha (Table A.2). At the end of 100 year period the forecasted soil carbon stock of the baseline reaches a value of 36.1 tC/ha or the loss of 27 tC/ha.

Table A.2. Soil carbon development predictions over 30 years

[24] 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.

Project 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	63,1	-0,40	0,225	63,1	0,0
1	62,9	-0,40	0,225	62,7	-0,4
2	62,7	-0,40	0,225	62,5	-0,6
3	62,5	-0,40	0,225	62,3	-0,8
4	62,3	-0,40	0,225	62,1	-1,0
5	62,1	-0,40	0,225	61,9	-1,2
6	61,9	-0,40	0,225	61,7	-1,4
7	61,7	-0,40	0,225	61,6	-1,5
8	61,6	-0,40	0,225	61,4	-1,7
9	61,4	-0,40	0,225	61,2	-1,9
10	61,2	-0,40	0,225	61,1	-2,0
11	61,1	-0,40	0,225	60,9	-2,2
12	60,9	-0,40	0,225	60,8	-2,3
13	60,8	-0,40	0,225	60,6	-2,5
14	60,6	-0,40	0,225	60,5	-2,6
15	60,5	-0,40	0,225	60,3	-2,8
16	60,4	-0,40	0,225	60,2	-2,9
17	60,2	-0,40	0,225	60,0	-3,1
18	60,1	-0,40	0,225	59,9	-3,2
19	59,9	-0,40	0,225	59,8	-3,3
20	59,8	-0,40	0,225	59,6	-3,5
21	59,7	-0,40	0,225	59,5	-3,6
22	59,5	-0,40	0,225	59,3	-3,8
23	59,4	-0,40	0,225	59,2	-3,9
24	59,3	-0,40	0,225	59,1	-4,0
25	59,1	-0,40	0,225	59,0	-4,1
26	59,0	-0,40	0,225	58,8	-4,3
27	58,9	-0,40	0,225	58,7	-4,4
28	58,7	-0,40	0,225	58,6	-4,5
29	58,6	-0,40	0,225	58,4	-4,7
30	58,5	-0,40	0,225	58,3	-4,8

Source: *Project Implementation Unit, Moldsilva (ICAS), Chisinau*

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

Taking into account the carbon status of vegetation and soil on the different land-use classes and its likely development the following scenario can be postulated (Table A3).

Table A3. Total soil carbon stocks and dynamics

No.	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)	Carbon Stock in 15 years
1.	***Degraded lands***	***4 520,04***	***0,44***	***64,80***	***228 739***		***192 486***
1.1.	Rich soils	1 568,59	0,34	83,90	132 138	-0,60	118 021
1.2.	Poor soils	2 951,45	0,73	32,00	96 601	-0,50	74 465
2.	***Pasture***	***6 068,57***	***0,31***	***56,70***	***371 987***		***328 291***
2.1.	Rich soils	4 856,75	0,38	66,90	326 762	-0,50	290 337
2.2.	Poor soils	1 211,82	0,12	37,20	45 225	-0,40	37 954
TOTAL		**10 588,61**			**600 726**		**520 777**

***Source** : Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

On the basis of the lands foreseen to be included in the project according to the land-use category and soil group, the total carbon balance was calculated (Table A4). At the same time the likely evolution of the soils of the corresponding lands was taken into consideration. The main carbon losses will occur as a result of diminishing soil fertility in connection with the aggravated erosion process. Thus, according to the above mentioned methodology it was established that the annual soil losses caused by erosion constitute in average 1.5 t of fertile soil on pastures and 1.6 tons on degraded lands.

The share of carbon in the 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 the case of pastures the annual losses of carbon in the result of erosion at 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.

The results of the two approaches are relatively similar in its soil carbon levels and predictions of reduced carbon stocks in a 15 years period, although in detail (e.g. vegetation carbon) there are some differences of the models.

Table A4. Total soil carbon stocks and dynamics with average data

Land-use type	Area (ha)	Carbon in vegetation (t C)	Soil carbon (t C)	Annual carbon loss (t C/yr)	Carbon stock in 15 years (t C)
Degraded soils	***4 520,04***		***226 051***	***1 161***	***208 632***
Rich soils	1 568,59		131 605	546	123 417
Poor soils	2 951,45		94 446	615	85 216
Pastures	***6 068,57***	***40 962,85***	***369 996***	***1 826***	***342 602***
Rich soils	4 856,75	32 783,06	324 917	1 588	301 094
Poor soils	1 211,82	8 179,79	45 080	238	41 508
Total	**10588,61**	**40 963**	**596 047**	**2 988**	**551 234**

***Source** : Project Implementation Unit, Moldsilva (ICAS), Chisinau.*

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

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 selected 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 a

DATA ON DEGRADED STATUS OF THE AREA COVERING PROJECT LAND PARCELS

Enclosed as separate document

Annex 6 b

AN EXAMPLE OF CADASTRAL INFORMATION ON LAND USE OF THE PROJECT SITES

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 9

CALCULATIONS ON THE BASE OF TARAM V.1.3. MODULE
Enclosed as separate document

Annex 10

SPREADSHEET SHOWING SAMPLE SIZE CALCULATION
Enclosed as separate document

Annex 11

AFFORESTATION/REFORESTATION DATA BEFORE THE PROJECT
Enclosed as separate document

Annex 12

ECONOMIC ANALYSIS OF MOLDSILVA
Enclosed as separate document

Annex 13a

CALCULATION OF BASELINE SOIL CARBON
Enclosed as separate document

Annex 13b

BASELINE SOIL PLOTS
Enclosed as separate document

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