Monitoring report form

(Version 04.0)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT	
Title of the project activity	India: Himachal Pradesh Reforestation Project - Improving Livelihoods and Watersheds
Reference number of the project activity	4174
Version number of the monitoring report	8
Completion date of the monitoring report	13/03/2015
Registration date of the project activity	04/03/2011
Monitoring period number and duration of this monitoring period	1st Monitoring Period (01/07/2006 to 31/12/2012)
Project participant(s)	**India**: M/s HP Mid-Himalayan Watershed Development Project (MHWDP) **Spain**: International Bank for Reconstruction and Development (IBRD) as trustee for the BioCarbon Fund (BioCF) Kingdom of Spain - Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness Zeroemissions Carbon Trust, S.A **Switzerland**: Syngenta Foundation for Sustainable Agriculture **Ireland**: Government of Ireland - Department of the Environment, Community and Local Government
Host Party(ies)	India
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	14 – Afforestation and Reforestation A/R ACM 0001 Version 03 – Afforestation and Reforestation of Degraded Land
Estimated amount of GHG emission reductions or net anthropogenic GHG	170,746 t CO2e

removals by sinks for this monitoring period in the registered PDD	
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	65,582 t CO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	65,582 t CO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	Not Applicable

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>> The A/R CDM project is being implemented in the Indian State of Himachal Pradesh. The state is located in the North-Western Himalayan region of India and has 12 districts, which are categorized into four agro-climatic zones, i.e., i) Siwalik hills, ii) Mid hills, iii) High hills and iv) Cold dry zone. The Project area lies in the mid and high Siwalik hills at an altitude ranging from 600 to 1,800 meters and covers 11 watershed divisions in 10 districts and is spread over the catchments of Ravi, Beas and Sutlej, major rivers of Northern India.

The A/R CDM project has been designed under the MHWD Project. It has been developed and implemented through a series of consultations involving MHWDP and its stakeholder constituents namely, Forest Department (Government of Himachal Pradesh) local institutions, Gram Panchayats (GPs); and the International Bank for Reconstruction and Development as the trustee of the BioCarbon Fund. The project is implementing A/R CDM activities on 4,003.07 ha of degraded lands in 420 land parcels of the watersheds spread over in 177 Gram Panchayats of Mid-Himalayan region.

The four guiding principles of the project are: (i) adoption of native and locally preferred tree species for reforestation, (ii) involvement of the local GPs and small and marginal farmers in reforestation activities to strengthen the ongoing watershed management interventions, (iii) facilitation of technical, financial and capacity development support from MHWDP for reforestation activities, and iv) distribution of carbon revenue to local institutions (GPs) and farmers.

The major objectives of the project are to:

- improve the productive potential of degraded land and watershed catchments by enhancing biomass production and carbon stocks on degraded land included in the project,
- sequester greenhouse gas (GHG) removals by sinks through reforestation on degraded forest, community and private lands, and
- contribute revenue to improve livelihoods and incomes of rural households residing in the watersheds covered under the project.

The project is expected to restore degraded land through reforestation activities and bring value addition to the activities undertaken for improving catchments as part of the MHWDP. The project is expected to provide multiple benefits to poor households through meeting their needs of small timber, firewood, minor forest produce, besides providing employment opportunities and revenue from the sale of certified emission reductions. The three reforestation models implemented in the project are outlined below.

- Restoration forestry: In this model, reforestation of degraded forestland is undertaken by planting 1,100 plants/ha of mostly native species. The restoration forestry aims to protect watersheds, conserve biodiversity, and regenerate native flora, and involves supplemental planting of native tree species on degraded high altitude lands of selected GPs. Regenerated forests are expected to provide non-timber forest products to local communities and improve their livelihood opportunities. Out of a total area of 3,176.86 ha under this model, 2,943.14 ha has been planted during this monitoring period.

- Community forestry: This model is being undertaken for reforestation of degraded community lands (common land). The species included in this model are largely native species. The reforestation activity will lead to protection of watersheds, improvement in biomass required to meet the local community needs such as small timber, fuelwood, fodder and non-timber forest products. Out of a total area of 293.06 ha under this model, 226.74 ha has been planted during this monitoring period.

- Farm forestry: Under this model, reforestation has been promoted on abandoned or long-term fallow private lands with the objective of providing fruits and fodder to private land owners. Through this model, in addition to protection of abandoned lands from soil erosion, land owners derive fuelwood non-timber products, and employment. From a total area of 533.15 ha under this model, 40.31 ha has been planted during this monitoring period.

The A/R CDM project contributes to sustainable development in the following ways:

- Restoration of degraded forest land, degraded community land, and degraded and abandoned private land, which are subject to severe soil erosion and unsustainable land use practices.

- Promotion of local community participation, particularly small and marginal farmers in plantation activities with multi-purpose species on degraded forestlands, degraded common lands, and private degraded lands.

- Generation of employment through silvicultural activities such as nursery raising, site preparation, seedling transportation, planting, protection and maintenance of plantations. About 343 person days/ha of employment is expected to be generated during the project period

- Promotion of biodiversity and environmental protection objectives through planting and protection of native tree species, reduction in risk of soil erosion and prevention of downstream siltation of water bodies.

- Supply of multiple products to local communities.

- Transfer of revenues accrued from the project to participating gram panchayats and individual farmers.

The progress of project implementation is as below.

- Start date of the project: 01 July 2006 - Progress of planting activities: from 2006 to 2012
- Registration of the project: 04 March 2011
- First monitoring period: 01 July 2006 to 31 December 2012
- Start of the first periodic verification: 08 October 2013

The project will continue to be implemented and managed by the MHWD project authorities till 2016 or beyond (if MHWD is extended) and subsequently by the State Forest Department. The Project Directorate will manage and transfer the carbon revenue to local stakeholders, i.e. panchayats and/or individual farmers. In addition to carbon revenue, the restoration, community and farm forestry activities will bring additional benefits such as land reclamation, increased biomass supply and livelihood opportunities to local communities.

During the first monitoring period, the project has demonstrated the implementation of CDM project activities; developed institutional mechanisms for the sale of Certified Emission Reductions (CERs); promoted financial arrangements for restoration of degraded lands; and enabled participation of resource-poor farmers in the implementation of the project. Being the first of its kind, the project is expected to have significant demonstration effect in the country. The addition of Bio-carbon component to the watershed project of the HP through this CDM project has been a pioneering effort to demonstrate the climate change mitigation through watershed restoration activities.

The net anthropogenic GHG removals by sinks from the project at the end of first monitoring period (01/07/2006 to 31/12/2012) are 65,582 tCO_2e. The details of calculations of net anthropogenic GHG removals by sinks are presented in the ER calculation spreadsheet included as **Annex I** to the MR.

A.2. Location of project activity

>> The project is located in the mid-altitude region of Himachal Pradesh, India at elevations ranging between 600 and 1,800 meters above mean sea level. The project area is spread over 420 land parcels in 177 gram panchayats (village councils) of 11 watershed divisions namely Nahan, Swarghat, Solan, Namhol, Kullu, Rampur, Mandi, Sujanpur, Dharamshala, Nurpur and Chowari in Dharamshala and Bilaspur regions. The details of land parcels planted during the monitoring period are presented in **Annex II** to the MR. The Figure A.1 shows project area covering various districts of Himachal Pradesh.

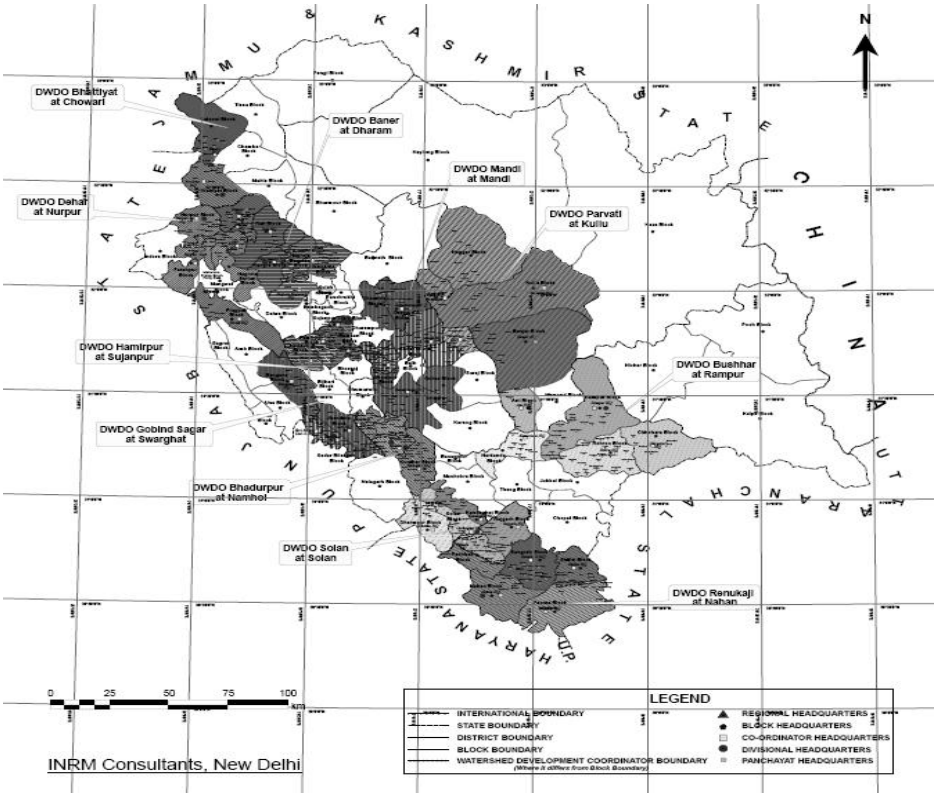

Figure A. 1: Map of Himachal Pradesh with watershed divisions marked and selected divisions identified

A.3. Parties and project participant(s)

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 project participant (Yes/No)
India	M/s HP Mid-Himalayan Watershed Development Project (MHWDP)	No
Spain	International Bank for Reconstruction and Development (IBRD) as trustee for the BioCarbon Fund (BioCF) Kingdom of Spain -Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness Zeroemissions Carbon Trust, S.A	Yes
Switzerland	Syngenta Foundation for Sustainable Agriculture	No
Ireland	Government of Ireland - Department of the Environment, Community and Local Government	Yes

A.4. Reference of applied methodology and standardized baseline

>> "Afforestation and Reforestation of degraded land" (AR-ACM0001, version 03).

The A/R methodological tools and guidelines applied at validation and verification of the project are noted below.

A/R Methodological Tools

- Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (version 01)[1]
- Calculation of the number of sample plots for measurements within A/R CDM project Activities (version 02)[2]
- Tool for testing significance of GHG emissions in A/R CDM project activities (version 01)[3]
- Estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of a CDM A/R project activity (version 03)[4]
- Tool for estimation of GHG emissions related to displacement of grazing activities in an A/R CDM project activity (version 02)[5]
- Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities (version 01)[6]
- Procedure to define the eligibility of land for afforestation and reforestation project activities (version01)[7].
- Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in A/R CDM project activities (version 01)[8]
- Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (version 04.1)[9].

[1] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-02-v1.pdf

[2] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-03-v2.pdf

[3] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-04-v1.pdf

[4] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v3.pdf

[5] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-09-v2.pdf

[6] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-13-v1.pdf

[7] https://cdm.unfccc.int/EB/022/eb22_repan16.pdf

[8] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-06-v1.pdf

[9] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.1.pdf

- Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM Project Activities (version 01.1.0)[10].
- Demonstration of Appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities (version 01.0.1)[11].

EB Guidelines

- Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents (Version 02.0) (EB 66, Annex 24)[12].
- Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities (Version 01.1) (EB68, Annex 31)[13].

A.5. Crediting period of project activity

>> The Project has adopted renewable crediting period. The first crediting period of 20 years, is renewable further for two additional 20-year crediting periods. The starting date of the first crediting period is 01/07/2006, which ends on 30/06/2026.

A.6. Contact information of responsible persons/ entities

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Mr. Avtar Singh, Chief Project Director, H.P Mid Himalayan Watershed Development Project, Forest Road Solan, Himachal Pradesh, 173212.
Tel: +91 1792 223043; Email: cpdmhwdp@yahoo.co.in

Mr.Simon Whitehouse, Fund Manager/Mr.Jose Andreu, Operations Team Leader, International Bank for Reconstruction and Development (IBRD), 1818 H Street NW, Washington DC, 20433.
Tel: +1 202 458 4416 / +1 202 458 5051; Email: ibrd-carbonfinance@worldbank.org

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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Project has been implemented as a sub project of the Mid Himalayan Watershed Development Project (MHWDP) involving HP Forest Department and the local institutions i.e. Gram Panchayats through community user groups. The officials responsible for coordinating project implementation and organization of data/information/reporting of the project have been designated at various levels.

Out of the project area of 4,003.07 ha, a total of 3,210.19 ha area has been planted until the end of first monitoring period. The details of reforestation activities implemented in different project strata from 1 July 2006 to 31 December 2012 are presented in **Annex II** to the MR, and the summary is presented in Table B1 below.

The public entity implementing the project, HP Mid Himalayan Watershed Development Project (MHWDP) has control over all the project area. The MHWDP directly manages forest and community lands. The MHWDP has also signed sub-project agreements with the private land owners for implementing the project on private lands included in the project. A copy of the sub-project agreement signed with private land owners has been shared with the DOE team at the

[10] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-16-v1.1.0.pdf

[11] https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-18-v1.0.1.pdf

[12] https://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid32.pdf

[13] https://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid30.pdf

verification site visit. A copy of sub-project agreements is also submitted as part of the supporting documentation to the MR.

Table B.1: Project area planted during the first monitoring period and the project area that needs to be planted

	Project area planted during the first monitoring period (ha)	Remaining project to be planted (ha)	Total project area (ha)
Restoration forestry (Degraded forestland)	2,943.14.	233.72	3,176.86
Community forestry (Degraded community land)	226.74	66.32	293.06
Farm forestry (Degraded private land)	40.31	492.84	533.15
Total	3,210.19	792.88	4,003.07

The area of 792.88 ha that was not planted during the first monitoring period is proposed to be planted during the second monitoring period. The proposed schedule for planting these areas has been presented in **Annex III** and is summarized in Table B2 below.

Table B2: Proposed planting schedule for the remaining project area that needs to be planted

	Restoration forestry (Degraded forestland) (ha)	Community forestry (Degraded community land) (ha)	Farm forestry (Degraded private land) (ha)	Project area to be planted (ha)
2013	180.00	50.00	200.00	430.00
2014	53.72	16.32	292.84	362.88
Total	233.72	66.32	492.84	792.88

The selection of species was based on their suitability to altitude, slope, topography, and site quality. Focus was on native species or species that are widely adapted to the location. Furthermore, among the suitable species, those with moderate to high growth rate of biomass and ability to provide multiple benefits to the community were selected.

The project includes degraded forestland, community land and private land categories, for which planting models – restoration forestry, community forestry and farm forestry, respectively were adopted, and based on altitude, each of the three models were further categorized into high, medium and low altitude. As a result, nine (9) project strata were identified in the registered PDD. As part of the ex post stratification, areas of the project strata that are not planted during the first monitoring period are grouped into a separate stratum. The details of ex post stratification are presented in section D.3 on implementation of sampling plan.

Fencing: was used to protect about 50 percent of the project area while the remaining area did not require fencing.

Seed: High quality seeds were selected from forest and plantation sources for raising seedlings. The seeds collected were tested for their germination ability and growth in the nurseries.

Nursery Technology: Decentralized nurseries were established in different watershed divisions and in Gram Panchayats, which reduced the transportation cost as well as vehicular emissions. Species were raised in nursery for a period of 12 to 18 months. All nursery activities were carried

out using manual labour. The seedlings raised in nurseries were transported to planting sites. To ensure better survival of plants, nursery activities focused on developing sturdy and profuse root system for seedlings.

Site preparation: This involved clearing of weeds from an area of about 0.06 m^2 for each seedling and digging pits of 45x45x45cm. Clearance of vegetation was restricted to the area of pits (i.e. 0.06 m^2 per pit). The total area disturbed per hectare was insignificant at around 70 m^2/ha (0.007% of area planted). This helped to protect the soil moisture and to avoid oxidation of soil organic matter. Slash and burn practice was not used in the project area to avoid the emissions of greenhouse gases. All land preparation activities were carried out using manual labour.

Planting*:* Planting was carried out during monsoon months (July-Aug and Nov-Dec). The list of species planted in the project is presented in table B.3 below. The replacement planting was carried out to replace the failed seedlings during second to fifth year after planting. Seedlings were replanted depending on the mortality of the planted seedlings. The proportion of fast and slow growing species planted in the project approximates to that proposed in the Box A.5.2 of the registered PDD.

Table B.3: Species planted in project

Acacia catechu	*Grewia optiva*
Acacia nilotica	*Lannea grandis*
Albizia lebbeck	*Leucaena leucocephala*
Albizzia procera	*Mallotus philippinensis*
Albizzia stipulata	*Melia azadirachta*
Alnus nitida	*Myrica sculenta*
Azadirachta indica	*Olea glandulifera*
Bambusa stricta	*Pinus roxburghii*
Bamboo	*Pinus wallichiana*
Bauhinia variegata	*Poplus ciliata*
Bauhinia purpurea	*Prunus padus*
Butea monosperma	*Punica Granatum*
Bombax ceiba	*Pyrus pashia*
Cassia fistula	*Quercus leucotrichophora*
Cassia seamia	*Robinia pseudoacacia*
Cedrus deodara	*Salix alba*
Celtis australis	*Syzygium cuminii*
Dalbergia sissoo	*Tectona Grandis*
Dendrocalamus strictus	*Terminalia arjuna*
Emblica offcinalis	*Terminalia tomentosa*
Engelhardtia colebrookiana	*Toona ciliata*
Ficus spp./Ficus roxburghii	
Flacourtia indica	
Grevillea robusta	

Fertilizer and manure application: It was decided not to apply both organic and inorganic fertilizer to the plants.

Species mix: A wide range of species were used in planting to ensure that communities' requirements for timber and non-timber product supplies are met.

Weeding and cultural operations*:* Weeding was carried out manually to reduce competition for planted seedlings. Manual weeding was done twice a year for 5 years during September to February. Cultural operations did not result into disturbance of top soil.

Tending, thinning operations*:* The silvicultural operations were not carried out as the project is in the early stages of growth and establishment.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>> **None**

B.2.2. Corrections

>> **None**

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>> **None**

B.2.4. Changes to project design of registered project activity

>> **None**

B.2.5. Changes to start date of crediting period

>> **None**

B.2.6. Types of changes specific to afforestation or reforestation project activity

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The "Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents" (Version 02.0) (Annex 24, EB 66)[14] were applied to the project.

It was assessed that the changes in planting schedule in terms of year-wise area planted and species composition have not impacted the baseline scenario and additionality of the project. It is clarified that the changes in the area planted and species composition are small changes that resulted from small changes that are part of normal maintenance and as replacement for seedling mortality on degraded lands as well as adjustment to the seedling supply from nurseries. These changes do not have impact on the baseline scenario and additionality.

As per the paragraph 6 of the "Procedures for notifying and requesting approval of changes from the project activity as described in the registered project design document" (EB 48, annex 66)[15] and the "Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents" (Version 02.0) (Annex 24, EB66), it was assessed that the changes identified are minor, without the need for submitting a notification or a request for approval.

The types of changes of A/R CDM project from the description in the registered PDD confirming to the "Guidelines on accounting of specified types of changes in A/R CDM project activities from the

[14] http://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid32.pdf

[15] http://cdm.unfccc.int/EB/048/eb48_repan66.pdf

description in registered project design documents" (Version 02.0) (Annex 24, EB66) are summarized in the table B.4 below.

Table B.4: Types of changes in the project relative the project description in the PDD

	Types of changes from the Project description in the PDD of an A/R CDM project activity	**Applicability to the project**
a)	Changes in year wise areas planted, possibly resulting in a part of the project area not being planted;	Yes, as result of minor changes in year wise area planted relative to the schedule of planting proposed in the PDD; an area of 3,210.19 ha out of 4,003.07 ha has been planted until December 2012; and the planting of the remaining area of 792.88 ha is proposed during the second monitoring period as per the schedule presented in Table B2 above.
b)	Changes in species composition, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage;	Yes, changes in species composition occurred during the project implementation. Due to degraded site conditions and other location specific factors, survival and growth rates of some species were not as anticipated resulting in their replacement with species with similar growth characteristics that have better survival. In addition, small changes to the stand models were needed to be made as per the field level implementation requirements, site conditions of land parcels, and to adjust the planting schedule to the supply of seedlings from nurseries. These small changes in species composition do not have impact on the baseline and the additionality of the project.
c)	Changes in stocking density, if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage:	No changes
d)	Changes in timing and choice of silvicultural operations:	No change in silvicultural operations
e)	Changes in timing of harvest occurring before the third verification;	No
f)	Changes related to collection of non-timber forest products;	No
g)	Changes in tree/shrubs propagation methods;	No
h)	Changes in post –harvest replanted/regeneration methods;	Not applicable as planted areas are not harvested
i)	Changes in technology employed;	Yes, for measurement of tree height, clinometer was proposed to be used. However, height of the seedlings of the planted project areas was not as anticipated because of the degraded nature of sites. It was not feasible to use clinometer. Therefore, pole method was adopted. With this method, wooden pole

		with graduated height was held vertically along the side of the tree seedling and the tree height corresponding to the graduate pole was recorded.
j)	Changes in inputs (e.g. fertilizers, certified seeds, watering);	No
k)	Changes in stratification for sampling;	No
l)	Changes in type of sample plots (e.g. temporary, permanent, point –sampling);	No
m)	Changes in number of sample plots and their allocation to strata;	Yes, the calculation of number sample plots and their allocation to the project strata has been revised from original 168 sample plots to 152 sample plot. The change is primarily due to the small area of private lands planted relative to the total area of private lands under the project.
n)	Changes in the project boundary (limited to reduction in project area), if the changes are demonstrated at verification to be consistent with the baseline identification and additionality demonstration made at the validation stage.	No
o)	Changes in quality assurance/quality control (QA/QC) procedures, where it can be demonstrated that the changed QA/QC procedures are used by the National Forest Inventory or were applied in another registered A/R CDM project activity	No
p)	Changes in parameters, equations, or methods used in tree biomass estimation, if the applicability of the changed parameters, equations, or methods is demonstrated at verification using the "Tool for demonstration of applicability of allometric equations and volume equations in A/R CDM project activities" when available, or if the changed parameters, equations, or methods do not result in a decrease in precision of the estimate of tree biomass;	No
q)	Changes from provisions regarding shifting of pre-project activities, if the related emissions are estimated at verification using the tool "Estimation of the increase in greenhouse gas (GHG) emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity" and are accounted for as leakage	No
r)	Changes in use of fire in site preparation, if the related emissions are estimated at verification using the tool "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity" and are accounted for as project emissions	No
s)	Changes in extent of soil disturbance in site preparation, if the related emissions are estimated at verification using Equation (2) of	No

	the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" and are accounted for as project emissions	
t)	Changes in methods of estimation of changes in any carbon pool, if the method applied at verification uses the latest version of the relevant approved tool and the applicability conditions of the methodology applied are consistent with the applicability conditions of the tool	No

As per the "Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities" (Version 01.1) (EB68, Annex 31)[16], several early versions of methodologies applied in registered A/R CDM project activities contain requirements that were withdrawn during revisions/improvements of these methodologies. The guidelines (EB68, Annex 31) allow a registered A/R CDM project activity to apply, at the time of verification, the improvements in the methodology that occurred after the date of registration of the project activity. The applicability of these guidelines to the implemented project is listed in the table B.5 below.

Table B.5: Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities.

Requirement	Guidelines	Applicability to the project
Monitoring of data and parameters	(i) Only data and parameters obtained from field measurement are required to be monitored; (ii) Monitoring is not required for data, parameters, or variables appearing as intermediate values in calculation steps and those taken from existing sources (e.g. published literature)	Yes, data and parameters required to be monitored in the A/R methodological tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" were monitored.
Sampling design, sample plot lay-out, and marking of permanent sample plots	(i) Use of temporary sample plots; (ii) Random lay-out of sample plots; (iii) A maximum allowable relative margin of error of the mean, for estimation of aboveground tree biomass, of ± 10% at 90% confidence level shall be allowed.	Yes, 90% confidence level and 10% precision was applied.
Accounting for uncertainty	Requirements related to uncertainty assessment, uncertainty analysis, methods of combining uncertainties, and uncertainty in expert judgment is superfluous and compliance with these requirements shall not be enforced.	Although separate uncertainty analysis need not be conducted as per these guidelines, the latest version of the AR Tool 14, version 4.1.0 requires assessment of uncertainty. In compliance of the AR Tool 14, version 04.1.0, uncertainty assessment was conducted and adjustment to the net anthropogenic GHG removals by sinks was made.
Field measurement of soil	(i) Instead of field measurement of soil organic carbon, the "Tool for estimation of change in soil organic	Yes, A/R methodological tool "Tool for estimation of change in soil organic carbon stocks due to the

[16] https://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid30.pdf

Requirement	Guidelines	Applicability to the project
organic carbon	carbon stocks due to the implementation of A/R CDM project activities" shall be used for areas which meet the applicability conditions of the tool; or (ii) The value of change in soil organic carbon shall be set to zero. Consequently, monitoring of data and parameters related to estimation of changes in soil organic carbon shall not be required.	implementation of A/R CDM project activities" was used for estimation of changes in soil organic carbon pool.
Clearance or burning of herbaceous vegetation	(i) Changes in carbon stocks resulting from clearance of herbaceous vegetation shall be set to zero; (ii) Emissions resulting from clearance or burning of herbaceous vegetation shall be set to zero. Consequently, monitoring of data and parameters related to (i) and (ii) above shall not be required.	Yes, loss of carbon in living herbaceous vegetation was not accounted for.
Estimation of emissions of nitrous oxide from use of fertilizers	Estimation and accounting of emissions of nitrous oxide from use of fertilizers shall not be required. Consequently, monitoring of data and parameters related to the above-mentioned emissions shall not be required.	The project did not use nitrogenous fertilizers. Therefore, emissions of nitrous oxide from use of fertilizers were not required to be monitored.
Burning of fossil fuel	Estimation and accounting of emissions from burning of fossil fuel, both within and outside the project boundary, shall not be required. Consequently, monitoring of data and parameters related to the above mentioned emissions shall not be required.	Yes, emissions from burning of fossil fuel, both within and outside the project boundary were not monitored and accounted for.

SECTION C. Description of monitoring system

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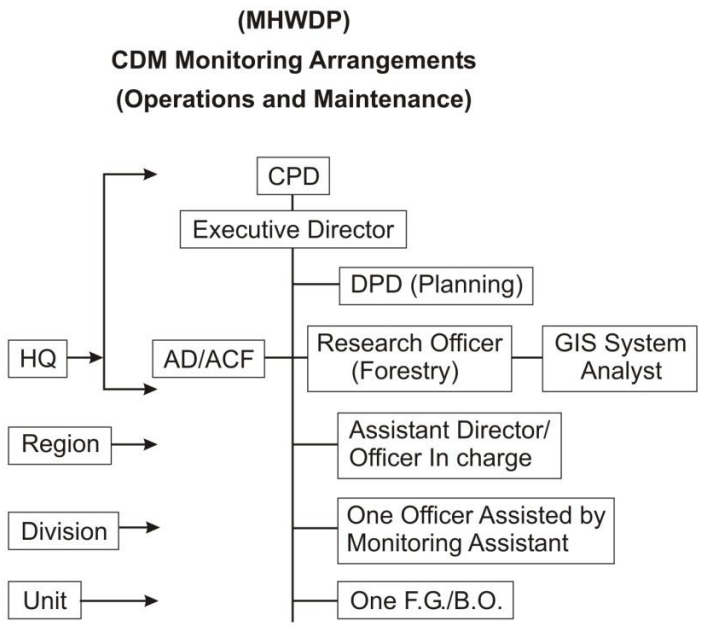
An effective monitoring system has been put in place through which periodic monitoring was carried out. The monitoring covered a range of parameters relevant for assessing the changes in GHG removals by sinks such as area planted, condition of land parcels, survival of seedlings, tree biomass growth, events occurring in the project area, status of contractual agreements with sub-project entities etc. Plantation Journals are being maintained and updated to reflect relevant information for each parcel.

The organization structure adopted for the project has facilitated successful conduct of project implementation and monitoring. The schematic overview of the organization structure for project monitoring is presented below.



>>

The types of parameters monitored in the project are noted below. The specific parameters monitored for calculation of actual GHG removals sinks are noted in the section D2.

Area of the project: The progress of planting in terms of the area planted and not planted in each stratum.

Growth and survival of seedlings*:* The survival of seedlings is checked through annual monitoring until seedling establishment.

Geographical coordinates: the Geographic coordinates of the project boundary checked as part of the monitoring.

Participation of GPs/ community groups/private land owners: Monitoring covers participation of agencies in implementing the project.

Natural hazards: Monitoring covers natural events such as fire etc. to assess the risk and implement preventive measures to address natural hazards.

Although field measurements were initiated from 15/05/ 2012, major part of measurements was conducted between 01/09/2012 and 31/10/2012. Subsequently, during November 2012 and December 2012, crosschecks of field measurements were performed and errors if any were identified and corrected as part of the QA/QC to ensure the accuracy of the measurements. Therefore, the field measurements and QA/QC checks of the field measurements were completed prior to 31/12/2012.

C.1 Emergency procedures adopted in the project

The project adopted procedures to address the following emergencies.

- *Procedures to assess fire and its management*
  The project implemented fire prevention measures such as establishment of fire lines, reduction of fuel load, clearance of brushwood and dry vegetation close to project parcels. In case of accidental fires, the area and carbon stock affected was assessed through survey and recorded in the project database. The procedures used for calculation of GHG emissions from fires were adopted.

- *Procedures to assess the impact of land slides*
  As the project area faces risks from landslides, erosion and landslide prevention measures were implemented. Procedures to assess the land slide and erosion impacts were adopted.

- *Procedures to assess the impact of pest and diseases*
  Monitoring procedures to assess the area affected by pests and diseases and measures to minimize the spread of infestation to areas outside project boundary were adopted.

- *Procedures to assess the impact of weather related natural hazards*
  Procedures to assess the impact of weather related natural hazard events such as droughts and floods in the project area were adopted.

C.2 Events reported during the first monitoring period

During the first monitoring period, few isolated fire events were reported, which were recorded and measures were implemented to control them. The details of fire events reported during the first monitoring period are presented in the Table C.1 below.

Table C.1: Details of fire events occurred during the monitoring period

SNo	Name of Division	Name of Gram Pachayat	Parcel ID	Area affected (ha)	Remarks
1	Nahan	Khood Drabil	NH038F3	1.52	Localized incidences of fire were controlled, and affected areas were replanted. No significant emissions resulted from these fires due to low biomass in early stages of planted areas.
2	-do-	Nehar Swar	NH008C1	1.68	
3	-do-	Kotla Molar	NH004P2	1.69	
4	Rampur	Banhar	RP040F1B	0.53	
5	Solan	Shariyana	SL033C4	1.23	
6	Namhol	Basantpur	NM056F1A	0.36	
7	-do-	-do-	NM056F1B	1.59	
8	-do-	Dhunkothi	NM019F1	2.01	
Total area				**10.61**	

The emissions related natural fires events are insignificant and the methodology does not foresee their estimation. Therefore, the project emissions related to natural fire events are ignored in the calculation of actual net GHG removals by sinks. Area affected in the fire events was replanted during the subsequent planting period.

C.3 Training activities conducted in support of the project implementation and monitoring

Training activities were organized in the field and at specialized training institutions in support of the project implementation and monitoring. The trainings covered a wide range of topics related to use of maps, Global Positioning System (GPS), forest inventory procedures, safety features during inventory, data collection and compilation, community mobilization for forest protection, conflict resolution, assessment of natural and anthropogenic risks and measures to be implemented to address emergencies. The details of training activities conducted in support of project implementation and monitoring are summarized in table C.2

Table C.2. Training activities implemented in support of project implementation and monitoring.

SNo	Topics	Period	Location	Personnel trained	Total
1	Training of Computer Operators/ Data Entry Operators Software handling	25 & 27 March, 09	Project HQ	Resource Persons from Prosix & Computer operators	10
2	Pre-validation/ validation workshop at World Bank	10-11, April 09	New Delhi & field visit at	IISc team (4) CPD, ED, DCF, World Bank	30

	office, N Delhi and field visit (Bio Carbon Project)		D/shala	functionaries, External Validators Project Officers & PDD consultants	
3	Training for Para Accountants, Panchayat Secretaries & Sahayaks.	21-23, May, 09	FTI, Chail	Para Accountants, Panchayat Sacretaries & Sahayaks	25
4	Workshop on Validation Issues pertaining to Bio Carbon Project	6-7 July, 09	Dharamshala Field Visit	RPDs, DPDs, DWDOs & WDCs	30
5	Study Tour cum Exposure Visit	20-24 Oct, 09	IIHR CST EMPRI (Bangalore) & MYRADA (Mysore)	RPD Dhala, DWDO Mandi DWDO Sujanpur, Asstt. Director D/shala	4
6	Community Mobilization Skills	17-18, May 2010	Nahan Divisions	Motivators of Nahan Div	26
7	Monitoring & Evaluation	14-18 Sept,2010)	EEI Nilokheri	Monitoring Assistants	3
8	Managerial Effectiveness	20-24, Sep 2010	IRMA Gujarat	Sh. A K Verma, ACF, HQ	1
9	Rural Livelihoods and Poverty Alleviation	19-22, Oct, 2010	IRMA Gujarat	Sanjiv Kumar, ACF DWDO, Solan, HS Paul ACF, DWDO Kullu, Munishi Ram, ACF, DWDO Mandi	3
10	Community Mobilization Skills	18-19 Nov, 2010	Namhol Division	Motivators	25
11	Community Based Watershed Management	December	IIRM Manila, Philippines	Surinder Paul, Dy Director (Plg), DWDO Kullu, & Sen	3
12	Google Earth	5 March, 2011	DCAD, Project HQ	CPD, Ex. Director, Sen, Ajay & Om Prakesh	5
13	Data collection and compilation	7 April, 2011	Project HQ	Monitoring Assistants	23
14	Community Mobilization Skills	15-16 Nov, 2010	DWDO Swarghat	Motivators	41
15	Community Mobilization Skills	18-19 Nov, 2010	DWDO Namhol	Motivators	25
16	Training on Inventory Techniques, Image Processing, GIS & GPS Applications	06-16 Dec,2010	Forest Survey of India, Dehradun	System Analyst & Marketing Coordinator	2
17	Data collection and compilation	7 April,2011	Project HQ	Monitoring Assistants	23
18	Vocational Training Certificate course in Computer Applications	13-18 June, 2011	Project HQ	AWDCs & WPDFs	20
19	Procurement Procedures for World Bank funded Project	16-28 Jan, 2012	NIFM Faridabad	Sanjeev Thakur, ACF O/O DWDO Solan	1
20	Social Conflicts Analysis and Resolution	6-10 Feb,2012	IIPD Delhi	AK Verma, ACF	1
21	Training on sample plot layout and biomass measurement	11 & 12 April, 2012	RPD Dharamshala	Deputy Ranger, Forest Guard, WDC	12

22	Geo- Spatial Technology for planning & project mgt	22-29, April,2012	GOI Hyderabad	Bimal Kumar, Sanjay Sen, Ajay Verma	3
23	Workshop on project and implementation monitoring skills	7 August,2012	Project HQ	Monitoring Assistants	21
24	Orientation Workshop for Project Staff associated with CDM Project	15 to 17 Sept, 2012	Project HQ	CPD, ED, DPDs, DWDOs, AWDO, WDCs, SMS, AWDCs	35

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter.)

Data / Parameter:	$BEF_{2,J}$
Unit:	Dimensionless
Description:	Biomass expansion factor for conversion of stem biomass (including bark) to total above-ground tree biomass increment for species *j;* dimensionless
Source of data:	Forest Survey of India (FSI) 1996: Volume Equations for India, Nepal and Bhutan, Ministry of Environment and Forests, Government of India; volume equations of species published in Journals and reports; and IPCC (2003) GPG LULUCF, Table 3A.1.10
Value(s) applied):	Value of species-wise $BEF_{2,j}$ is listed in the standard values worksheet of the ER calculation spreadsheet (Annex I to the Monitoring Report)
Purpose of data:	For conversion of stem biomass to above-ground tree biomass in the project.
Additional comment:	

Data / Parameter:	Rj
Unit:	Dimensionless
Description:	Root-shoot ratio for tree species or group of species *j* / kg d.m.yr^{-1} (kg d.m.yr^{-1})$^{-1}$
Source of data:	Root-shoot ratio of species published in journals and reports; and IPCC (2003) GPG LULUCF, Table 3A.1.8
Value(s) applied):	Value of species-wise root-shoot ratio (R_j) is listed in the standard values worksheet of the ER calculation spreadsheet (Annex I to the Monitoring Report)
Purpose of data:	For calculation of below ground tree biomass in the project.
Additional comment:	For species that have root-shoot ratio information published in journals and reports, those values were adopted; and for species that do not published root-shoot ration information, the root-shoot value for tropical and sub-tropical forest species, referenced in the IPCC (2003) GPG LULUCF, Table 3A.1.8 has been adopted. The information on sources of root-shoot ratio values of species in terms of published journals and reports has been included in the standard values worksheet of the excel sheet (Annex I to MR).

Data / Parameter:	Dj
Unit:	Dimensionless
Description:	Basic wood density for species *j* / t d.m. m^{-3}
Source of data:	Basic wood density of species published in journals and reports; and IPCC (2003) GPG LULUCF, Table 3A.1.10
Value(s) applied):	Value of species-wise basic wood density (D_j) is listed in the standard values worksheet of the ER calculation spreadsheet (Annex I to the Monitoring Report)
Purpose of data:	For conversion of volume in m^3 of wood to biomass in tonnes.
Additional comment:	The information on sources of basic wood density values of species in terms of published journals and reports has been included in the standard values worksheet of the excel sheet (Annex I to MR).

Data / Parameter:	**CF_j**
Unit:	Dimensionless
Description:	Carbon fraction of dry matter for species of type *j* / t C t^{-1} d.m.
Source of data:	IPCC (2003) GPG LULUCF
Value(s) applied):	0.5
Purpose of data:	For conversion of biomass to carbon
Additional comment:	

Data / Parameter:	**SOC (ΔC)**
Unit:	t C/ha
Description:	Annual increase in SOC (ΔC) in C/ha
Source of data:	Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM project activities, version 01.1.0; and approved spreadsheet for calculation of changes in soil organic carbon stocks (EB 60 Annex 12).
Value(s) applied):	0.51
Purpose of data:	To calculate the annual change in soil organic carbon pool
Additional comment:	The value of annual increment in SOC (ΔC) in C/ha has been calculated using the approved spreadsheet for calculation of changes in SOC (EB60, Annex 12).

Data/Parameters:	**$t_{(equilibrium)}$**
Unit:	years
Description:	Time in years required for increase in the soil organic carbon (SOC) to reach equilibrium
Source of data:	Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM project activities, version 01.1.0 (EB 60 Annex 12).
Value(s) applied:	20

Purpose of data:	To calculate the annual change in soil organic carbon pool.
Additional comment:	

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter:	A
Unit:	ha
Description:	Total area of the project
Measured/ Calculated / Default:	Calculated
Source of data:	Project monitoring
Value(s) of monitored parameter:	4,003.07 ha
Monitoring equipment:	GPS and GIS
Measuring/ Reading/ Recording frequency:	Measured at the start of the project and thereafter at monitoring intervals prior to each verification.
Calculation method (if applicable):	Sum of all project strata
QA/QC procedures:	Checked during monitoring period
Purpose of data:	Calculation of actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	A_i
Unit:	ha
Description:	Total area of stratum i
Measured/ Calculated / Default:	Measured
Source of data:	Project monitoring

<table>
<tr><td>Value(s) of monitored parameter:</td><td>Area of strata planned for planting (ha)

<table>
<tr><td></td><td>Forest</td><td>Community</td><td>Private</td><td>Total</td></tr>
<tr><td>Low</td><td>976.21</td><td>125.33</td><td>232.06</td><td></td></tr>
<tr><td>Medium</td><td>969.75</td><td>66.90</td><td>221.43</td><td></td></tr>
<tr><td>High</td><td>1,230.90</td><td>100.83</td><td>79.66</td><td></td></tr>
<tr><td>Total</td><td>3,176.86</td><td>293.06</td><td>533.15</td><td>4,003.07</td></tr>
</table>

Area of strata planted during the first monitoring period (ha)

<table>
<tr><td></td><td>Forest</td><td>Community</td><td>Private</td><td>Total</td></tr>
<tr><td>Low</td><td>929.87</td><td>109.39</td><td>11.45</td><td></td></tr>
<tr><td>Medium</td><td>876.87</td><td>56.66</td><td>22.79</td><td></td></tr>
<tr><td>High</td><td>1,136.54</td><td>60.69</td><td>6.08</td><td></td></tr>
<tr><td>Total</td><td>2,943.14</td><td>226.74</td><td>40.31</td><td>3,210.19</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment:</td><td>GPS and GIS, compass, and cloth and metal measurement tape</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Measured at the start of the project and thereafter at monitoring intervals corresponding to each verification</td></tr>
<tr><td>Calculation method (if applicable):</td><td>NA</td></tr>
<tr><td>QA/QC procedures:</td><td>Checked during monitoring period</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of actual net GHG removals by sinks</td></tr>
<tr><td>Additional comment:</td><td></td></tr>
</table>

Data / Parameter:	$A_{p,i}$
Unit:	ha
Description:	Area of sample plot p of stratum i
Measured/ Calculated / Default:	Measured
Source of data:	Project field measurement
Value(s) of monitored parameter:	500 m^2
Monitoring equipment:	GPS and GIS, compass, and metal and cloth measurement tape
Measuring/ Reading/ Recording frequency:	Monitoring period corresponding to each periodic verification
Calculation method (if applicable):	NA
QA/QC procedures:	QA/QC procedure includes multiple levels: checks of sample plot measurement by field staff and by the staff of project monitoring unit
Purpose of data:	Calculation of actual net GHG removals by sinks

Additional comment:	

Data / Parameter:	Species, j
Unit:	Dimensionless
Description:	Species planted in the project strata
Measured/ Calculated / Default:	Measured
Source of data:	Project monitoring data. The species planted in the project are listed in Table B.3 of the section B.1 of this monitoring report.
Value(s) of monitored parameter:	NA
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	Monitoring until establishment of species
Calculation method (if applicable):	NA
QA/QC procedures:	Checks to ensure consistency in field records and project database
Purpose of data:	Calculation of actual net GHG removals by sinks
Additional comment:	

Data / Parameter:	Survival
Unit:	Per cent
Description:	Survival of planted species
Measured/ Calculated / Default:	Measured
Source of data:	Project monitoring
Value(s) of monitored parameter:	80%
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	Monitoring period corresponding to each periodic verification
Calculation method (if applicable):	Percent of planted seedlings surviving in the field
QA/QC procedures:	Survival assessment is conducted in the field by the staff of the project is checked randomly in the field. The project monitoring unit also conducts checks.
Purpose of data:	Calculation of actual net GHG removals by sinks

Additional comment:	Survival assessment is conducted at annual and periodic intervals. The information on survival is presented under the parameter, survival, in the section D. For planted areas, survival information is used to implement replacement planting activities during the years 2 to 5. The survival percent is expected to improve further as replacement plantings in the areas planted during 2009 to 2012 are completed.

Data / Parameter:	DBH
Unit:	cm
Description:	Diameter at breast height (1.37m) of live trees
Measured/ Calculated / Default:	Measured
Source of data:	Measurement of trees on permanent sample plots
Value(s) of monitored parameter:	Values of DBH in cm recorded on sample plot measurement forms and transferred to ER calculation spreadsheet.
Monitoring equipment:	Calliper
Measuring/ Reading/ Recording frequency:	Monitoring period corresponding to each periodic verification
Calculation method (if applicable):	NA
QA/QC procedures:	Diameter measurements are randomly checked in the field e staff. The project monitoring unit also conducts checks
Purpose of data:	Calculation of actual net GHG removals by sinks
Additional comment:	Measurement of diameter of trees above minimum *DBH* of 2 cm on permanent sample plots following forest inventory procedures. DBH measurements are conducted at 1.37 meters as per the national forestry inventory procedures in India.

Data / Parameter:	H
Unit:	Meters
Description:	Tree height
Measured/ Calculated / Default:	Measured
Source of data:	Measurement of trees on permanent sample plots
Value(s) of monitored parameter:	Tree height in meters is recorded on sample plot measurement forms and transferred to calculation spreadsheet

Monitoring equipment:	For measurement of tree height, clinometer was proposed to be used. However, height of the seedlings of the planted project areas was not as anticipated because of the degraded nature of sites. Therefore, tree height was measured with pole method. The pole method refers to direct measurement of tree height with the use of graduated wooden or metal or fiberglass pole by placing it near a tree. For tree height measurement on sample plots, a wooden pole was used. With this method, wooden pole with graduated height was held vertically along the side of the tree seedling and the tree height corresponding to the graduate pole was recorded. As part of calibration, pole height was checked to ensure that there is no error in the height gradations marked on the pole.
Measuring/ Reading/ Recording frequency:	Monitoring period corresponding to each periodic verification
Calculation method (if applicable):	NA
QA/QC procedures:	Height measurements are randomly checked during sample plot measurement to ensure accuracy of measured data.
Purpose of data:	Calculation of actual net GHG removals by sinks
Additional comment:	The delayed schedule of planting, degraded soils, and slow growth of tree species resulted in seedlings with tree height smaller than anticipated. As a consequence, it was not feasible to use clinometer. The pole method was found to be appropriate for early stage measurement of tree seedling height, and it was also easy to use without errors, and was cost effective for measuring tree seedling height on sample plots. Although the use of pole method for measuring trees was anticipated, explicit reference to it was not made in the PDD. Therefore, as part of project monitoring, pole method is relevant for measurement of tree heights on the sample plots. The tree measurements on sample plots were checked and verified by auditors during the site visit.

Data / Parameter:	t2, t1
Unit:	Years
Description:	Time in interval between measurements of sample plots
Measured/ Calculated / Default:	Measured
Source of data:	Project
Value(s) of monitored parameter:	6.60 years
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	Monitoring period corresponding to each periodic verification
Calculation method (if applicable):	NA

QA/QC procedures:	Checked as part of project monitoring
Purpose of data:	Calculation of carbon stock change between monitoring periods
Additional comment:	

Data / Parameter:	$A_{BiomassBurn,t}$
Unit:	ha
Description:	Area affected in the biomass burn
Measured/ Calculated / Default:	Measured
Source of data:	Project monitoring
Value(s) of monitored parameter:	10.61 ha (Area affected in natural fires). This area was replanted.
Monitoring equipment:	Field survey/GPS
Measuring/ Reading/ Recording frequency:	Measured subsequent to the occurrence of a fire event
Calculation method (if applicable):	NA
QA/QC procedures:	Checked as part of project monitoring
Purpose of data:	Calculation of project emissions
Additional comment:	The methodology does not require estimation of emissions from natural fires. Therefore, area affected in natural fires was monitored but not considered in the estimation of project emissions.

D.3. Implementation of sampling plan

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Sampling plan has been implemented conforming to the monitoring plan and described in the sub-sections below:

D.3.1 Ex post stratification:

In the registered PDD, ex ante stratification of the project activity was conducted based on the stand models proposed for implementation in three land use categories (restoration forestry; community forestry; and farm forestry on private degraded lands); in three altitudes ranges (low– 600 to 1,100 meters; medium–1,100 to 1,400 meters; and high – 1,400 to 1,800 meters) of the project, which translate into 9 project strata as summarized below.

- Restoration forestry: low, medium and high strata
- Community forestry: low, medium and high strata
- Private/Farm forestry: low, medium and high strata

Some areas of the project strata were not planted by the end of the first monitoring period. As a consequence, the ex post stratification was conducted at the end of the first monitoring period taking into account progress in the area planted in the project strata. In the ex post stratification, all unplanted areas of the project are grouped into a separate stratum, i.e.10th stratum of the project. The details of stratification of the project are presented in the table D.1 and the stratification worksheet of the ER calculation sheet (Annex I to the Monitoring Report).

Table D.1: Ex post stratification of the project

Ex ante stratification (presented in the registered PDD)				Ex post stratification (at the end of the first monitoring period)			
S. No	**Stratum**	**Area (ha)**	**No. of sample plots**	**S.No**	**Stratum**	**Area (ha)**	**No. of sample plots**
1	Forest_Low	976.2	35	1	Forest_Low	929.87	35
2	Forest _Medium	969.7	35	2	Forest _Medium	876.73	35
3	Forest_High	1230.9	45	3	Forest_High	1,136.54	45
4	Community_Low	125.3	14	4	Community_Low	109.39	14
5	Community_Medium	66.9	8	5	Community_Medium	56.66	8
6	Community_High	100.8	11	6	Community_High	60.69	10
7	Private_Low	232.1	9	7	Private_Low	11.44	2
8	Private_Medium	221.4	8	8	Private_Medium	22.79	2
9	Private_High	79.7	3	9	Private_High	6.08	1
				10	Area not planted	792.88	
	Total area	4,003.07	168		Total area	4,003.07	152

The number of sample plots laid out in the project follows the sample size estimated in the registered PDD. Out of the 168 sample plots proposed in the registered PDD for monitoring and measurement of the carbon stock changes in the tree biomass, a total of 152 sample plots were laid out during the first monitoring period. Table D.1 provides the details of sample plots estimated by strata in the registered PDD under the *ex ante* stratification as well as the sample plots by strata laid out during project implementation and reflected under the *ex post* stratification in the first monitoring period. The number of sample plots laid out in the restoration forestry; and the community forestry strata closely corresponded to the number of sample plots estimated for these strata in the registered PDD. However, due to delay in implementing planting activities by the land owners in the private/farm forestry strata, it was not feasible to lay out the sample plots as per the number of plots estimated for the private land strata in the registered PDD, which is expected to be done subsequent to the completion of planting activities on private land strata. Therefore, the sample size implemented in the project corresponds to the sample size estimated in the registered PDD. The difference in the proposed and actual number of sample plots laid out is primarily due to the small area planted in the strata of the private land category and it is anticipated that the layout of estimated sample plots will be done subsequent to the completion of planting in the private land strata.

D.3.2 Sampling plan

The sampling plan adopted in the measurement of the carbon stock changes in the project area during the monitoring period is described below.

D.3.2.1 Sampling method

Sampling method followed was the stratified sampling.

D.3.2.2 Sample design

As part of the sampling design, sampling units (grids in the land parcels of a stratum; and location of sample plots within a grid) were identified following statistical procedures.

The 9 planted strata were included in the sampling design. The area not planted designated as 10th stratum of ex post stratification was not included in the sample frame as the planting activity has not been implemented in these areas. Therefore, the sampling design includes the planted area of 9 project strata referred under the *ex post* stratification in Table D.1

The standard operating procedures for forest inventories recommended by the Forest Survey of India were adopted in the sampling design and in location of sample plots in the field. Stratified random sampling was followed for selecting the land parcels for location of sample plots, which is summarized below.

- All Parcels in the strata were arranged sequentially in increasing order of the parcel area such that equal representation / weightage was given to each ha of land parcel in the project.
- The areas of land parcels were divided into 1 ha grids, resulting in each land parcel of the project is represented with equivalent number of 1 ha grids in each parcel.
- Random numbers were generated using three/four and five digit table of random numbers, which were divided by the total number of 1 ha grids of a stratum (for example, 3742 (random number) / 973 (number of 1 ha grids in a stratum, i.e. area of stratum).
- Digit number of reminder was identified as the selected (for example, 3742/973 and the reminder is 823) grid for laying out the sample plot. This exercise was repeated till grids equivalent to the number of sample plots assessed as part of sample size estimation were selected in a stratum enabling random selection of the grids for locating sample plots.

D.3.2.3 Sample size

Based on average growth rates of the species included in the project, a total of 168 sample plots were assessed in the registered PDD as per the procedure of the tool for "Calculation of the number of sample plots for measurements within A/R CDM project Activities, Version 02" for the assessment of changes in the carbon stock of the project during the monitoring period.

Out of the 168 sample plots estimated in the registered PDD, at the end of the first monitoring period, a total of 152 sample plots were laid out for measurement of carbon stock changes of the monitoring period. The number of sample plots laid out in the degraded forest land strata under the restoration forestry; and degraded community land strata under the community forestry are same as those assessed for these strata in the registered PDD. The fewer number of sample plots in the degraded and abandoned private land strata (relative to those noted in the registered PDD) under the private/farm forestry was due to the small proportion of area planted in the private land strata.

The list of sample plots along with their strata and location details are presented in **Annex I** (ER Calculation spreadsheet) of the Monitoring Report.

D.3.2.4 Locating sampling plots

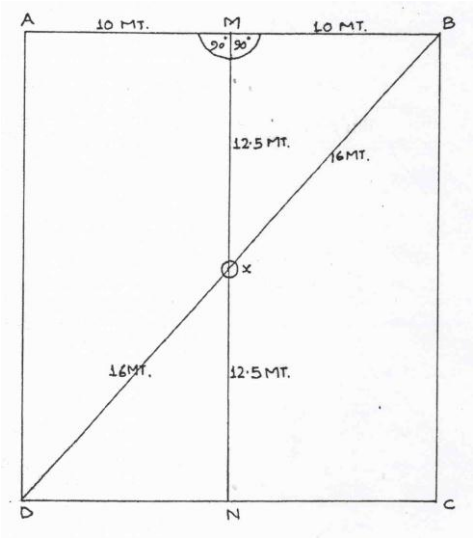
To avoid subjective choice in location of plots within a randomly selected grid, the permanent sample plots were located following systematic procedure. The rectangle sample plot of size 500 sq.mt (0.05 ha) in each selected land parcel grid was located based on the difference of the longitude and latitude intervals of the extreme points of a land parcel. The sample plot location in the field was accomplished with the help of a GPS and the GPS coordinates of each sample plot was recorded and archived. The list of sample plots along with GPS coordinates of latitude and longitude is included in the worksheet on list of sample plots in the ER calculation spreadsheet (Annex I to the Monitoring Report).

D.3.2.5 Layout of sample plots

Detailed trainings were conducted to train field team members in the layout of the sample plots and in the conduct of tree biomass measurements on the sample plots. For the layout of the sample plots, the centre point of each sample plot was fixed with a peg and GPS co-ordinates were recorded. With the help of a rope, lines of 12.5 meters in the north – south direction on either sides of the centre point were marked, and perpendicular lines with respect to the end points of 12.5 meter lines were also marked. The 10 meters width either side of the centre point on

perpendicular line was measured and the parallel and perpendicular lines were connected to establish a rectangle of size 25*20 meters plot. The accuracy of the plot dimensions was also checked with diagonal method. The figure D.1 below illustrates the layout of sample plots in the land parcels of the project strata.

Figure D.1: Diagram representing sample plot layout in the land parcels of project strata.



3. 3 Data collection

Data were collected on the monitored parameters including the changes in carbon stock of the project. The details of the monitored parameters on which data were collected are noted in the section D.2.

3.4 Quality assurance/Quality control

Quality assurance and quality control measures adopted in the monitoring plan were implemented to ensure collection of good quality data. The details of QA/QC procedures followed in the measurement and collection of the data were shared with the DOE verification team at the time of the verification site visit. The QA/QC aspects relevant to the monitored parameters are noted in the section D.2 under the respective parameters.

3.5 Implementation in the field

The implementation of the sample plot layout and measurement of monitoring parameters in the field was done by the personnel that were provided training on monitoring and measurement of carbon stock changes. The QA/QC procedures implemented resulted in reliable measurements of the monitored parameters, which were verified by the DOE team at the verification site visit.

D.3.6 Calibration of the equipment used in measurement of sample plots.

The equipment used in the measurement of carbon stock on sample plots is listed below.

- Metal/cloth tapes for measuring distances
- Global Positioning System (GPS) for locating plots
- Plot center markers for marking plots
- Caliper measuring for tree diameter at breast height (dbh)
- Pole with graduated scale for measuring height of tree species

The equipment was calibrated prior to use in the field by following standard operating procedures of forest inventory to avoid errors in the measurement of carbon stock. The details of calibration of the equipment are presented in the Table D.2 below.

Table D.2. Calibration record of the equipment

Item	Name/Type/ serial number	Date of calibration	Uncertainty	Remarks
Metal/cloth tape for measuring distances	Commercial	15/04/2012	None	As per the procedures of forestry inventory
Global Positioning System (GPS) for locating sample plots	Garmin GPS 76	15/04/2012	+/- 3 to 6 meters	As per the procedures of the user manual
Caliper for measuring tree diameter	Vernier Caliper	15/04/2012	None	As per the procedures of forestry inventory
Pole for measuring tree height	Commercial	15/04/2012	None	As per the procedures of forestry inventory

D.3.7 Assessment of adequacy of the sample size

The sample size estimated in the registered PDD was based on average growth rates of tree species selected for planting in the project. During sample plot measurements it was observed that the growth rates of the tree species in the project were significantly below the average growth rates of tree species used for estimation of sample size in the registered PDD. The severely degraded status of lands in the project, including steep slopes of land parcels, and delayed planting schedule were major factors in the smaller than anticipated growth rates. During the measurements, it was observed that the DBH of tree species on several plots was below the minimum DBH threshold. The biomass of the plots with trees below minimum DBH threshold was considered zero for the monitoring period.

After completion of the biomass measurements of 152 sample plots, the biomass estimated from the sample plot measurements was assessed for compliance with 90/10 confidence/precision requirements. As per the "Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities" (Version 01.1) (EB68, Annex31)[17], the allowable error of ±10% of the expected mean carbon stock and 90% confidence interval was used for assessing the compliance with confidence/precision requirements.

The assessment showed that less than anticipated growth rates of tree species due to degraded status of lands, steep slopes of parcels, high variability in biomass growth rates, and several sample plots with trees smaller than the minimum DBH threshold were the factors in the biomass estimate of the project not meeting the 90/10 confidence/precision requirements.

It was not feasible to increase the sample size for the reasons of inclement weather and high costs associated with the lay out and measurement of additional sample plots on steep slopes and difficult geographic conditions of the project strata. In this context, the guidance of the A/R Methodological Tool (AR Tool 14) *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, version 04.1.0* was used to assess the uncertainty in the biomass estimate of the project.

As per the paragraph 22 of the AR Tool 14,

If uncertainty ($u_{\Delta c}$) is greater than 10 per cent, then the project proponent may decide to either:

[17] https://cdm.unfccc.int/Reference/Guidclarif/ar/methAR_guid30.pdf

(a) Install additional sample plots; or

Increase in the number of sample plots to address the variability in the biomass estimate was considered during the sample plot measurements and efforts made to increase the sample size in excess of 152 sample plots that were already laid out were not successful. Because of the inclement weather conditions and high costs associated with layout and measurement of additional sample plots on difficult geographic conditions of the project, it was not feasible to install additional sample plots for meeting the 90/10 confidence/precision requirements.

(b) Accept a deduction in the estimated change in carbon stocks of biomass.

Based on the equation 6 of the AR Tool 14, *Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, version 04.1.0,* applied to the measurements based on 152 sample plots, the uncertainty ($u_{\Delta c}$) of 27.43% was assessed in the tree biomass estimate. The calculation of uncertainty is presented in the *Biomass_AR Tool 14 V04.1.0 worksheet* of the ER calculation spreadsheet (Annex I to the MR). As this value is greater than 10%, per the guidance noted in the paragraph 22 and Appendix 2 of the AR tool 14, version 04.1.0, uncertainty associated with the tree biomass was estimated, and appropriate discount was applied to the project biomass to calculate the carbon stock change to ensure the conservativeness in the biomass estimate of the project.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>> The *ex ante* baseline net GHG removals by sinks accounting for above and belowground biomass is insignificant and are considered **zero**. As per the PDD (para E3, page 74), the baseline carbon stock changes also need not be monitored during the project crediting period.

E.2. Calculation of project emissions or actual net GHG removals by sinks

>> **Estimation of changes in the carbon stocks**

The verifiable changes in the carbon stock in tree above-ground biomass and below-ground biomass within the project boundary are estimated as per the equations of the AR ACM0001 Version 03 referenced below.

$$\Delta C_P = \sum_{t=1}^{t^*} \Delta C_t * \frac{44}{12} * 1year - E_{BiomassLoss}$$ Equation (13) of AR ACM0001 Version 03

where:

ΔC_P	Sum of the changes in carbon pools in above-ground and below-ground tree biomass, and soil organic carbon in the project scenario; t CO_2-e
ΔC_t	Annual change in carbon stock in above-ground and below-ground tree biomass, and soil organic carbon pools for year *t*; t C yr^{-1}
$E_{BiomassLoss}$	Increase in CO_2 emissions from loss of existing woody biomass due to site-preparation (including burning), and/or to competition from forest (or other vegetation) planted as part of the A/R CDM project activity; t CO_2-e
t	*1, 2, 3, …t** years elapsed since the start of the A/R project activity; yr
44/12	Ratio of molecular weights of CO_2 and carbon; t CO_2-e (t C)$^{-1}$

ΔC_t has been estimated using the following equation:

$$\Delta C_t = \sum_{i=1}^{M_{PS}} (\Delta C_{AG,i,t} + \Delta C_{BG,i,t} + \Delta C_{DW,i,t} + \Delta C_{LI,i,t} + \Delta C_{SOC,i,t})$$ Equation (14) of AR ACM0001 Version 03

1. where:

ΔC_t	Annual change in carbon stock in all carbon pools for *year t*; t C yr^{-1}
$\Delta C_{AG,i,t}$	Annual carbon stock change in above-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); t C yr^{-1}
$\Delta C_{BG,i,t}$	Annual carbon stock change in below-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); t C yr^{-1}
$\Delta C_{DW,i,t}$	Annual change in the dead wood carbon pool in stratum *i*,; t C yr^{-1} (per the registered PDD, this pool is excluded from project monitoring and accounting)
$\Delta C_{LI,i,t}$	Annual change in the litter carbon pool in stratum *i*,; t C yr^{-1} (per the registered PDD, this pool is excluded from project monitoring and accounting)
$\Delta C_{SOC,i,t}$	Annual carbon stock change in the soil organic carbon pool for stratum *i*, time *t*; t C yr^{-1}
i	*1, 2, 3, ...* M_{PS} strata in the project scenario
t	*1, 2, 3, ...* t^* years elapsed since the start of the A/R CDM project activity

Changes in the deadwood and litter carbon pools that are excluded from monitoring and accounting are set equal to zero.

Aboveground and Belowground Tree Biomass

The carbon stock change in above-ground and below-ground tree biomass per unit area was estimated on the basis of field measurements in permanent sample plots. For this purpose, Biomass Expansion Factors (*BEF*) method has been used. The

The methodology AR ACM0001, version 03; and AR Methodological Tool 14, version 04.1.0 follow similar steps in the estimation of carbon changes of above ground and below tree biomass. While the notations used for some variables used in the estimation of carbon stock changes in biomass under the AR ACM0001, version 03 methodology; and AR Methodological Tool 14, version 04.1.0 are different. As the AR Tool 14, version 04.1.0 has been approved recently and it incorporates provisions for addressing uncertainty in carbon stock estimates of the aboveground and below ground biomass pools, the AR Tool 14, version 04.1.0 has been adopted to estimate the changes in carbon changes of above ground biomass and below tree biomass in the ER calculations spreadsheet (Annex I to the MR).

Step 1: Measurements of diameter at breast height (*DBH,* at typically 1.37 m above-ground level), and height (*H*), of the trees above minimum *DBH* of 2 cm were conducted on the permanent sample plots

Step 2: Stem volume of trees was estimated based on volume equations

Majority of the species adopted in the project are native species. The volume equations of species proposed for planting were included as an Annex to the registered PDD. Subsequent to the registration of the project, EB approved A/R Methodological Tool "*Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities* (EB67, Annex 24)", According to the paragraph 5 of the tool; the volume equations applied to the project context should meet at least one of the three following criteria.

(a) The equation is used in the national forest inventory, or the national GHG inventory of the host Party;
(b) The equation has been used in commercial forestry sector of the host Party for 10 years or more;
(c) The equation was derived from a data set of at least 30 sample trees, and the value of coefficient of determination (R^2) was not less than 0.85.

During the monitoring period, the volume equations proposed in the project were checked for their compliance with the criteria of the paragraph 5 of the A/R Methodological Tool. It was assessed that major proportion of volume equations of species included in the registered PDD have been adopted in the national forest inventory and published in the official publication, *Volume Equations of for India, Nepal and Bhutan* by the Forest Survey of India, a national institution under the Ministry of Environment and Forests, Government of India; and a nodal agency for forest inventory in India. Therefore, most volume equations listed in the registered PDD confirm to the criteria (a), paragraph 5 of the AR Tool noted above. It was noticed that some volume equations listed in the registered PDD produce erroneous volume estimates. Moreover, during project implementation, additional species were planted in the project or species that had low survival were replaced with other species that were not listed in the registered PDD. In such cases, the volume equations of tree species confirming to the criteria (a), paragraph 5 of the AR Tool and listed in the official publication, *Volume Equations of for India, Nepal and Bhutan* were adopted. For species that did not have species specific published volume equations, the volume equations of the rest of the species category in the official publication, *Volume Equations of for India, Nepal and Bhutan* were adopted. The updated volume equations listed in the standard values worksheet of the ER calculation sheet (Annex I to the MR) comply with the criteria (a) of the paragraph 5 of the AR Tool noted above.

The above procedures ensure that the volume equations adopted for the project comply with the guidelines of the AR methodological tool on the appropriateness of volume equations in the project.

Step 3: Application of *BEF* to convert the stem volume into total above ground tree volume.

The BEF values of species proposed for planting were included in the registered PDD. During the project implementation some planted species that did not survive were replaced with other suitable species. As a consequence, for the species that did not have species specific BEF values, the average BEF of the rest of the species planted in the project was adopted. The BEF of the project species is listed in the standard values worksheet of the ER calculation sheet (Annex I to the MR).

Step 4: The above ground tree volume converted into biomass by multiplying with basic wood density.

The wood density values of species proposed for planting were included in the registered PDD. During the project implementation some planted species that did not survive were replaced with other suitable species. As a consequence, for the species that did not have species specific wood density values, the average wood density of the rest of the species planted in the project was adopted. The wood density of the project species is listed in the standard values worksheet of the ER calculation sheet (Annex I to the MR).

$B_{TREE\_l,j,i,p,i} = V_j(x_{1,l}, x_{2,l}, x3_{,l}...) * D_j * BEF_{2,j} * (1 + R_j)$ Equation (5) Appendix 1, AR Tool 14 Version 04.1

where:

$B_{TREE\_l,j,p,i}$	Biomass of tree *l* of species *j* in sample plot *p* of stratum *i*; t d.m.
$V_j(x_{1,j}, x_{2,j}, x_{3,j}...)$	Stem volume of tree *l* of species *j* in sample plot *p* of stratum *i*, estimated from the tree dimension(s) as entry data into a volume table or volume equation; m^3
D_j	Wood density (over-bark) of tree species *j*; t d.m. m-3
$BEF_{2,j}$	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for species *j*; dimensionless
1+Rj	Root-shoot ratio for tree species *j*; dimensionless

The calculations of aboveground and belowground tree biomass are presented in the worksheet on tree biomass of the ER calculation spreadsheet (Annex I to the MR).

Step 5: Estimation of change in carbon stock in trees between two points in time – As per the section 6.2, paragraphs 19 and 20 of the AR Tool 14, version 04.1.0, estimation of change in carbon stock by re-measurement of sample plots uses the below equations.

$$\Delta C_{TREE} = \frac{44}{12} * CF_{TREE} * \Delta B_{TREE}$$ Equation (3) AR Tool 14 Version 04.1

$$\Delta B_{TREE} = A * \Delta b_{TREE}$$ Equation (4) AR Tool 14 Version 04.1

$$\Delta b_{TREE} = \sum_{i=1}^{M} w_i * \Delta b_{TREE,i}$$ Equation (5) AR Tool 14 Version 04.1

$$u_{\Delta C} = \frac{t_{VAL} * \sqrt{\sum_{i=1}^{M} w^2{}_i} * \sum_{i=1}^{M} w^2{}_i * \frac{s^2{}_{\Delta,i}}{n_i}}{\Delta b_{TREE}}$$ Equation (6) AR Tool 14 Version 04.1

where:

ΔC_{TREE}	Change in carbon stock in trees between two successive measurements; t CO2e
CF_j	Carbon fraction of tree biomass; t C (t d.m.)-1 (IPCC default value = 0.5 t C t.d.m)
ΔB_{TREE}	Change in tree biomass within the biomass estimation strata; t d.m. (The change in tree biomass ΔB_{TREE} refers to B_{TREE} for the first monitoring period as the tree biomass attributable prior to the start of the project is zero).
A	Sum of areas of the biomass estimation strata; ha
Δb_{TREE}	Mean change in tree biomass per hectare within the biomass estimation strata; t.d.m. ha-1
w_i	Ratio of the area of stratum *i* to the sum of areas of biomass estimation strata (i.e. ⁄); dimensionless
$\Delta b_{TREE\,i}$	Mean change in carbon stock per hectare in tree biomass in stratum *i*; t d.m. ha-1
$u_{\Delta c}$	Uncertainty in Uncertainty in ΔC_{TREE}
t_{VAL}	Two-sided Student's *t*-value for a confidence level of 90 per cent and degrees of freedom equal to *n* – *M*, where *n* is total number of sample plots within the tree biomass estimation strata, and *M* is the total number of tree biomass estimation strata
$s^2{}_{\Delta,i}$	Variance of mean change in tree biomass per hectare in stratum *i*; (t d.m. ha-1)^2
n_i	Number of sample plots, in stratum *i*, in which tree biomass was re-measured

The ER calculation spreadsheet (Annex I to the MR) presents the details of this step in the worksheet, Biomass_AR Tool14, Version 04.1.0.

Step 6: As per the paragraph 21 AR Tool 14, version 04.1.0, mean change in tree biomass per hectare in a stratum and the associated variance estimated per the equations below.

$$\Delta b_{TREE,i} = \frac{\sum_{p=1}^{n_i} \Delta bTREE_{p,i}}{n_i}$$ Equation (7) AR Tool 14, Version 04.1

$$s^2{}_i = \frac{ni * \sum_{p=1}^{n_i} bTREE_{p,i} - (\sum_{p=1}^{n_i} bTREE_{p,i})}{n_i * (n_i - 1)}$$ Equation (8) AR Tool 14, Version 04.1

where:

Δb_{TREE}	Mean change in tree biomass per hectare in stratum *i*; t d.m. ha-1 .
$\Delta bTREE_{p,i}$	Change in tree biomass per hectare in plot *p* in stratum *i*; t d.m. ha-1
$s^2{}_{\Delta,i}$	Variance of mean change in tree biomass per hectare in stratum *i*; (t d.m. ha-1)^2
n_i	Number of sample plots, in stratum *i*, in which tree biomass was re-measured

Step 7: As per the paragraph 22, AR Tool 14, version 04.1.0, if uncertainty estimated using equation (6) is greater than 10 per cent, the project biomass estimate is made conservative by applying uncertainty discount as per the procedure laid out in Appendix 2 of AR Tool 14. The ER calculation spreadsheet (Annex I to the MR) presents the details of this step in the worksheet, Biomass_AR Tool14, Version 04.1.

In the Biomass AR Tool 14 V04.1 worksheet of the ER calculation spreadsheet (Annex I to the MR), the $u_{\Delta c}$ calculated as per the equation 6, AR Tool 14, version 4.1 was 27.43% (column Y13). As per the Table 1, Appendix 2, AR Tool 14 , version 4.1, if the uncertainty is between 20 < U ≤ 30, a discount of 75% of the standard deviation of the biomass per ha has to be applied to calculate the uncertainty value.

Accordingly, discount for uncertainty is calculated for each stratum and the project. The calculation of discount for uncertainty in the GHG removals by sinks for the project is presented below.

Discount for uncertainty in GHG removals by sinks for the project in CO2e

= 75% of the weighted standard deviation of the biomass (t.d.m/ha)* project area (sum of area of project strata) *(44/12).

= 4,177.85 t CO2e (column AE13 of the Biomass AR Tool 14 V04.1 worksheet of the ER calculation spreadsheet (Annex I to the MR)

Step 8: The change in carbon stock of trees in CO2e for the monitoring period ($\Delta CTREE$) is calculated by subtracting the discount for uncertainty (column AF13 of the Biomass AR Tool 14 V04.1 worksheet of the ER calculation spreadsheet (Annex I to the MR)

Soil Organic Carbon

The rate of change in SOC stock in project scenario was estimated as per the latest version of *A/R Methodological Tool - Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM project activities*, version 01.1.0 (EB 60 Annex 12). The parameters used for calculation of carbon stock changes in soil organic carbon are presented in the approved spreadsheet of the AR Tool on SOC, version 01.1.0 and presented as **Annex IV** to the MR.

Considering that the published information on climate and soil type of project area was not available, expert opinion was sought on the climate and soil type information applicable to the project area. In this context, the expert noted below was consulted.

Dr. K.S. Kapoor, Senior Scientist and Head, Soil and Biodiversity Division, Himachal Pradesh Forest Research Institute, Conifer Campus, Panthghati, Shimla, Himachal Pradesh 171 009

Based on the expert opinion, the project area was categorized as corresponding to the warm temperate moist climate, and with sandy soils. (soils of Shiwalik hills and mid Himalayan degraded slopes are sandy and have soil low carbon status). The SOC_{Ref} value corresponding to the warm temperate moist/sandy soils in the Table 3 of the AR tool 16, version 1.1.0 was adopted for the reference SOC stocks of the lands included in the project.

The project complies with all the applicability conditions of the tool as described below.

(a) The areas of the project to which this tool is applied:

(i) Do not fall into wetland category: None of the project areas fall in the category wetlands.

- The areas of the project do not fall into the category of wetland. This has been confirmed by the information from cadastre and field visits conducted during project design, implementation, and site visits during validation and verification.

(ii) Do not contain organic soils as defined in Annex A: glossary of the IPCC GPG LULUCF 2003:

- The project soils are not organic soils and comply with the requirements 1 and 2 of the glossary of IPCC GPG LULUCF 2003.

(iii) Are not subject to any of the land management practices and application of inputs as listed in the Tables 1 and 2;

- The project soils are not subjected to management practices and input applications listed in Table 1 of the "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities" (Version 01.1.0).

(b) The A/R CDM project activity meets the following conditions:

(i) Litter remains on site and is not removed in the A/R CDM project activity;

- Litter is accumulated throughout the period of forest establishment and growth and remains undisturbed in the project area during entire rotation period of the forest.

(ii) Soil disturbance attributable to the A/R CDM project activity is:

• In accordance with appropriate soil conservation practices;

- Soil disturbance from site preparation in the project activity is as per the land management and soil conservation practices of the Government of Himachal Pradesh.
- There is a limited soil disturbance from site preparation in the project activity and the site disturbance is not repeated within 20 year period.

$$SOC_{INITIAL,i} = SOC_{REF,i} * f_{LU,i} * f_{MG,i} * f_{IN,i}$$ Equation (1) AR Tool_SOC , Version 01.1.0

where:

$SOC_{INITIAL,i}$	SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; t C ha^{-1}
$SOC_{REF,i}$	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation. normally forest) by climate region and soil type applicable to stratum *i* of the areas of land; t C ha^{-1}
$f_{LU,i}$	Relative stock change factor for baseline land-use in stratum i; the land use factor of grassland is adopted as the lands under the baseline are degraded lands and pastures. As per A/R Methodological Tool - *Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities,* Table 6, Annex 12, EB60, land use factor of 1.0 is applied.

$f_{MG,i}$	Relative stock change for management regime, dimensionless; as per A/R Methodological Tool - *Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities,* Table 6, Annex 12, EB60; the management factor of 0.7 for severely degraded lands is applied.
$f_{IN,i}$	Relative stock change factor for baseline inputs in stratum *i* of the areas of land; dimensionless. No inputs are used in the baseline, therefore as per A/R Methodological Tool - *Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities,* Table 6, the input factor of 1.0 is applied.
i	= 1, 2, 3, … strata of project, dimensionless.

The values $SOC_{REF,1}$, $f_{LU,i}$, $f_{MG,i}$, and $f_{IN,i}$ are taken from the Table 3 and Table 6 of AR Tool. The climate regime applicable to the project is warm temperate moist as per the IPCC climate zones[18] and soils of SOC_{REF} stock for mineral soil corresponding to sandy soils in Table 3 of AR Tool has been adopted.

$$SOC_{INITIAL,i} = SOC_{REF,i} * f_{lu,i} * f_{MG,i} * f_{IN,i}$$

$$SOC_{INITIAL,i} = 34 * 1.0 * 0.7 * 1.0$$

$$= 23.8 \text{ t C ha}^{-1}$$

There has been less than 10% site disturbance due to site preparation activities. Therefore, as per the paragraph 9 of the tool, equation 2 of A/R Methodological Tool, the soil carbon loss is zero.

$$SOC_{loss,i} = 0$$ Equation (3) AR Tool _SOC, Version 01.1.0

where:

$SOC_{loss,i}$ = Loss of SOC caused by soil disturbance attributable to the A/R CDM project activity, in stratum *i* of the areas of land; t C ha^{-1}

i = 1, 2, 3, … strata of the project, dimensionless

The rate of change in SOC stock in project scenario until the steady-state SOC content is reached is estimated as follows:

$$dSOC_{t,i} = 0$$ for t < t prep, I Equation (4) AR Tool _SOC, Version 01.1.0

[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf

Approved spreadsheet to facilitate the calculation of changes in soil organic carbon showing IPCC major climate zones, Annex to A/R Methodological Tool - *Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities*

$$dSOC_{t,i} = \frac{SOC_{LOSS,i}}{1year}$$ for t = t prep,I Equation (5) AR Tool , Version 01.1.0

$$dSOC_{t,i} = \frac{SOC_{REF,i} - (SOC_{INITIAL,i} - SOC_{LOSS,i})}{20}$$ for t prep i < t ≤ t prep,I +20 Equation (6) AR Tool _SOC, Version 01.1.0

where:

$dSOC$	Rate of change in SOC stock in stratum I of the areas of land in year t, t C $ha^{-1}yr^{-1}$
$t_{PREP,i}$	The year in which first soil disturbance takes place in stratum *i* of the areas of land
$SOC_{LOSS,i}$	Loss of SOC caused by soil disturbance attributable the A/R CDM project activity in stratum *i* of the areas of land; t C ha-1
$SOC_{REF,i}$	Reference SOC stock corresponding to the reference condition in native lands (i.e. non-degraded, unimproved lands under native vegetation, normally forest) by climate region and soil type applicable to stratum *i* of the areas of land; t C ha^{-1}
$SOC_{INITIAL,i}$	SOC stock at the beginning of the A/R CDM project activity in stratum *i* of the areas of land; t C ha^{-1}
i	1, 2, 3, … strata of project, dimensionless
t	1, 2, 3, … years elapsed since the start of the A/R CDM project activity

$$dSOC_{loss,i} = \frac{34 - (23.8 - 0)}{20} = 0.51$$

As per the tool, the rate of change of SOC stock is 0.51 t C ha^{-1} yr^{-1}

$t_{equilibrium}$ = Time period in years for increase in SOC to reach equilibrium. The A/R tool adopted 20 years as the $t_{equilibrium}$

The change in SOC stock for all the strata of the areas of land, in year *t,* is calculated as:

$$dSOC_{i,t} = \frac{44}{12} * \sum_{i} Ai * dSOC_{i.t} * 1year$$ Equation (8) AR Tool _SOC, Version 01.1.0

where:

$\Delta SOC_{i,t}$	= Change in SOC stock in areas of land meeting the applicability conditions of this tool, in year *t*; t CO2-e
A_i	= The area of stratum *i* of the areas of land; ha
$dSOC_{t,i}$	= The rate of change in SOC stocks in stratum *i* of the areas of land; t C ha^{-1} yr^{-1}
i	= 1, 2, 3, … strata of project, dimensionless.

The ER calculation spreadsheet (Annex I to the MR) presents the details of carbon stock changes in the Soil Organic Carbon in the worksheet,_Soil Carbon.

Actual Net GHG Removals by Sinks

The actual net GHG removals by sinks of the project in terms of CO_2e corresponding to the equation 13 of AR ACM0001, version 03 includes the carbon stock change in aboveground biomass and belowground biomass; and soil organic carbon.

The calculations of carbon stock changes in the aboveground and below ground biomass adjusted for uncertainty correspond to the equations of the AR Tool 14, Version 04.1; and calculation of carbon stock changes in soil organic carbon conducted correspond to the equations of AR Tool for estimation of carbon stock changes in SOC , Version 01.1.0.

The calculation of actual net GHG removals by sinks of the project is presented in the worksheet - Actual Net GHG Removals – in the ER calculation spreadsheet (Annex I to the MR).

E.2.1 Project emissions

The project did not use biomass burning in site preparation. During project implementation few isolated fire events were identified and measures were implemented to control them.

The emissions related natural fires events are insignificant and the methodology does not foresee their estimation. Therefore, the project emissions related to natural fire events are ignored in the calculation of actual net GHG removals by sinks. Area affected in the fire events was replanted during the subsequent planting period.

E.3. Calculation of leakage

>> The potential sources of leakage relevant to A/R CDM project was assessed based on the guidance presented in the latest version of the A/R Methodological Tool, "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity (Version 01)".

As per the guidance of the above A/R Tool, the project is not subject to leakage emissions attributable to displacement of pre-project for the following reasons.

(a) There has been no pre-project agricultural activity in the areas included in the project, which confirms that there is no displacement of agricultural activities.

(b) The grass/fodder production in the project is greater than the grass production in the baseline, which clarifies that if the planned AR-CDM project activity produces more grass or fodder than the base activity, leakage due to conversion of land for grazing need not be accounted (page 68, Section D2 of PDD).

The A/R CDM project has also implemented the following measures to minimize potential leakage from the grazing:

- Grass production under the A/R CDM project is estimated to be twice the pre-project grass production[19].
- Local communities are permitted to harvest and stall feed the livestock
- Under the watershed development project, there are activities that promote stall feeding to avoid grazing
- Under the watershed project the farmers are encouraged to shift to high yielding or crossbred cows, which are stall-fed, thereby avoiding the need for their grazing.

$$LK = 0$$

Therefore, leakage emissions associated with the project are assessed to be **zero.**

[19] Integrated Watershed Development Project, Kandi Final Report; and monitoring and evaluation report of the Integrated Watershed Development Project (Hills)-II in Himachal Pradesh.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)	0	65,582	0	65,582

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)	170,746 t CO_{2e}	65,582 t CO_{2e}

E.6. Remarks on difference from estimated value in registered PDD

>> During the first monitoring period, growth rates of the tree species in the project have been observed to be significantly below the average growth rates of tree species in the registered PDD. The severely degraded status of lands in the project, steep slopes of land parcels, and delayed planting schedule were major factors in the smaller than anticipated carbon stock. Additionally, during project implementation, additional species were planted in the project or species that had low survival were replaced with other species that have similar growth characteristics. Also a few species show slower rate of growth in initial stages under unfavourable conditions, resulting in low amount of carbon stock accumulation and the resulting GHG removals by sinks relative to the values estimated ex ante in the registered PDD.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	65,582 t CO_{2e}	Not Applicable (monitoring period ended on 31 December 2012)

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	M/s H.P Mid-Himalayan Watershed Development Project
Street/P.O. Box	Forest Road
Building	MHWDP Hq.
City	Solan
State/Region	Himachal Pradesh
Postcode	173212
Country	India
Telephone	91-1792-223043
Fax	91-1792-220064
E-mail	cpdmhwdp@yahoo.co.in
Website	
Contact person	Mr. Avtar Singh
Title	Chief Project Director
Salutation	Mr.
Last name	Singh
Middle name	
First name	Avtar
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	International Bank for Reconstruction and Development (IBRD) as Trustee of the BioCarbon Fund (BioCF)
Street/P.O. Box	1818 H Street, NW
Building	MC
City	Washington
State/Region	District of Columbia
Postcode	20433
Country	United States of America
Telephone	+1 202 458 4416 / +1 202 458 5051
Fax	+1 202 522 7432
E-mail	ibrd-carbonfinance@worldbank.org
Website	www.carbonfinance.org

Contact person	Mr. Simon Whitehouse / Mr. Jose Andreu
Title	Fund Manager / Operations Team Leader
Salutation	Mr.
Last name	Whitehouse / Andreu
Middle name	
First name	Simon / Jose
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required ensuring consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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