SIMPLIFIED BASELINE AND MONITORING METHODOLOGIES FOR SELECTED A/R SMALL-SCALE CDM PROJECT ACTIVITY CATEGORIES

I. Introduction

1. This document contains simplified baseline and monitoring methodologies for selected small-scale A/R CDM project activity categories. Specifically it covers:

- A simplified baseline methodology and default factors for small-scale afforestation or reforestation project activities conducted over grasslands and croplands[1]
- A simplified monitoring methodology based on appropriate statistical methods to estimate, measure and monitor the actual net greenhouse gas removals by sinks and leakage.

2. The methodologies outlined in this document have been designed to provide a simple, transparent, accurate and low-cost decision-making framework for small-scale A/R CDM project participants. As such, they encompass the most likely cases of prior land-use on lands to be used for small-scale A/R activities. Cases that are very specific have not been addressed by the present methodologies given that some could add complications, and that simplifications may not be possible. In accordance with decision 14/CP.10, Project participants can propose simplified methodologies for those cases not covered in the present document. Such methodologies will be subject to the consideration of the Executive Board.

3. Before using simplified methodologies, project participants shall:

- Determine whether the land of the project is eligible using **attachment A;**
- Determine whether the project activity is additional using **attachment B**

II. General guidance

4. Carbon pools to be considered by these methodologies are the following: above ground biomass (including woody perennial biomass[2] and trees) and below ground biomass. Values chosen for parameters to calculate changes in carbon stocks in the baseline and monitoring methodologies, as well as the choice of approaches whenever this methodology proposes options, shall be documented, including sources and references, and justified in the CDM-SSC-AR-PDD. The choice of equations and values for parameters shall be conservative (e.g. that net anthropogenic greenhouse gas removals by sinks are not overestimated).

5. **Emissions of greenhouse gases as part of the actual net GHG removals by sinks** do not need to be accounted for.

III. Simplified Baseline Methodologies for small scale A/R CDM Project Activities

Baseline net greenhouse gas removals by sinks

6. Simplified methodologies for projecting the baseline net GHG removals by sinks are based on the approach specified by paragraph 22 (c) of the modalities and procedures for AR under the CDM: "Changes

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[1] Wetlands and settlements are not covered by the present methodologies for two reasons. First, methodologies for wetlands are still under development and given the state of knowledge, simplification is not yet possible. On the other hand, conversions from settlements and wetlands to forests are unlikely for several reasons, including the social and environmental impacts that such conversions can cause.

[2] ***"Woody perennial biomass"*** includes biomass from non-tree vegetation (e.g. coffee, tee, rubber plant or oil palm) and shrubs that are present in croplands and grasslands below the threshold (in terms of canopy cover, minimum area and tree height) used to define forests.

in carbon stocks in the pools within the project boundary from the most likely land use at the time "the project starts.".

7. According to Dec.14/CP.10: "*If project participants can provide relevant information that indicates that, in the absence of the small-scale afforestation or reforestation project activity under the CDM, no significant changes in the carbon stocks within the project boundary would have occurred, they shall assess the existing carbon stocks prior to the implementation of the project activity. The existing carbon stocks shall be considered as the baseline and shall be assumed to be constant throughout the crediting period.*"

"If significant changes in the carbon stocks within the project boundary would be expected to occur in the absence of the small-scale afforestation or reforestation project activity, project participants shall" use this simplified baseline methodology.

8. In order to assess if there are significant changes in the baseline net GHG removals by sinks, project participants shall assess whether changes in carbon stocks from woody perennials are expected to be significant and provide documentation to prove this, for example, by expert judgement.

- If significant changes to the stocks of carbon in the absence of the project activity are not expected to occur, the baseline net greenhouse gas removals by sinks shall be assumed to be equal to zero,
- If the stocks of carbon are expected to decrease in the absence of the project activity, the baseline net greenhouse gas removals by sinks shall be assumed to be equal to zero,
- Otherwise, baseline net greenhouse gas removals by sinks shall be equal to the changes in carbon stocks from the woody perennials that are expected to occur in the absence of the project and shall be projected using the methodology below.

<u>Projecting Baseline Net GHG removals by sinks</u>

9. Annual baseline net GHG removals by sinks during a monitoring period will be determined by the equation:

$$\Delta B = B_{(t)} - B_{(t-1)}$$

where:

ΔB = Annual changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the project activity
$B_{(t)}$ = Carbon stocks within the project boundary at time "t" that would have occurred in the absence of the project activity (ton C)

$$B_{(t)} = \sum_{i} \left(B_{A(t),i} + B_{B(t),i} \right) \cdot A_i$$

where:

$B_{A(t)}$ = Carbon stocks in aboveground biomass at time "t" of stratum i that would have occurred in the absence of the project activity (tonC/ha)
$B_{B\,(t)}$ = Carbon stocks in belowground biomass at time "t" of stratum i that would have occurred in the absence of the project activity (tonC/ha)
A_i = Project area of stratum i (ha)

10. Stratification of the project for the purposes of projecting the baseline net GHG removals by sinks shall proceed in accordance with section 4.3.3.2 of the GPG for LULUCF. For each stratum, the following calculations shall be performed:

For above ground biomass

$B_{A(t)} \quad = M_{(t)} * 0.5$

where:

$M_{(t)}$= above ground biomass at time "t" that would have occurred in the absence of the project activity (tonnes dry matter/ha).
0.5 = factor to convert tonnes of biomass (dry matter) to ton Carbon

11. Values for $M_{(t)}$ shall be projected using average biomass growth rates specific to the region and the age of the perennial using the following equation:
if $a < m$, then $M_{(t)} = g * a$
else, $M_{(t)} = 0$

where:

"g" is the biomass accumulation rate of the woody perennial (tonnes of dry matter/ha/yr)
"m" is the time to maturity of the woody perennial (years)
"a" is the average age of the woody perennial (years)

12. Documented local values for "g" should be used. In the absence of such values, national default values should be used. If national values are also not available, the values should be obtained from table 3.3.2 of GPG for LULUCF.

13. Values for "m" considered by the project shall be specified by project participants for each species considered to be part of the baseline. These values shall be identified in the CDM-AR-PDD.

For below ground biomass

$B_{B(t)} \quad = M_{(t)} * R * 0.5$

where:

R = Root to shoot ratio (dimensionless)
0.5 = factor to convert tonnes of biomass (dry matter) to tonnes of carbon (dimensionless)

14. Documented local values for R should be used. In the absence of such values, national default values should be used. If national values are also not available, the values should be obtained from tables 3.3.2 and 3.4.3 of GPG for LULUCF.

Actual net greenhouse gas removals by sinks

15. Annual net GHG removals by sinks during a monitoring period shall be projected using the equation:

$\Delta N = N_{(t)} - N_{(t-1)}$

where:

ΔN= Annual changes in carbon stocks in the carbon pools within the project boudaryof the project scenario
$N_{(t)}$= Carbon stocks within the project boundary at time "t" under project scenario (ton C)

16. The stocks of carbon for the project scenario at the starting date of the project[3] (i.e. t=0) shall be the same as for the projection of the baseline net greenhouse gas removals by sinks at t=0. For all other years, the carbon stocks within the project boundary at time "t" ($N_{(t)}$) shall be calculated as follows:

$N_{(t)} = \sum((N_{A(t)} + N_{B\,(t)})_i * A_i)$

where:

$N_{A(t)}$ = Carbon stocks in aboveground biomass at time "t" of stratum i from project scenario (tonC/ha)
$N_{B(t)}$ = Carbon stocks in belowground biomass at time "t" of stratum i from project scenario (tonC/ha)
A_i = Project area of stratum i (ha)

17. Stratification for the project scenario shall be undertaken in accordance with section 4.3.3.2 of the GPG for LULUCF. The following calculations shall be performed for each stratum:

For above ground biomass

$N_{A(t)} = T_{(t)} * 0.5$

where:

$T_{(t)}$ = Above-ground biomass at time "t" for the project scenario (tonnes of dry matter/ha)
0.5 = factor to convert tonnes of biomass (dry matter) to tonnes of carbon (dimensionless)

$T_{(t)} = SV_{(t)} * BEF * WD$

where:

$SV_{(t)}$ = Stem volume at time "t" for the project scenario (m^3/ha)
WD = Basic wood density (tonnes/ m^3).
BEF = Biomass expansion factor (over bark) from stem volume to total volume (dimensionless)

18. Values for $SV_{(t)}$ shall be obtained from national sources (e.g. standard yield tables). Documented local values for BEF should be used. In the absence of such values, national default values should be used. If national values are also not available, the values should be obtained from table 3A.1.10 of GPG for LULUCF. Documented local values for WD should be used. In the absence of such values, national default values shall be consulted. If national default values are also not available, the values should be obtained from table 3A.1.9 of GPG for LULUCF.

For below ground biomass

$N_{B(t)} = T_{(t)} * R * 0.5$

where:

R = Root to shoot ratio (dimensionless)
0.5 = factor to convert tonnes of biomass (dry matter) to tonnes of carbon (dimensionless)

19. Documented national values for R should be used. If national values are not available, the values should be obtained from table 3A.1.8 of GPG for LULUCF

[3] The starting date of the project should be considered to be the point in time when the land is prepared for the initiation of the afforestation or reforestation project activity. In accordance with paragraph 23 of the modalities and procedures for afforestation and reforestation project activities under the CDM, the crediting period shall begin at the start of the afforestation or reforestation project activity under the CDM.

Leakage

20. According **to decision 14/CP.10** *"If project participants demonstrate that the small-scale afforestation or reforestation project activity under the CDM does not result in the displacement of activities or people, or does not trigger activities outside the project boundary, that would be attributable to the small-scale afforestation or reforestation project activity under the CDM, such that an increase in greenhouse gas emissions by sources occurs, a leakage estimation is not required. In all other cases leakage estimation is required."*

21. Project participants should assess the possibility of leakage from the displacement of activities or people considering the following indicators:

- Percentage of families/households of the community involved in or affected by the project activity displaced due to the project activity,
- Percentage of total production of the main produce (e.g. meat, corn) within the project boundary displaced due to the CDM A/R project activity.

If the value of these two indicators is lower than 10%, then

$L_t = 0$

If the value of any of these two indicators is higher than 10%, then

$L_t = \Delta N * 0.15$

Ex ante estimation of net anthropogenic GHG by sinks

22. ***"Net anthropogenic greenhouse gas removals by sinks"*** is the actual net greenhouse gas removals by sinks minus the baseline net greenhouse gas removals by sinks minus leakage.

Net anthropogenic GHG removals = Actual net GHG removals by sinks– baseline net GHG removals -leakage

23. Project participants should provide in the PDD a projection of the net anthropogenic GHG removals for all crediting periods. For this purpose, for each year, ΔN, ΔB, L are multiplied by 44/12.

24. Actual net greenhouse gas removals by sinks shall be calculated as $\sum(\Delta N * 44/12)_t$
Baseline net greenhouse gas removals by sinks shall be calculated as $\sum(\Delta B * 44/12)_t$
Leakage, as applicable, zero or $\sum(L * 44/12)_t$

where:

ΔN= annual changes in carbon stocks in the carbon pools within the project boundaryof the project scenario
ΔB= annual changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the project activity
44/12= Conversion factor from ton C to ton CO_2 equivalent

IV. Simplified Monitoring Methodology for Small-scale A/R CDM Projects

Ex post estimation of baseline Net GHG removals by sinks

25. In accordance with paragraph 6 of appendix B to decision 14/CP.10, no monitoring of the baseline is requested. Baseline net greenhouse gas removals by sinks for the monitoring methodology will be the same as the projection of this element using the simplified baseline methodology above.

Ex post estimation of actual Net GHG removals by sinks

26. Before performing the sampling to determine any changes in carbon stocks, project participants need to measure and monitor the area that has been planted. This can be performed through, for example, on-site visits, analysis of cadastral information or aerial photographs.

27. Once project participants have selected the method to monitor the area that has been planted, this method should be used to monitor the performance of the planted areas throughout the project activity. If significant underperformance is detected, changes in carbon stock from such areas shall be assessed as a separate stratum.

28. Changes in carbon stocks shall be estimated through stratified sampling procedures and the following equations:

$\Delta P = P_{(t)} - P_{(t-1)}$

where:

ΔP = Annual changes in carbon stocks in the carbon pools within the project boundary achieved by the project
$P_{(t)}$= Carbon stocks within the project boundary at time "t" achieved by the project (ton C)

$P_{(t)} = \sum((P_{A(t)} + P_{B(t)})_i * A_i)$

where:

$P_{A(t)}$ = Carbon stocks in aboveground biomass at time "t" of stratum i achieved by the project during the monitoring interval (Ton C/ha)
$P_{B(t)}$ = Carbon stocks in belowground biomass at time "t" of stratum i achieved by the project during the monitoring interval (Ton C/ha)
A_i= project area of stratum i (ha)

29. Stratification for sampling shall be the same as the stratification for the ex ante estimation of the actual net GHG removals by sinks, above. The following calculations will be performed for each stratum:

<u>For above ground biomass</u>
$P_{A(t)} = E_{(t)} * 0.5$

where:

$E_{(t)}$ Above-ground biomass (tonnes of dry matter/ha) at time "t" achieved by the project.
0.5 = factor to convert tonnes of biomass (dry matter) to tonnes of carbon (dimensionless)

30. $E_{(t)}$ will be estimated through the following steps:

Step 1: Design a statistically sound sampling procedure. Such procedures should be designed according to the standard methods described in the GPG-LULUCF (2004) section 4.3.3.4 and should incorporate the occurrence of fires and pests. This procedure includes the specification of the number, type and size of permanent plots and should be described in the CDM-SSC-AR-PDD. In doing so, the allowed sampling error for monitoring shall be not larger than +/- 20%, at a 95% confidence level for the mean.

Step 2: Establish and mark permanent plots and document their location in the first monitoring report.

Step 3: Perform measurements of DBH or DBH and tree height, as appropriate, which should be reflected in the monitoring reports.

Step 4: Calculate AGB using allometric equations developed locally or nationally. If these allometric equations are not available:

Option 1: Use of allometric equations included in Attachment C to this report or in Annex 4A.2 of GPG for LULUCF.

Option 2: Use of Biomass Expansion Factors and stem volume as follows:

$$E_{(t)} = SV * BEF * WD$$

where:

SV = Stem volume (in m^3/ha)
WD = Basic wood density (in Mg/m^3).
BEF = Biomass expansion factor (over bark) from stem volume to total volume (dimensionless)

31. Project participants shall use the default BEF proposed by GPG for LULUCF, specifically for tropical broad-leaved species, in order to obtain a conservative estimate of total biomass.

32. SV shall be calculated from on site measurements using the appropriate parameters (such as DBH or DBH and height). Consistent application of BEF should be secured on the definition of stem volume (e.g. total stem volume, thick wood stem volume require different BEFs).

33. Documented local values for WD should be used. In the absence of such values, national default values should be used. If national values are also not available, the values should be obtained from table 3A.1.9 of GPG for LULUCF.

<u>For below ground biomass</u>

$P_{B(t)}$ can be calculated as follows:

$$P_{B(t)} = E_{(t)} * R * 0.5$$

where:

R = Root to shoot ratio (dimensionless)
0.5 = factor to convert tonnes of biomass (dry matter) to tonnes of carbon (dimensionless)

34. Documented national values for R should be used. If national values are not available, the values should be obtained from table 3A.1.8 of GPG for LULUCF.

35. If root to shoot ratios for the species concerned are not available, project proponents shall use the allometric equation developed by Cairns et al. (1997):

$$P_{B(t)} = \exp(-7747 + 0.8836 * \ln E_{(t)}) * 0.5$$

Ex post estimation of leakage

36. In order to estimate leakages, project participants shall monitor, for each monitoring period, each of the following indicators:

- Percentage of families/households of the community involved in or affected by the project activity displaced due to the implementation of the project activity;
- Percentage of total production of the main produce (e.g. meat, corn) within the project boundary displaced due to the CDM A/R project activity.

37. If the value of these two indicators for the specific monitoring period is lower than 10%, then

$$L_{p(t)} = 0$$

38. If the value of any of these two indicators is higher than 10%, then

$$L_{p(t)} = \Delta P * 0.15$$

Ex post calculation of net anthropogenic GHG by sinks

39. ***"Net anthropogenic greenhouse gas removals by sinks"*** is the actual net greenhouse gas removals by sinks minus the baseline net greenhouse gas removals by sinks minus leakage

Net anthropogenic GHG removals = Actual net GHG removals by sinks– baseline net GHG removals -leakage

Actual net greenhouse gas removals by sinks shall be calculated as $\sum (\Delta P * 44/12)_t$
Baseline net greenhouse gas removals by sinks shall be calculated as $\sum (\Delta B * 44/12)_t$
Leakage, as applicable, zero or $\sum (L_{p(t)} * 44/12)_t$

where:

ΔP = annual changes in carbon stocks in the carbon pools within the project boundary achieved by the project
ΔB = annual changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the project activity
$L_{p(t)}$=Leakage resulting from the project activity at time „t"
44/12= Conversion factor from ton C to ton $CO2$ equivalent

Monitoring frequency

40. At least a 5-year monitoring frequency of a statistically adequate number of permanent sample plots is needed for an appropriate monitoring of above-ground and below-ground biomass.

Data collection

41. Data collection shall be organized taking into account the carbon pools measured, the sample frame used and the number of plots to be monitored in accordance with the section on QA/QC below. Table 1 and 2 outline the data to be collected to monitor the actual net GHG removals by sinks and leakage.

Table 1. Data to be collected or used in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary from the proposed A/R CDM project activity, and how this data will be archived:

Data variable	Source	Data unit	Measured (m), calculated (c) or estimated (e)	Frequency	Proportion	Archiving	Comment
Location of the areas where the project activity has been implemented	Field survey or cadastral information or aerial photographs or satellite imagery	Lat-long	(m)	5 years	100%	Electronic, paper, photos	GPS can be used for field survey.
Ai - Size of the areas where the project activity has been implemented for each type of strata	Field survey or cadastral information or aerial photographs or satellite imagery or GPS	ha	(m)	5 years	100%	Electronic, paper, photos	GPS can be used for field survey.
Location of the permanent sample plots	Project maps and project design	Lat-long	defined	5 years	100%	Electronic, paper	Plot location is registered with a GPS and marked on the map.
Diameter at breast height (1.30 m)	Permanent plot	Cm	M	5 years	Each tree in the sample plot	Electronic, paper	Measure dbh for each tree that falls in the sample plot and applies to size limits
Height	Permanent plot	Cm	M	5 years	Each tree in the sample plot	Electronic, paper	Measure dbh for each tree that falls in the sample plot and applies to size limits

Data variable	Source	Data unit	Measured (m), calculated (c) or estimated (e)	Frequency	Proportion	Archiving	Comment
Basic wood density	Permanent plots, literature	Mg/m^3	E	once	3 samples per tree from base, middle and top of the stam of three individuals	Electronic, paper	
Total CO2	Project	Mg	C	5 years	All project data	Electronic	Based on calculated data from all plots and carbon pools

Table 2. Data to be collected or used in order to monitor leakage and how this data will be archived:

Data variable	Source	Data unit	Measured (m), calculated (c) or estimated (e)	Frequency	Proportion	Archiving	Comment
Percentage of families/households of the community involved in or affected by the project activity displaced due to the implementation of the project activity	Participatory survey	Nb of families or households	(e)	At least 5 years	%	electronic	
Percentage of total production of the main produce (e.g. meat, corn) within the project boundary displaced due to the CDM A/R project activity.	Survey	Quantity (volume or mass)	(e)	At least 5 years	%	electronic	

Quality Control and Quality Assurance

42. As stated in the GPG-LULUCF (page 4.111) monitoring requires provisions for quality assurance (QA) and quality control (QC) to be implemented via a QA/QC plan. The plan shall become part of project documentation and cover procedures as described below for:

(1) collecting reliable field measurements;
(2) verifying methods used to collect field data;
(3) verifying data entry and analysis techniques; and
(4) data maintenance and archiving. Especially point 4 is important, also for SSC AR project activity, as time scales of projects are much longer than technological improvements of electronic data archiving. Each point of importance for SSC AR projects are treated in the following section.

Procedures to ensure reliable field measurements

43. Collecting reliable field measurement data is an important step in the quality assurance plan. Those responsible for the measurement work should be trained in all aspects of the field data collection and data analyses. It is good practice to develop Standard Operating Procedures (SOPs) for each step of the field measurements, which should be adhered to at all times. These SOPs describe in detail all steps to be taken of the field measurements and contain provisions for documentation for verification purposes so that future field personnel can check past results and repeat the measurements in a consistent fashion. To ensure the collection and maintenance of reliable field data, it is good practice to ensure that:

- Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible;
- Field teams install test plots if needed in the field and measure all pertinent components using the SOPs to estimate measurement errors;
- The document will list all names of the field team and the project leader will certify that the team is trained;
- New staff are adequately trained.

Procedures to verify field data collection

44. To verify that plots have been installed and the measurements taken correctly, it is good practice to re-measure independently every 10 plots and to compare the measurements to check for errors; any errors found should be resolved, corrected and recorded. The re-measurement of permanent plots is to verify that measurement procedures were conducted properly. At the end of the field work check independently 10-20% of the plots. Field data collected at this stage will be compared with the original data. Any errors found should be corrected and recorded. Any errors discovered should be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

Procedures to verify data entry and analysis

45. Reliable carbon estimates require proper entry of data into the data analyses spreadsheets. Possible errors in this process can be minimized if the entry of both field data and laboratory data are cross-checked and, where necessary, internal tests incorporated into the spreadsheets to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data should be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot should not be used in the analysis.

Data maintenance and storage

46. Because of the relatively long-term nature of these projects, data archiving (maintenance and storage) will be an important component of the work. Data archiving should take several forms and copies of all data should be provided to each project participant.
Copies (electronic and/or paper) of all field data, data analyses, and models; estimates of the changes in carbon stocks and corresponding calculations and models used; any GIS products; and copies of the measuring and monitoring reports should all be stored in a dedicated and safe place, preferably offsite.

47. Given the time frame over which the project will take place and the pace of production of updated versions of software and new hardware for storing data, it is recommended that the electronic copies of the data and report be updated periodically or converted to a format that could be accessed by any future software application.

Table of abbreviations and parameters (in order of appearance):

Parameter or abbreviation	refers to	units
ΔB	Annual changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the project activity	ton C
$B_{(t)}$	Carbon stocks within the project boundary at time "t" that would have occurred in the absence of the project activity	ton C
$B_{A(t)}$	Carbon stocks in aboveground biomass at time "t" of stratum i that would have occurred in the absence of the project activity	tonC/ha
$B_{B\ (t)}$	Carbon stocks in belowground biomass at time "t" of stratum i that would have occurred in the absence of the project activity	tonC/ha
A_i	Project area of stratum i	ha
$M_{(t)}$	Above ground biomass at time "t" that would have occurred in the absence of the project activity	tonnes dry matter/ha
0.5	Factor to convert tonnes of biomass (dry matter) to ton Carbon	dimensionless
g	Biomass accumulation rate of the woody perennial	tonnes of dry matter/ha/yr
m	Time to maturity of the woody perennial	time
a	Age of the woody perennial	years
R	Root to shoot ratio	dimensionless
ΔN	Annual changes in carbon stocks in the carbon pools within the project boundary of the project scenario	ton C
$N_{(t)}$	Carbon stocks within the project boundary at time "t" under project scenario	ton C
$N_{A(t)}$	Carbon stocks in aboveground biomass at time "t" of stratum i from project scenario	tonC/ha
$N_{B(t)}$	Carbon stocks in belowground biomass at time "t" of stratum i from project scenario	tonC/ha
$T_{(t)}$	Above-ground biomass at time "t" for the project scenario	tonnes of dry matter/ha
$SV_{(t)}$	Stem volume at time "t" for the project scenario	m^3/ha
WD	Basic wood density	tonnes/ m^3
BEF	Biomass expansion factor (over bark) from stem volume to total volume	dimensionless
L_t	Leakage for the project scenario at time "t"	ton C
ΔP	Annual changes in carbon stocks in the carbon pools within the project boundary achieved by the project	ton C
$P_{(t)}$	Carbon stocks within the project boundary at time "t" achieved by the project	ton C
$P_{A(t)}$	Carbon stocks in aboveground biomass at time "t" of stratum i achieved by the project	Ton C/ha
$P_{B(t)}$	Carbon stocks in belowground biomass at time "t" of stratum i achieved by the project during the monitoring interval	Ton C/ha
$E_{(t)}$	Above-ground biomass at time "t" achieved by the project	tonnes of dry matter/ha
DBH	diameter at breast height	cm or m

$L_{p(t)}$	Leakage resulting from the project activity at time „t"	ton C

Attachment A. Demonstration of land eligibility

In order to demonstrate the eligibility of land for afforestation and reforestation, project proponents shall show that the land has not contained a forest since December 31 1989. To do this, project participants shall explain in the CDM-SSC-AR-PDD why the land is eligible and provide one of the following supporting evidence:

(1) Aerial photographs or satellite imagery complemented by ground reference data; or

(2) Ground based surveys (land use permits, land use plans or information from local registers such as cadastre, owners register, land use or land management register).

(3) If options 1 and 2 are not available/applicable, project participants shall submit a written testimony which was produced by following a participatory rural appraisal methodology.

Attachment B: Assessment of additionality

Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

Investment barriers, other than the economic/financial barriers*, inter alia*:
- Debt funding is not available for this type of project activity;
- No access to international capital markets due to real or perceived risks associated with domestic or foreign direct investment in the country where the project activity is to be implemented;
- Lack of access to credit;

Institutional barriers, *inter alia*:
- Risk related to changes in government policies or laws;
- Lack of enforcement of forest or land use-related legislation.

Technological barriers, *inter alia*:
- Lack of access to planting materials
- Lack of infrastructure for implementation of the technology.

Barriers related to local tradition, *inter alia:*
- Traditional knowledge or lack thereof, laws and customs, market conditions, practices;
- Traditional equipment and technology;

Barriers due to prevailing practice, *inter alia*:
- The project activity is the "first of its kind": No project activity of this type is currently operational in the host country or region.

Barriers due to local ecological conditions, *inter alia*:
- Degraded soil (e.g. water/wind erosion, salination, etc.);
- Catastrophic natural and / or human-induced events (e.g. land slides, fire, etc);
- Unfavourable meteorological conditions (e.g. early/late frost, drought);
- Pervasive opportunistic species preventing regeneration of trees (e.g. grasses, weeds);
- Unfavourable course of ecological succession;
- Biotic pressure in terms of grazing, fodder collection, etc.

Barriers due to social conditions, *inter alia*:
- Demographic pressure on the land (e.g. increased demand on land due to population growth);
- Social conflict among interest groups in the region where the project takes place;
- Widespread illegal practices (e.g. illegal grazing, non-timber product extraction and tree felling);
- Lack of skilled and/or properly trained labour force;
- Lack of organisation of local communities.

Attachment C: Default allometric equations for estimating aboveground biomass

Annual rainfall	DBH limits	Equation	R^2	Author
Broadleaved species, tropical dry regions				
<900 mm	3 – 30 cm.	AGB = $10^{\{-0.535 + \log_{10}(\pi * DBH^2/4)\}}$	0.94	Martinez-Yrizar et al (1992)
900 – 1500 mm.	5 – 40 cm.	AGB = exp{-1.996 + 2.32 * ln(DBH)}	0.89	Brown (1997)
Broadleaved species, tropical humid regions				
< 1500 mm.	5 – 40 cm.	AGB = 34.4703 – 8.0671*DBH + 0.6589*(DBH^2)	0.67	Brown et al (1989)
1500 – 4000 mm.	< 60 cm.	AGB = exp{-2.134 + 2.530 * ln(DBH)}	0.97	Brown (1997)*
1500 – 4000 mm.	60 - 148 cm.	AGB = 42.69 – 12.800*(DBH) + 1.242*$(DBH)^2$	0.84	Brown et al (1989)*
1500 – 4000 mm.	5 - 130 cm.	AGB = exp{-3.1141 + 0.9719*ln(DBH^2*H)	0.97	Brown et al (1989)
1500 – 4000 mm.	5 - 130 cm.	AGB = exp{-2.4090 + 0.9522*ln(DBH^2*H*S)}	0.99	Brown et al (1989)
Broadleaved species, tropical wet regions				
> 4000 mm.	4 – 112 cm.	AGB = 21.297 – 6.953*(DBH) + 0.740*(DBH^2)	0.92	Brown (1997)
> 4000 mm.	4 – 112 cm.	AGB = exp{-3.3012 + 0.9439*ln(DBH^2*H)}	0.90	Brown et al (1989)
Coniferous trees				
n.d.	2 – 52 cm.	DBH = exp{-1.170 + 2.119*ln(DBH)}	0.98	Brown (1997)
Palms				
n.d.	> 7.5 cm.	AGB = 10.0 + 6.4 * H	0.96	Brown (1997)
n.d.	> 7.5 cm.	AGB = 4.5 + 7.7 * SH	0.90	Brown (1997)