GLOBAL CARBON CHECK

URBAN TREE PLANTATION METHODOLOGY FOR INDIA

UFCP1404 - Urban Tree Plantation Methodology for India

Version 1.0

CONTEXT

1. SUMMARY

The Urban Forest Credit Program (UFCP) - Urban Tree Plantation Methodology for India governs GHG mitigation in urban areas of India through Afforestation, Reforestation and/or Canopy expansion for woody biomass (urban forests).

The goal is to achieve real, additional, permanent, verifiable, and enforceable GHG removals, leading to urban forest carbon offset credits.

The Methodology Drafting Group and Registry created the Urban Forest Credit Program for various reasons:

- Urban trees are planted for environmental and social benefits to human communities, not for harvest or timber value.
- Urban forests are public resources, mostly managed by non-profit organisations, land trusts, and local governments.
- Urban tree canopies are declining nationwide, and public funding struggles to keep up with tree loss.
- Equitable distribution and maintenance of urban forests remain a challenge.
- Carbon crediting provides a means to monetize urban trees, aligning urban forests with carbon crediting and prioritising long-term tree and forest survival.
- Urban forest planting projects cannot afford to wait for 5 years to receive revenue; they need earlier funding to support tree maintenance.
- Given tree loss and inequitable tree distribution in cities, and considering that Afforestation, Reforestation and/or Canopy expansion projects are primarily executed by non-profits and local governments on public land, there are strong public policy reasons to support a carbon protocol for these valuable urban forest projects.
- Enabling urban areas and cities to not only restore their canopy cover but also rejuvenate ecological diversity and enhance social well-being
- This program also encourages project developers to transform spaces into vibrant, purposeful places.
- Urban forestry plays a vital role in mitigating GHG emissions by cooling cities, thus reducing the need for air conditioning and sequestering CO2 through tree growth

The main thing is to increase the canopy cover towards green India initiative under the National Action Plan for Climate Change(NAPCC). According to URDPI there should be 10 - 12 sqm of per capita of canopy cover [1]in urban areas and 1.2 - 1.4 Ha of green space per 1000 population[2].

Sources

- AR-TOOL 12 - Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities
- URDPI - Urban and Regional Development Plans Formulation and Implementation Guidelines
- FAO - Food and Agriculture Organisation, Guidelines on urban and peri-urban forestry

2. DEFINITIONS

Urban Area : The urban area definition is formulated based on the Census Bureau of India criteria, encompassing a minimum population of 5,000, a requirement that at least 75 percent of the working population is engaged in non-agricultural occupations, and a minimum population density of 400 persons per square kilometre.

UDA : Urban Development Authority (Example: AUDA - Ahmedabad Urban Development Authority)

MC : Municipal Corporations

Quasi-municipal : Entity is an organisation that operates similarly to a municipal government but lacks full municipal legal authority. These entities often provide local services or perform functions typically associated with municipalities but under a different legal framework.

PP's : Public Private Partnership

[1]https://forests.gujarat.gov.in/writereaddata%5Cimages%5Cpdf%5CStatus-of-Tree-Cover-in-Urban-Areas-of-Gujarat.pdf
[2] https://mohua.gov.in/upload/uploadfiles/files/URDPFI%20Guidelines%20Vol%20I(2).pdf

3. APPLICABILITY

Projects must be situated within or along the boundary of at least one of the following areas:

1. The defined boundaries outlined in the latest publication by the India Census Bureau.
2. The limits of any legally established incorporated[3] urban, city or town under state jurisdiction.
3. The borders of unincorporated[4] cities, towns, or urban regions as designated by district or state law.
4. The jurisdictional limits of regional metropolitan planning agencies or councils, established through legislative measures or public charters.
5. The demarcation of land that is owned, designated, and actively utilised by UDA, PP's, private, municipal or quasi-municipal entities.
6. Additionally, any transportation, power transmission, or utility right of way is considered, with the condition that it commences, concludes, or traverses through any portion of the aforementioned areas 1 through 4.

The Project may be located outside the boundary of areas 1 through 6 due to the urban-rural gradient and the public policy interest in preserving forest land and open space along that gradient. However, if the Project lies outside the boundary of 1 through 6, it must still be within or across parcels that form a contiguous sequence, chain, or progression. Additionally, part of the property line of these contiguous parcels must align with the boundary of areas 1 through 6.

Urban Forest Scopes

This methodology includes the following scopes but not limited to, under urban forestry for accounting and issuing credits for GHG reduction or removal.

- Green Belt Area, Peri-urban Forests and Woodlands(Forests and woodlands encircling towns and cities)
- City Parks, City Gardens or Urban Forests (> 0.5 ha)
- Pocket Parks or Gardens with Trees (< 0.5 ha)

[3] "Incorporated" refers to the boundaries or limits of a city or town that has been formally recognized and established as a legal entity under the jurisdiction of the state.
[4] "Unincorporated" pertains to areas that, while urban in nature, have not been formally incorporated as separate legal entities. Meaning that these areas do not have their own local government and are typically governed by district or state authorities.

- Green Strip, Trees on Roads, Streets or in Public Squares(Linear tree populations, small tree groups, and individual trees enriching streets, squares, parking lots, and public areas.)
- Other Green Spaces with Trees(Inclusive of urban agricultural plots, sports grounds, vacant lands, lawns, river banks, open fields, cemeteries contributing to urban green spaces)

4. BOUNDARY

Carbon pools		Selected (answer with Yes or No or Optional)	Explanation / Justification
Above ground		Yes	One of the primary outcomes of Urban Tree Plantation projects is the substantial increase in standing live carbon stocks.
Below ground		Yes	One of the primary outcomes of Urban Tree Plantation projects is the substantial increase in standing live carbon stocks in inclusion to its BGB.
Dead Wood	Standing dead wood	Optional	While standing dead wood is typically a minor component Urban Tree Plantation projects, there are rare instances where it can become a significant portion.
	Lying Dead Wood	No	Parks, Gardens, trees on roadside and streets undergo regular maintenance, including the removal of dead wood. Instead of allowing these organic materials to decay and potentially release methane, they are responsibly collected and utilized as feedstock for a district/city owned methane plant. This sustainable practice prevents the addition of methane emissions,

			contributing to environmental conservation.

5. ADDITIONALITY

To be considered additional, a project activity must demonstrate that it leads to emission reductions or removals beyond what would occur in a "business as usual" scenario, and it wouldn't have happened without the incentives provided by carbon markets. Projects mandated by law or regulation are excluded from this criteria.

The Project Operator must meet the following additionality requirements:

Step 1: Regulatory Surplus

- Pass the Legal Requirements Test, ensuring that urban trees planted due to laws or ordinances are not eligible.
- Prohibiting crediting for projects that convert forested land or cut down healthy trees to plant project trees.

Step 2: Performance Benchmark

The overall additionality of quantified GHG Reductions from project activities is considered as a performance standard approach. This is done by developing a performance benchmark, which can be derived from the baseline scenario for each project activity.

In this methodology as the baseline output delivers the tree cover area per capita in urban areas. If not meeting the standard of 10-12 sqm then any activity which helps to improve tree cover are considered additional. Also the continuous decrease in canopy cover in project area and activity that help to regain the canopy cover is considered as additional.

Urban forests, being a public resource, often face funding challenges that hinder the maintenance and growth of tree cover. Carbon revenues play a vital role in addressing this shortfall by providing essential funding for planting additional trees and supporting maintenance efforts to ensure a higher survival rate of trees until they reach maturity.

Moreover, the majority of large-scale urban tree planting initiatives are typically led by government entities, non-profit organizations, or private property developers who are addressing to comply with government regulations. Notably, these projects are ineligible for carbon credits under the protocol. Given that carbon revenues only partially offset the expenses associated with tree planting, there is minimal concern about developers involved in urban forest carbon projects experiencing disproportionate or unjust benefits.

6. BASELINE

Performance Baseline

Explanation/ Justification

Performance based baseline are used to avoid immediate anomalies in the context of urban forestry, which can arise from these situations. Organizations that have a consistent but not limited to history of tree planting, tree plantation drives and/or subsequently engage in carbon offset projects may receive significantly fewer carbon credits compared to entities with no prior commitment to urban tree planting. To put it in terms of baselines, the baseline for organizations actively planting trees would be the number of trees they traditionally plant each year, while entities with no prior tree planting commitment would have a baseline of zero.

For example, consider Uttar Pradesh, which initiated its tree plantation drive by planting 25 crore trees. More than 101 percent plantation was achieved in 14 districts whereas 51 districts recorded 100 per cent plantation. The tree plantation drive would lead to much higher baseline value in some cases un-eligibility. If the principle of additionality is applied rigidly on a project-by-project basis, entities with a history of tree planting may be tempted to halt their efforts temporarily, bringing their business-as-usual baseline to zero to maximize their carbon credit eligibility.Additionally, governments with progressive tree ordinances or land use regulations designed to increase tree canopy cover may find themselves receiving fewer carbon credits. This is because the trees planted as per their regulations would be considered part of their baseline and would, therefore, be ineligible for carbon crediting. The inflexible application of a 'legal requirements' test could create a counterproductive incentive for cities to leave their trees unregulated and unprotected.

While focusing on the concept of additionality within a single project or a specific tree-planting organization can provide valuable insights and allow for comparisons with other similar endeavors (a common practice), it's important to recognize that isolating a project or entity from its broader regional or national context overlooks the wealth of comparable regional or national data. This regional or national data might offer a more accurate benchmark than the data derived from a single project or entity

Procedure to define Baseline

Performance standard factors towards the baseline are derived by describing the project activity for increasing the canopy cover/urban trees in urban areas and towns according to the set scope. By taking the geographical scope (as mentioned in section 3) of regional data into consideration with temporal scope between 4-10 years of historical data. Multiple Urban areas can be taken into consideration mathematically to produce a performance standard baseline.

By demonstrating that the city fails to meet the URDPI guidelines for basic ratio of 10-12 sqm of tree cover per capita for the population. Alternatively, it can be demonstrated by revealing a sustained decline in canopy cover within the urban or city area.

Considering the data demonstrating that the loss of trees surpasses the gains achieved through new plantings, or the city fails to meet URDPI guidelines even after the new plantings it is clear that newly planted trees are justified as additional to the decreasing canopy baseline. In fact, the negative baseline would even support the idea of considering any trees protected from removal as additional.

The population data for baseline generation can be sourced from the Census Bureau of India or local self-government bodies, such as Urban Development Authorities, Municipal Corporations, and Quasi-Municipal Corporations.

7. LEAKAGE

Leakage represents the net change in anthropogenic greenhouse gas (GHG) emissions occurring beyond the project's boundaries and attributable to project activities. The ongoing rapid urbanisation has led to the expansion of urban and city limits, making it increasingly challenging to pinpoint land use and land cover (LULC) changes resulting from the UFCP project's afforestation efforts. Several complex scenarios contribute to addressing leakage concerns in urban forest credit projects.

For instance, consider the case where Sabarmati River Front in Ahmedabad, Gujarat, purchased land and transformed it into a forest reserve, while simultaneously, the Gujarat Slum Rehabilitation Policy led to government-provided housing for the same area's residents within the same city boundary. Additionally, urban areas often have predefined allocations for public spaces, parks, gardens, and roads. Therefore, reforestation and efforts to enhance canopy cover in such areas may not significantly impact leakage.

Given these inherent intricacies within Urban Forest Credit Projects (UFCP) and the limited availability of resources at the national or international scale to identify leakage for such projects, the overall leakage is conventionally regarded as negligible.

8. QUANTIFICATION

This section provides an overview of the essential criteria and guidelines for assessing net greenhouse gas (GHG) removals in an urban tree plantation project. For sampling please refer to *Strata Classification and Sampling Tool.*

To determine the actual onsite carbon stocks, the project developer/proponent updates the forest carbon inventory of the project during monitoring before the crediting issuance period, following the *Strata Classification and Sampling Tool* in relation to the updation of the survival count.

The calculation of total net GHG reductions and removals for every crediting issuance period for projects primary effects are calculated as mentioned below.

The allometric equation used must be demonstrated to be appropriate for the purpose of estimation of tree biomass by applying the tool *Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities.*

This method is applicable only in ex-post estimation of change in carbon stock in trees for monitoring of project activities. Under this method, the same sample plots (i.e. here each sample plot are individual sample trees) are measured on two successive occasions and the plot-level change in biomass is obtained by subtracting the plot biomass on the first occasion from the plot biomass on the second occasion.

Take the total sample based upon the *Strata Classification and Sampling Tool* .

8.1. General

In the project scenario, net greenhouse gas removals are calculated as below.

$$C_{TREE} = \Delta C_{TREE,p} + \Delta C_{DW,p} + \Delta C_{DWS,p} \quad (1)$$

Where:

C_{TREE}	=	Carbon stock in tree biomass; $t\ CO_2e$
$\Delta C_{TREE,p}$	=	Change in carbon stock in trees between two successive measurements period p ; $t\ CO_2e$
$\Delta C_{DW,p}$	=	Change in carbon stock in dead wood between two successive measurements period p ; $t\ CO_2e$
$\Delta C_{DWS,p}$	=	Change in carbon stock in dead wood in dead tree stump between two successive measurement period p; $t\ CO_2e$

8.2. Change in Charbon Stock in Trees

$$\Delta C_{TREE,p} = C_{TREE,t} - C_{TREE,t-3} \quad (2)$$

$$C_{TREE,t} = \sum_{i=1}^{ni}\left(\frac{44}{12} \times CF_{TREE} \times B_{TREE_i}\right) \tag{3}$$

$$B_{TREE_i} = \sum_{s=1}^{ns}\left(SC_{i,s} \times b_{TREE,i,s}\right) \tag{4}$$

Where:

$\Delta C_{TREE,p}$	=	Change in carbon stock in trees between two successive measurements period p ; $t\ CO_2e$
C_{TREE_t}	=	Carbon stock in trees at time t ; $t\ CO_2e$
$C_{TREE_{t-3}}$	=	Carbon stock in trees at time $t - 3$; $t\ CO_2e$
CF_{TREE}	=	Carbon fraction of tree biomass; $t\ C\ (t.d.m)^{-1}$ (A default value of 0.47 is used unless transparent and verifiable information can be provided to justify a different value)
B_{TREE_i}	=	Tree biomass in strata i; $t.d.m$
$SC_{i,s}$	=	Survival count of the specific species s in strata i ; dimensionless
$b_{TREE,i,s}$	=	Mean tree biomass of specific tree species s in strata i, $t.d.m$
i	=	1,2,3..... strata in project boundary
s	=	1,2,3..... tree species in strata i

8.3. Carbon Stock in Dead Wood

8.3.1. Biomass in standing dead wood

$$C_{DW,t} = \frac{44}{12} \times CF_{TREE} \times B_{DW} \tag{5}$$

$$B_{DW} = \sum_{i=1}^{ni}\left(\sum_{s=1}^{ns}\left(\sum_{k=1}^{nk}\left(\left(1 + R_s\right) \times f_s\left(DBH_k, H_k\right) \times \alpha_k\right)\right)\right) \tag{6}$$

Where:

$C_{DW,t}$ = Carbon stock in dead wood in standing dead tree; $t\,CO_2e$

B_{DW} = Biomass of dead wood in standing dead trees; $t.d.m$

CF_{TREE} = Carbon fraction of tree biomass; $t\,C\,(t.d.m)^{-1}$ (A default value of 0.5 is used unless transparent and verifiable information can be provided to justify a different value)

R_s = Root-shoot ratio for tree species s; dimensionless

$f_s(DBH_k, H_k)$ = Above-ground biomass of the k^{th} dead tree of species s in strata i;$t.d.m$

α_k = Biomass reduction factor for the k^{th} dead tree, depending upon its condition according to Dead tree classification table below; dimensionless

s = 1, 2, 3, ... tree species in strata i

i = 1, 2, 3, ... strata in project boundary

k = 1, 2, 3, ... dead tree of species s in strata i

Dead Tree Classification

For the following two categories of standing dead wood, the biomass of standing dead wood is estimated by applying a biomass reduction factor to whole tree biomass:

Dead tree class	Biomass reduction factor
Dead trees which have lost only leaves and twigs	0.975
Dead trees which have lost leaves, twigs and small branches (diameter < 10 cm)	0.80

Note: If the decay class is higher refer to standing wood in stump

8.3.2. Carbon stock in standing dead wood

$$\Delta C_{DW,p} = C_{DW,t} - C_{DW,t-3} \quad (7)$$

Where:

$\Delta C_{DW,}$	=	Change in carbon stock of dead wood in standing trees between two successive measurements period p ; $t\ CO_2e$
$B_{DW,t}$	=	Carbon stock of dead wood in standing trees at time t ; $t.d.m$
$B_{DW,t-}$	=	Biomass of dead wood in standing trees at time $t-3$; $t.d.m$

8.3.3. Carbon stock for tree stumps in standing dead wood

$$D_{MIDSTUMP} = 0.57 \times DBH \times \left(\frac{H_{STUMP}}{H_{STUMP} - H_{DBH}}\right)^{0.80} for\ H_{STUMP} > 4\,m \quad (8)$$

Where:

D_{MID}	=	Mid-height diameter of the dead tree stump; m
DBH	=	Diameter at breast height of the dead tree stump; m
H_{STU}	=	Height of the stump; m
H_{DBH}	=	Height above ground level at which DBH is measured; m

Tree Stump Classification

The condition of the stump wood is determined by striking it with a machete. If the blade bounces off, it is considered sound. If it penetrates slightly into the wood, it is categorised as intermediate. If it causes the wood to disintegrate, it is classified as rotten. This methodology is outlined in IPCC GPG LULUCF 2003, section 4.3.3.5.3 on Dead Organic Matter.

Decay Class	The density reduction factor
Sound	1.00

Intermediate	0.80
Rotten	0.45

$$\Delta C_{DWS,p} = C_{DWS,t} - C_{DWS,t-3} \quad (9)$$

$$C_{DWS,t} = \sum_{i=1}^{ni}\left(\frac{44}{12} \times CF_{TREE} \times d_s \times (1 + R_s) \times \frac{\Pi}{4}\sum_k D_{MIDSTUMP,k}{}^2 \times H_k \times \beta_k\right) \quad (10)$$

Where:

$\Delta C_{DWS,p}$	=	Change in carbon stock in dead wood in dead tree stumps between two successive measurement period p; t CO2e
$C_{DWS,t}$	=	Carbon stock in dead wood in dead tree stumps at time t; t CO2e
CF_{TREE}	=	Carbon fraction of tree biomass; $t\ C\ (t.d.m)^{-1}$ (A default value of 0.5 is used unless transparent and verifiable information can be provided to justify a different value)
d_s	=	Basic wood density of species s; t d.m. m^{-3}
R_s	=	Root-shoot ratio for tree species s; dimensionless
$D_{MIDSTUMP,k}$	=	Mid-height diameter of the k^{th} dead tree stump of species s in strata i ; m
H_k	=	Height of the k^{th} dead tree stump of species s in strat i ; m
β_k	=	Density reduction factor applicable to the k^{th} dead tree stump of species s in strat i; dimensionless
s	=	1, 2, 3, ... tree species in strata i
i	=	1, 2, 3, ... strata in project boundary
k	=	1, 2, 3, ... dead tree of species s in strata i

9. MONITORING

Project proponents/developers must detail the procedures for collecting and reporting all data and parameters listed. The monitoring plan must contain at least the following information. Project proponents must also detail the procedures for collecting and reporting all data and parameters.

The report should also address the following questions:

- Has there been any change in the contact information of the Project Operator? If so, please provide the new contact information.
- Have there been any changes in land ownership of the Project Area?
- Have there been any modifications to the Project Design?
- Have there been any changes in the implementation or management of the Project?
- Have there been any significant alterations to the site (e.g., flooding or human interventions)?
- Have there been any substantial tree or canopy losses, estimated to be greater than 8% of Project Trees or 8% of the canopy?
- Are there any other significant elements to report?
- An outline of each monitoring task and their respective technical requirements.
- A definition of the accounting boundary.
- Specifications for measured parameters, including tables for directly measured tree attributes (e.g., diameter at breast height, total height) used as independent variables in allometric equations.
- Detailed information about data collection, including techniques outlined in a standardized field data collection procedure.
- The planned frequency of monitoring.
- Quality assurance and quality control (QA/QC) procedures for accurate data collection, anomaly detection, completeness checks, independent analysis verification, and other safeguards as needed.
- Procedures for archiving data, including any anticipated updates to electronic file formats. All monitoring data, including QA/QC data, must be electronically archived for a minimum of two years after the last project crediting period.
- Roles, responsibilities, and the capacity of the monitoring team and management.

9.1. Data and Parameters Available at Validation

Data / Parameter:	CF
Data unit:	$t\,C\,(t.d.m)^{-1}$
Description:	Carbon Fraction of biomass
Equations	3, 5, 10
Source of data:	IPCC is a reputable source approved by the GCACH consideration.
Description of measurement methods and procedures to be applied:	IPCC default value is taken into consideration. 1. For section 8.2 in methodology, the value of 0.47 is taken into count. 2. For section 8.3 in methodology,the value of 0.5 is taken into count.
QA/QC procedures to be applied:	In case of different value, transparent and verifiable information can be provided to justify a different value from any research paper or publication from a renowned publication platform.
Purpose of data:	To calculate tree biomass to further identify change in carbon stock during each credit issuance cycle
Comments:	https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Chp3_2_Forest_Land.pdf

Data / Parameter:	R_s
Data unit:	dimensionless
Description:	Root-shoot ratio for tree species s
Equations	6, 10

Source of data:	https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/Chp3/Anx_3A_1_Data_Tables.pdf
Description of measurement methods and procedures to be applied:	Default value of 0.27 can be taken into consideration.
QA/QC procedures to be applied:	In case of different value, transparent and verifiable information can be provided to justify a different value from any research paper or publication from a renowned publication platform.
Purpose of data:	To calculate total tree biomass in inclusion to BGB to further identify change in carbon stock during each credit issuance cycle
Comments:	N/A

Data / Parameter:	α_k
Data unit:	dimensionless
Description:	Biomass reduction factor of the dead tree
Equations	6
Source of data:	IPCC is a reputable source approved by the GCACH consideration.
Description of measurement methods and procedures to be applied:	1. Dead trees which have lost only leaves and twigs, 0.975 is taken into count. 2. Dead trees which have lost leaves, twigs and small branches (diameter < 10 cm), 0.80 is taken into count.
QA/QC procedures to be applied:	N/A

Purpose of data:	To calculate the biomass in standing dead wood within the project area
Comments:	1. Adapted from the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG-LULUCF 2003): p. 4.105, section 4.3.3.5.3 DEAD ORGANIC MATTER. 2. Ibid.

Data / Parameter:	d_s
Data unit:	$t.d.m^{-3}$
Description:	Basic wood density for species s
Equations	10
Source of data:	IPCC is a reputable source approved by the GCACH consideration.
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	N/A
QA/QC procedures to be applied:	N/A
Purpose of data:	To quantify the biomass of dead trees belonging to specific species within the project area
Comments:	Values from Table 3A.1.9 of IPCC GPG-LULUCF 2003 are used unless transparent and verifiable information can be provided to justify different values

9.2. Data and Parameters Monitored

Data / Parameter:	$b_{TREE,i,s}$
Data unit:	$t.d.m^{-1}$
Description:	The survival count of the specific species S within stratum i
Equations	4
Source of data:	Value is derived from field measurements within the project's boundaries
Description of measurement methods and procedures to be applied:	Value is determined by calculating the average of the sample plots, (i.e sample trees), from field measurements
Frequency of monitoring/recording:	Every 3 years
QA/QC procedures to be applied:	N/A
Purpose of data:	To calculate tree biomass of specific species as per the strata.
Comments:	N/A

Data / Parameter:	$SC\ i,s$
Data unit:	Dimensionless ; i.e. numerical numbers

Description:	The survival count of the specific species S within stratum i
Equations	4
Source of data:	Value is derived from field measurements within the project's boundaries
Description of measurement methods and procedures to be applied:	Employ remote satellite data in conjunction with geotagging carried out during the tree planting activity in the project, or the Standard Operating Procedures (SOP) established by municipal corporations to identify the survival of the plantation in urban areas.
Frequency of monitoring/recording:	Every 3 years
QA/QC procedures to be applied:	During the employment of remote satellite data, If any of the planted trees fall within the canopy cover of existing trees, utilize ground truth analysis to ensure the highest quality assurance and quality control (QA/QC)
Purpose of data:	To calculate biomass of trees within the project area.
Comments:	N/A

Data / Parameter:	DBH
Data unit:	cm or any unit of length specified
Description:	Diameter at Breast height of a tree
Equations	6, 8
Source of data:	Value is derived from field measurements within the project's boundaries

Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Frequency of monitoring/recording:	Every 3 years
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Purpose of data:	To quantify the biomass of dead trees within the project area
Comments:	N/A

Data / Parameter:	H
Data unit:	m or any other unit of length specified
Description:	Height of tree
Equations	6, 8, 10
Source of data:	Value is derived from field measurements within the project's boundaries
Description of measurement methods and procedures to be applied:	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied

Frequency of monitoring/recording:	Every 3 years
QA/QC procedures to be applied:	Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied
Purpose of data:	To quantify the biomass of dead trees belonging to specific species within the project area
Comments:	N/A

Data / Parameter:	β_k
Data unit:	dimensionless
Description:	Density reduction factor
Equations	10
Source of data:	IPCC is a reputable source approved by the GCACH Consideration.
Description of measurement methods and procedures to be applied:	The condition of the stump wood is determined by striking it with a machete. If the blade bounces off, it is considered sound. If it penetrates slightly into the wood, it is categorized as intermediate. If it causes the wood to disintegrate, it is classified as rotten. This methodology is outlined in IPCC GPG LULUCF 2003, section 4.3.3.5.3 on Dead Organic Matter.

Decay Class	The density reduction factor
Sound	1.00
Intermediate	0.80

	Rotten | 0.45
Frequency of monitoring/recording:	Every 3 years
QA/QC procedures to be applied:	N/A
Purpose of data:	To quantify the biomass of dead trees stump
Comments:	1. The stump wood is struck with a machete - if the blade bounces off it is sound; if it enters slightly into the wood, is it intermediate; and if it causes the wood to fall apart, it is rotten. IPCC GPG LULUCF 2003, section 4.3.3.5.3 DEAD ORGANIC MATTER. 2. Adapted from Harmon, M. E. and J. Sexton. (1996) Guidelines for Measurements of Woody Detritus in Forest Ecosystems. US LTER Publication No. 20. US LTER Network Office, University of Washington, Seattle, WA, USA

Appendix I

Offer insights into the types of urban forest activities integrated into the project area. Provide comprehensive explanations for each urban forest activity and how they incorporate the six dimensions to transform urban spaces into meaningful places. Concisely outline the integration of the six dimensions[5] into the project area through the implementation of dimension-specific Elements.

Table 1 : Provide information on if any of the following Urban Forest Type are implemented in the project.

Urban Forest Type	Yes / No

[5] https://www.fao.org/3/i6210e/i6210e.pdf - Dimension of Urban Forest Design (Page 38 - 41)

Peri-urban forests and woodlands	
City parks and urban forests (>0.5 ha)	
Pocket parks and gardens with trees (<0.5 ha)	
Trees on streets or in public squares	
Other green spaces with trees	

Table 2 : Provide information on if any of the following Urban Forest Type are implemented in the project.

Urban Forest Type	Which Dimensions are implemented	How they are implemented
Peri-urban forests and woodlands	Example: Dimensions Implemented 1) Perceptual 2) Functional 3) Ecological	Provide a brief explanation of how specific elements from each dimension are incorporated into the design of peri-urban forest and woodland, offering insights into the design concept and its application in this context
City parks and urban forests (>0.5 ha)		
Pocket parks and gardens with trees (<0.5 ha)		
Trees on streets or in public squares		
Other green spaces with trees		

Appendix 2

Despite the vital role urban trees play, there has been a noticeable gap in global research regarding their response to climate change and the urban heat island effect. Furthermore, lack of comprehensive studies and resources towards tree growth factors within urban and city ecosystems of not just India but at global scale. To fill this gap, our approach considers data from 10 global regions, spanning various climates, from boreal to subtropical[6].

Ex-Ante Calculation

Basal area serves as a valuable metric for quantifying the growth of individual trees. In this approach, we employ a consistent basal value to estimate a tree's Diameter at Breast Height (DBH) during its initial 30 years of growth. When considering the influence of urban zones and climate change on tree growth across all four climate zones, we observe that the average basal area over 30 years is nearly 0.12. Consequently, we adopt a static basal value of 0.12 for our estimations in the calculation of ex-ante credits.

$$DBH = 2 * \sqrt{(BA / \pi)} \tag{11}$$

Where :

DBH	=	Diameter at Breast Height (DBH)
BA	=	Basal Value 0.12

Utilise the DBH value by applying it to the specific allometric equation tailored to each tree species of interest. This process enables the calculation of ex-ante values, offering insights into predicted outcomes for the respected species.

If the project proponent intends to employ an alternative method for calculating ex-ante credits, provide comprehensive details regarding the chosen method. This should include references to pertinent scientific papers and journals. Additionally, please ensure clear documentation of any underlying assumptions or hypotheses considered during the calculation process.

6 https://www.nature.com/articles/s41598-017-14831-w