# PROJECT DESCRIPTION FOR TIST PROGRAM IN INDIA VCS-001


Document Prepared By Clean Air Action Corporation

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|---|---|
| **Project Title** | The International Small Group and Tree Planting Program, India, VCS-001 |
| **Version** | Version 01 |
| **Date of Issue** | 08-February-2013 |
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## PROJECT DETAILS

### 1.1 Summary Description of the Project

The International Small Group and Tree Planting Program (TIST) is a combined reforestation and sustainable development project, in India, carried out by subsistence farmers. The farmers plant trees on their land and retain ownership of the trees and their products. They receive training from TIST and a share of the carbon revenues from CAAC.

TIST empowers Small Groups of 6-to-12 subsistence farmers in India, Kenya, Tanzania, and Uganda to combat the devastating effects of deforestation, poverty and drought. Combining sustainable development with carbon sequestration, TIST already supports the reforestation and biodiversity efforts of over 64,000 subsistence farmers. Carbon credit sales generate participant income and provide project funding to address agricultural, HIV/AIDS, nutritional and fuel challenges. As TIST expands to more groups and more areas, it ensures more trees, more biodiversity, more climate change benefit and more income for more people.

TIST provides an administrative backbone that supplies training in building nurseries, tree planting, conservation farming, building fuel-efficient stoves and malaria and HIV/AIDS prevention. Part of the backbone is a two-way communications network that includes newsletters, weekly meetings at the Small Group level, monthly meetings where groups of Small Groups receive training, periodic seminars at the national level and an award winning monitoring system based on hand-held computers and GPS. TIST is available to everyone and all are considered equal. The rotating leadership and the Small Group rules empower women and the undereducated. Those who are the most successful, regardless of education levels or gender, become mentors and leaders.

This project description (PD) is for a subset of the TIST project in India and initially applies to 452 Small Groups, 2,599 members, 924 project areas and 671.8 ha. The main species planted are *Tectona grandis*, *Gmelina arborea*, and *Mangifera indica*.

### 1.2 Sectoral Scope and Project Type

This project is seeking registration under the Verified Carbon Standard (VCS 3.3) as an Afforestation, Reforestation and Revegetation (ARR) project and has been developed in compliance with the VCS Guidance for Agriculture, Forestry and Other Land Use Projects (VCS Version 3.3). It is a grouped project.

### 1.3 Project Proponent

| Project Proponents | Point of contact | Roles/ Responsibility | Contact Details |
|---|---|---|---|
| Clean Air Action Corporation (CAAC) | Charles E. Williams, Vice President | Project developer, implementer, manager | Clean Air Action Corporation<br>7134 South Yale Ave, Suite 310<br>Tulsa, Oklahoma 74136<br>United States of America<br>Phone: +1-918-747-8770 |

## 1.4 Other Entities Involved in the Project

| Other Entities | Point of contact | Roles/ Responsibility | Contact Details |
|---|---|---|---|
| TIST Tree Planting India Private Limited (TIST India) | Joseph Rexon | Manages TIST India operations | TIST Tree Planting India<br>Flat A, Plot No.69, 26th Street,<br>Sankar Nagar, Pammal,<br>Chennai 600075 |
| Environmental Services, Inc (ESI) | Shawn McMahon | Validator/Verifier | Environmental Services, Inc.<br>3800 Clermont St., NW<br>North Lawrence, OH 44666<br>United States of America<br>Phone: +1-330-833-9941 |

## 1.5 Project Start Date

01-January-2004

## 1.6 Project Crediting Period

30 years starting 01-January-2004 and ending to 31-December-2033

## 1.7 Project Scale and Estimated GHG Emission Reductions or Removals

| | |
|---|---|
| Project | yes |
| Large-project | no |

| Years | Estimated GHG emission reductions or removals (tCO2e) |
|---|---|
| Year 2004 | 0 |
| Year 2005 | 58 |
| Year 2006 | 360 |
| Year 2007 | 2,341 |
| Year 2008 | 4,927 |
| Year 2009 | 8,734 |
| Year 2010 | 11,538 |
| Year 2011 | 13,185 |
| Year 2012 | 13,174 |
| Year 2013 | 13,193 |
| Year 2014 | 13,195 |
| Year 2015 | 13,195 |
| Year 2016 | 13,195 |

| | |
|---|---|
| Year 2017 | 13,195 |
| Year 2018 | 13,195 |
| Year 2019 | 13,195 |
| Year 2020 | 13,195 |
| Year 2021 | 13,195 |
| Year 2022 | 13,195 |
| Year 2023 | 13,195 |
| Year 2024 | 13,195 |
| Year 2025 | 13,195 |
| Year 2026 | 13,195 |
| Year 2027 | 13,195 |
| Year 2028 | 13,195 |
| Year 2029 | 13,195 |
| Year 2030 | 13,195 |
| Year 2031 | 13,195 |
| Year 2032 | 13,195 |
| Year 2033 | 13,195 |
| **Total estimated ERs** | 331,410 |
| **Total number of crediting years** | 30 |
| **Average annual ERs** | 11,047 |

## 1.8 Description of the Project Activity

### 1.8.1 Project Overview

Since its inception in 1999, over 64,000 participants organized into over 9,000 TIST Small Groups have planted over eleven million trees in Tanzania, India, Kenya, and Uganda - accomplishing GhG sequestration through tree planting, creating a potential long-term income stream, and developing sustainable environments and livelihoods. Replication of TIST in India began in 2002. Tree planting for this PD began in 2004.

Currently, there are about 4,000 TIST participants, in over 700 Small Groups, registered in the TIST program in India and are working to break their local cycle of deforestation, drought and famine. The trees planted in thousands of discrete groves and land parcels are already beginning to reduce erosion, stabilize and enrich the soil, and will soon be providing shade. In the future, they will provide other benefits, including edible fruits and nuts, medicines, windbreaks, firewood and timber.

This PD is for a subset of the reforestation project in India as described in Section 1.1.

As a grassroots initiative, Small Groups are provided a structural network of training and communications that allows them to build on their own internal strengths and develop best practices. Small Groups benefit from a new income source; the sale of carbon credits that result from the sequestration of carbon from the atmosphere, into the biomass of the trees and soil. These credits are expected to be approved under VCS and, because they are tied to tree growth, will be sustainable. The carbon credits create a new 'virtual' cash crop for the participants who gain all the direct benefits of growing trees and also receive quarterly cash stipends based on the GhG benefits created by their efforts. The maturing trees and conservation farming will provide additional sustainable benefits that far exceed the carbon payments. These include improved

crop yield, improved environment, and marketable commodities such as fruits, nuts, and honey. TIST utilizes a high-tech approach to quantify the benefits and report the results in a method transparent to the whole world, which includes palm computers, GPS, and a dynamic "real time" internet-based database.

TIST contributes to the following indicators for sustainable development – Social well-being, Economic well-being, Technological well-being, and Environmental well-being:

Socio-economic well-being

- TIST generates employment of local Quantifiers and staff who travel to TIST tree groves and woodlots to quantify the number, location, circumference, and species of trees planted as a result of this project activity. The project also provides jobs for an office staff, who oversee the production of the TIST newsletter, the scheduling and coordination of Cluster meetings, the synchronization of Palm data from the Quantifiers, and the establishment of the voucher payment system.

- TIST reinforces the removal of social disparities by encouraging participation among all members of society regardless of income, religion, or sex. TIST also removes social disparities by training participants to use the concept of rotating leadership within the Small Group format.

- TIST reinforces good practices for human health. TIST provides training on improved farming practices, including use of compost manure which, when adopted, have improved crop output in many cases and helped to secure food. In addition, TIST uses the node meetings as a delivery mechanism to train participants in health matters, including HIV/AIDS awareness and prevention.

Technological well-being

- TIST provides the transfer of environmentally safe and sound technologies, including the use of Palm computers, laptop computers, GPS devices, Internet, and improved farming practices. In addition, the TIST newsletter documents best practices, identified by the participants themselves, for sharing appropriate and adaptive technologies with one another.

Environmental well-being

- The TIST program improves resource sustainability and reduces resource degradation. Because TIST participants plant trees, and because not all trees survive, the deadfall alone will reduce the need for participants to continue to cut down trees outside TIST project boundaries after just a few years. Once enough trees are planted, they have the potential to provide a sustainable fuel wood supply.

- Resource degradation exists when soils erode. TIST trees directly stabilize soils. They also provide shade that enables grasses to grow under the canopy, which further reduces soil degradation. They produce fruit, nuts, and traditional medicines, which lessen the pressure to obtain these from non-TIST tree stocks.

- By empowering Small Groups to select which tree species to plant and training on benefits of indigenous species, the project reinforces biodiversity friendliness.

- The impact of TIST is to reduce the levels of pollution in general. TIST provides an improvement in air quality through the sequestration of carbon. Soil stabilization that results from TIST also has the ability to improve water quality over the long-term. TIST does not own a fossil-fueled vehicle.

### 1.8.2 How the project will achieve GHG removals

The TIST India project will achieve GHG removals through reforestation/revegetation and sequester atmospheric $CO_2$ in live aboveground and belowground biomass.

TIST project areas are located on lands owned or controlled by TIST small hold farmers and that have been used as cropland or grassland. Because the farmers also own the trees that they plant, the species are selected by the Small Groups, based on their needs and the benefits, which they desire to obtain. As a result, numerous species and varieties have been selected. Table 1.8 lists the species and indicates whether they are indigenous to the area. Additional species may be added over the 30-year life of the project, as additional planting takes place. The specific species for each project area are shown in the "Strata" worksheet.

**Table 1.8 Tree Species Selected**

| ***Scientific Name*** | **Common name** | **Height (m)** | **Indigenous** |
|---|---|---|---|
| Anacardium occidentale | Cashew | 15 | no |
| Aniba Rosaedora | Rosewood | 30 | no |
| Azadirachta indica | Neem | 20 | yes |
| Bombax ceiba | Silk Cotton | 30 | yes |
| Casuarina equisetifolia | Casuarina | 30 | yes |
| Citrus limonum | Lemon | 6 | yes |
| Citrus sinensis | Orange | 13 | no |
| Endiandra glauca | Endiandra glauca | 0 | no |
| Eucalyptus grandis | Flooded Gum | 55 | no |
| Gmelina Arborea | Beechwood | 30 | yes |
| Grevillea Robusta | Grevillea, River Oak, Silk Oak | 25 | no |
| Mangifera indica | Mango | 25 | yes |
| Melia azedarach | Chinaberry, Bead Tree | 7+ | yes |
| Olea europaea | Olive | 10 | no |
| Phyllanthus emblica | Nelli | 15 | yes |
| Pouteria sapota | Sapota | 18 | no |
| Psidium guajava | Guava | 15 | no |
| Pterocarpus Marsupium Roxbo | Indian Kino Tree | 30 | yes |
| Pterocarpus santalinus | Red Sandalwood | 10 | yes |
| Swietenia mahagoni | Mahogany | 40 | no |
| Tamarindus indica | Tamarind | 20 | yes |
| Tectona grandis | Teak | 30 | yes |
| Toona ciliata | Red Cedar | 25 | yes |
| Zanthoxylum spp. | East African Satinwood | 35 | yes |

**Project technologies, products, services and activities**

The technologies associated with tree planting have been developed through discussions with Tamil Nadu Forestry Department and use of existing literature. In addition, TIST works with the

Small Groups and local experts to develop best practices that are recommended to the members for adoption. The following describes the technologies employed.

**General:** The project involves direct tree planting of species selected by the individual Small Groups, to meet their individual goals and needs. A list of suitable species was prepared based on input from local experts.

**Nurseries:** TIST best practices call for Small Groups to acquire seeds and develop their own nurseries using either seedbeds, or pots, made from plastic bags. Some Small Groups acquire seedlings from other groups, other individuals and local forest services.

**Tree Planting:** Tree planting is accomplished by manual methods using hand tools. TIST best practices call for farmers to dig individual holes that are 45 cm wide, 45 cm deep, spaced 2.5 m to 3.5 m apart for each seedling and fertilized using natural fertilizers. TIST does not own any fossil fuel vehicles or equipment to be used for tree planting.

**Monitoring:** TIST has deployed an innovative and award winning[1] data collection system that consists of battery-operated Palm computers, GPS receivers, data and image uploads through laptops or Internet access points to monitor project activities. The data collection is conducted by trained local representatives, called Quantifiers, who are often Small Group members. They travel to each specific project area by walking, bikes, and local buses. TIST does not own any vehicles.

**Internet:** TIST uses Internet technology to make program results available transparently to a worldwide audience. It is also used to transfer field data collected with the Palm computers to the TIST database server located in the USA.

**Pest Management:** Small Groups are trained to use local natural techniques to manage pests. For example:

- Neem seeds are ground and added to boiling water. The mixture is left overnight and then applied to seedlings when cool.
- Neem leaves, washing soap, salt and red pepper (chili) are mixed together, then added to water and covered with the pan (this is a dangerous mixture!) and then boiled. The cooled mixture is applied to the seedlings.
- Ash is added to the area with seedlings.
- The area is well weeded to avoid encouraging pests.
- Neem leaves are boiled in water to make 'bitter water' and then applied to the seedlings.

**Ongoing management:** Long-term management of the trees rests with the Small Groups. However, due to the ongoing tree payment based on live tree counts and the long-term profit sharing arrangement with the Small Groups, there are ample incentives for the groups to maintain healthy long-term stands. All species will be maintained for the 30-year life of the project. Small Groups have contracted to replant trees that die in the first 20 years.

Management of the trees is dependent on the species. For example:

- *Tectona grandis:* Initial spacing can be 2x2 meters, planted in rows and in strong light *(75% to 100% light)*. Thinning should take place at 5, 8, 18 and 28 years bringing stem density down to where there is no canopy friction.

[1] ComputerWorld Honors Program Laureate, 2007.

- *Gmelina arborea:* Planting should take place at the beginning of the rainy season. Spacing should be 2x2 meters for plantations and 4.5x4.5 for agroforestry. It needs sun and is sensitive to competition so 3–4 weedings are required during the first two years of growth.

- *Mangifera indica*: Initial spacing should be over 34 x 34 feet. Irrigation is recommended for the early years. Pruning can be done after the first fruiting (usually after year four) to improve the form. After that pruning should be restricted to removing dead limbs.

### 1.8.3 Schedule

The starting date of the proposed small-scale A/R CDM activity and the crediting period begins 1 January, 2004. The project is scheduled to last 30 years but may be extended if the carbon market is vibrant enough to support it.

**Justification:** TIST maintains a database record of each project area showing when it was first quantified by a TIST staff member and how old the trees were. These records appear at www.tist.org under “Project Areas” and under each region, group center, and Small Group where audits have taken place. The data collected by TIST indicates that the first trees planted by Small Groups, in project areas subject to this PD, were planted in 2004. See "Grove Summary" and "Strata" worksheets for age of trees.

**Gantt Charts:** The following Gantt charts show the timing of annual events for the project. The numbers along the top of each chart are years. Where "project" is indicated in the title, it is for the 30-year project life. Where "project area" is indicated, it is for events that might take place within a project area and the year one may be an event rather than the beginning project date. With all the different project areas, species, farmers and planting schedules, these charts are very general and subject to change.

**Main planting schedule (project).** Main planting has taken place, but additional planting may take place in individual project areas, over the next few years, where the original planting density is low.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Replacement planting schedule (project).** As trees die, farmers are to replant for 20 years. Replanting can start as soon as the second year. Replanting is shown for 25 years because of the staggered start of individual project areas.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Monitoring (project).** Monitoring is ongoing. The internal goal is to quantify each grove annually. Whether that is achieved or not, the Quantifiers are out in the field, all the time, visiting the multitude of project areas.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Validation and verification (project).** Validation takes place around year six, when project areas have been established and trees are already in the ground and growing. It is expected that the initial verification will take place at the same time. While it is a cost trade off, because the monitoring is ongoing, it is possible that verification could take place as much as annually.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Thinning (project area).** Thinning is allowed, because it improves tree growth. Because of the different species and their different growth rates, the different planting schedules, the different original spacing and different farmers, thinning can begin in as early as four years, where an early harvest for poles or firewood is made.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Fruit and nut harvest (project area).** Most of the trees won't bear any fruits, nuts or other products for five or six years. After that, harvest will be annual.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Deadwood harvest (project areas).** Farmers may harvest deadwood any time it exists. For those that lose trees in the first year, it will come in year one. However, it is expected that most deadwood harvest will take place in later years as larger trees are lost, or branches die.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## 1.9 Project Location

**Figure 1.9 General area of the TIST project**

The individual project sites are located in villages in the five districts of Tamil Nadu State, namely Kancheepuram, Tiruvannamalai, Thiruvallur, Vellore and Villupuram. The locations of the district are shown in Figure 1.9

TIST has adopted a "grouped project" approach for this PD. As required by VCS, a KML file has been prepared that defines the extent of the geographic area of the expanded program. The KML file defines the districts listed above. See Appendix 06.

The district and village of each project area are in Appendix 04, "Grove Summary" worksheet. The geographic locations and boundaries of each project area have been determined using a GPS and identified with a unique number and geographic coordinate. Appendix 01 shows the single point location of each project area on a 1990 Landsat 4/5 satellite image. Appendix 02 shows the single point location of each project area on a 2000 Landsat 7 satellite image. Appendix 03 is a KML file that can be loaded on Google Earth that identifies each project area and plots each boundary. In addition, TIST maintains all of this data in an interactive format on a website that is publicly available to anyone with Internet access. Included on the site are GPS tracks of the project areas on a geographic grid. It can be accessed as follows:

1. Go to tist.org
2. At top, select Project Area (example: India). Note Country Profile information showing current tree count, Small Group count and predominate species information for all the TIST activities in the country. This information, as well as the rest of the information on the web site, is updated as much as several times a day, as field staff upload their data.
3. On the right, below map, select a Project Area (example: select Tamil Nadu). Note current Area Profile summaries at top showing current tree count, Small Group count and predominate species information for all the TIST activities in the Project Area.
4. Towards bottom, select a Group Center (example: Arani). Note current Group Center Profile data at top showing current tree count, Small Group count and predominate species information for all the TIST activities in the Group Center, and the link to Sponsored Project Areas.
5. Select link “Click Here to View the Quantified Tree Groves in this Group Center Displayed on a Satellite Map.” A Google Maps satellite image will appear with red dots showing the location of all the project areas assigned to this Group Center. Placing the cursor and clicking on a dot will display an information balloon about that project area.
6. Use the browser back button to return to the Group Center Profile page.
7. Note the table at bottom of page listing the Small Groups assigned to this Group Center, their tree and seedling counts and the Last Audit Date.
    a) The camera icon next to the group name is a link to pictures of the Small Group and their project areas. Digital photographs are taken with TIST’s data acquisition system and are automatically dated and mapped to the Small Group.
    b) The Adobe icon is a link to the Small Groups GhG contract with the Project Participant. It is password protected and not generally available to the public.
    c) Last Audit Date refers to the last time a TIST Quantifier (a staff member trained to collect project area data using TIST’s data acquisition system) collected data from this Small Group’s project area. It is a link to detailed quantification data.
8. Select one of the dates under Last Audit Date (example: date associated with Pillaiyarappan,, 2008IN488).
9. On the Tree Audit page is a list of each project area belonging to the selected Small Group. Under Groves Present are the name, latitude and longitude of the project area.
10. Select a Name in the Groves Present section (example: rajavel) that is a hot link and the GPS perimeter of that project area will appear showing the bounding latitude and longitude, identification and area.
11. On the same page, select the link at the top “Click here to view this grove perimeter plotted on a satellite image.” The perimeter of the project area is now displayed on a Google Maps satellite image. If there is a grey screen stating “we are sorry, but we don’t have imagery at

this zoom level for this region" use the minus button ("-") at the top left to zoom out until the satellite image comes into view. Additional clicking on the minus button will display the project area with a regional perspective.

12. On the satellite page, there are two other options. The first link, "Click Here to View Pictures of the TIST Small Group that has Planted Trees in this Grove" goes to the same set of pictures described in 7.a., above. The second link, "Click Here to View All the Quantified Tree Groves in this Group Center Displayed on a Satellite Map," displays all of the project areas in the Group Center as described in 5., above.
13. Use the browsers back button to navigate back to the Tree Audit page to see more details about each project area including species, tree count and age.

## 1.10 Conditions Prior to Project Initiation

TIST project areas are located in the plains of southern India in the state of Tamil Nadu.

**Climate:** The climate in southern India shows only slight seasonal variations. The climate of Tamil Nadu is essentially tropical with high humidity throughout the year and an annual mean temperature of about 29º C. The temperature in the height of summer (April and May) seldom exceeds 43º C and in winter (January and February) rarely falls below 18º C. Tamil Nadu receives an average annual rainfall of 960 mm, most of which comes during the rainy season (October-December). Frosts occur in the high hill regions of western Tamil Nadu, but have not been recorded in the plains where TIST sites are located. The region receives a flood slightly less often than once every ten years. Droughts also occur in the region about once every ten years. Tamil Nadu also plays host to the occasional cyclone, however none have occurred in the past 30 years in regions where TIST groves are located.

**Soils:** The predominant soil in the Kancheepuram, Tiruvannamalai, Vellore and Villupuram Districts is red loam. In Kancheepuram District, black or "blackcotton" soil can be found throughout, lateritic soils on the plateaus and alluvial soil along the coast. In Thiruvallur, 63% of the soils are lateritic and 28% are red loam and black soils. Information about the soil in a specific project area appears in Appendix 4 (Grove Summary worksheet).

**Watersheds:** The Palar River is the main watershed in the Kancheepuram and Vellore Districts. There are no perennial rivers in Tiruvannamalai. The Araniyar, Kusasthalaiyar, Adyar and Cooum are the major water sheds in Thiruvallur. The main river in Villupuram is the Varaganathi River.

**Ecosystems:** The project areas in all four districts are in the East Deccan dry-evergreen forests ecosystem. Due to the high level of human activity, primarily for agriculture, little of the general area that surrounds the project areas is in a natural state.

**Rare and Endangered Species:** TIST activities are in areas where there is a long history of human habitation and agriculture and consequently these lands have low biodiversity and the wildlife habitat is severely degraded. A list of threatened species that were potentially present in the project areas was compiled through review of the literature and discussion with local experts. Field observations by TIST staff, discussions with forest department officials and villagers indicate the absence of any endangered or rare species in the project areas.

The following provides the lists of threatened species that could potentially be present in the project areas and the sources from which they were obtained.

The IUCN Red List[2] of Threatened Reptiles and a list of Threatened Mammals of India was reviewed with the biologist of the Arignar Anna Zoological Park in Chennai for species that may be present in the districts where TIST project areas are located (A. Manimoshi, personal

[2] http://www.iucnredlist.org/

communication, 31 July 2008). A list of endangered plants in Tamil Nadu was also reviewed and the following were listed as present in the districts where TIST project areas are located.

The following list was developed from this review:

**Table 1.10 IUCN Red List of Threatened Species**

| Scientific Name | Common Name | Status |
|---|---|---|
| **Mammals and Reptiles** | | |
| Bos gaurus | Gaur | VU |
| Canis aureus | Jackal | VU |
| Panthera pardus | Leopard | TR |
| Melurus ursinus | Sloth bear | VU |
| Python molurus molurous | Indian Python | VU |
| Crocodylus palustris | Mugger (march crocodile) | VU |
| **Birds found in the area** | | |
| *Brachypteryx major* | White-bellied Shortwing | VU |
| *Schoenicola platyura* | Broad-tailed Grassbird | VU |
| *Mycteria leucocephala* | Painted Stork | NT |
| *Anthus nilghiriensis* | Nilgiri Pipit | NT |
| *Garrulax jerdoni* | Grey-breasted Laughingthrush | NT |
| *Pelecanus philippensis* | Spot-billed Pelican | VU |
| **Birds- maybe found in area** | | |
| *Ficedula nigrorufa* | Black-and-rufous Flycatcher | NT |
| *Eumyias albicaudata* | Nilgiri Flycatcher | NT |
| **Birds previously found but may not be found now** | | |
| *Ardeotis nigriceps* | Great Indian Bustard | EN |
| *Sypheotides indica* | Lesser Florican | EN |
| *Leptoptilos javanicus* | Lesser Adjutant | VU |
| *Haliaeetus leucoryphus* | Pallas's Sea-eagle | VU |
| *Aquila clanga* | Greater Spotted Eagle | VU |
| *Eurynorhynchus pygmeus* | Spoon-billed Sandpiper | VU |
| *Rynchops albicollis* | Indian Skimmer | VU |
| *Columba elphinstonii* | Nilgiri Wood-pigeon | VU |
| *Pycnonotus xantholaemus* | Yellow-throated Bulbul | VU |
| *Chaetornis striatus* | Bristled Grass-warbler | VU |
| *Anhinga melanogaster* | Oriental Darter | NT |
| *Ephippiorhynchus asiaticus* | Black-necked Stork | NT |
| *Phoenicopterus minor* | Lesser Flamingo | NT |
| *Ichthyophaga ichthyaetus* | Grey-headed Fish-eagle | NT |
| *Sarcogyps calvus* | Red-headed Vulture | NT |
| *Circus macrourus* | Pallid Harrier | NT |
| *Anthracoceros coronatus* | Malabar Pied-hornbill | NT |
| *Buceros bicornis* | Great Hornbill | NT |
| **Birds previously not found but may be found now** | | |
| *Columba punicea* | Pale-capped Pigeon | VU |
| *Ficedula subrubra* | Kashmir Flycatcher | VU |
| *Parus nuchalis* | White-naped Tit | VU |
| *Amandava formosa* | Green Avadavat | VU |
| *Threskiornis melanocephalus* | Black-headed Ibis | NT |
| *Aythya nyroca* | Ferruginous Duck | NT |

| Table 1.10 IUCN Red List of Threatened Species | | |
|---|---|---|
| **Scientific Name** | **Common Name** | **Status** |
| *Ichthyophaga humilis* | Lesser Fish-eagle | NT |
| *Aegypius monachus* | Cinereous Vulture | NT |
| *Sterna acuticauda* | Black-bellied Tern | NT |
| **Plants** | NA | |
| *Hildegardia populifolia* | NA | CR |
| *Indigofera barberi* | NA | Not assessed |
| *Lindsaea malabarica* | NA | NT |
| *Murdannia lanceolata* | NA | VU |
| *Neuracanthus neesiamus* | NA | Not assessed |

**Notes:**
EW = Extinct in wild
CR = Critical
EN = Endangered
VU = Vulnerable
CD = Conservation Dependent
NT = Near Threatened
DD = Data Deficient
N = Non-breeding visitor

**Project was not implemented for subsequent GhG removal**

The Project Proponent declares this project was not implemented to create GHG emissions for the purpose of its subsequent reduction, removal or destruction. The "Carbon Credit Sale Agreement" among the Project Proponent and the Small Groups members is long term and does not allow for the harvesting of trees, except for thinning to enhance growth. Trees that die are to be replanted. The project does not create any other products and the long term funding of the project is totally dependent on the revenue stream provided by a long-term tree growth.

## 1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

As a tree planting program that takes place voluntarily on existing farm land, there are few laws that are relevant to TIST. A review of the potentially applicable laws and regulations was made. . They include:

- National Forest Policy for India, 1988 sets a target of 33.33% forest cover. The policy suggests that afforestation on degraded wastelands could be an important component of achieving this goal.[3]

- Other policies regarding forests and land include The Tamil Nadu State Forest Act of 1882, The Wildlife Protection Act of 1972, and the Forest Conservation Act of 1980.[4] There is no law/ regulation specific to reforestation of privately owned degraded lands. However, the continued deforestation and forest degradation despite these policies show that they will continue as unrealized aspirations without additional funding and support. Without the

[3] Satya P. Mohapatra, Niloy K. Bhattacherjee, Soumitri Das and Prabhat Upadhyaya. 2005. Scope of production forestry in enhancing carbon mitigation in India: A preliminary report. ATREE. See Exhibit 01.

[4] http://www.forests.tn.nic.in/aboutus.html. See Exhibit 02.

project activity, the project area will not be reforested, and with the project activity the goals of the ongoing reforestation programs or policies will not be reduced.

## 1.12 Ownership and Other Programs

### 1.12.1 Right of Use

Each project area is a tree grove planted by a Small Group. It is named using a unique combination of the TIST number for that Small Group and the grove name.

- The landowner is a small hold farmer who is one of the TIST Small Group members. Ownership is through the land registry.
- The Project Participants do not own any of the land. TIST is a project name, not a legal entity, and does not own, control or have any rights to any of the land.
- The landowner covenants together with other farmers to form a Small Group. The Small Groups own the trees that they plant and determine how tree products and carbon revenues are divided among themselves.
- Host Country land law is silent as to the ownership of carbon and carbon pools. However, the Small Groups own the trees that they plant together and grant the rights to all carbon associated with TIST to TIST India under a "Carbon Credit Sale Agreement." See Exhibit 03.
- TIST India is a legally registered limited liability private corporation in India.
- TIST India Limited does not own, control or have any rights to any of the land.
- TIST India is a subsidiary of CAAC with CAAC owning 99% of its shares.
- TIST India has transferred and assigned the "Carbon Credit Sale Agreements" to CAAC. See Exhibit 04.
- Under this PD, VERs shall be issued to CAAC and sold by CAAC.
- The current land use is agricultural.

The status of the contractual relationship between the land owner and TIST will be monitored. This will include changes in ownership of the land and changes in Small Group membership.

### 1.12.2 Emissions Trading Programs and Other Binding Limits

The Project Proponent declares that net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program, or to meet binding limits on GHG emissions.

### 1.12.3 Participation under Other GHG Programs

The Project Proponent declares that several of the project areas were registered and validated under CDM on 15 January 2010. However it was never verified and no credits were issued. The

Project proponent has withdrawn the project and has not or will not claim GHG reductions under CDM nor any other GHG programs. See Exhibit 05.[5]

### 1.12.4 Other Forms of Environmental Credit

The Project Proponent declares this project does not create another form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program, or that any such credit has been, or will be, cancelled from the relevant program.

### 1.12.5 Projects Rejected by Other GHG Programs

Other than declared in 1.12.3, the Project Proponent declares this project has not been rejected by any other GhG program, has not been submitted to any other GhG project for crediting and is not claiming credits associated with the trees planted and maintained by this project under any other program.

## 1.13 Additional Information Relevant to the Project

### 1.13.1 Eligibility Criteria

Eligibility of this project is assessed at two levels. The first is based on the CDM methodology used and the second as a VCS grouped project.

**CDM Methodology Eligibility Requirements.** Regarding the former, the eligibility for a small-scale A/R CDM reforestation project is assessed using CDM Executive Board Report 35, Annex 18, "Procedures to define the eligibility of lands for afforestation and reforestation project activities."[6] To qualify as a CDM reforestation project, the project must meet the host country definition of a forest. India defines the minimum area of a "forest" as 0.05 hectares with a minimum tree crown cover of 15%, with trees having the potential to reach a minimum height of two meters at maturity, *in situ*. As a VCS project, however, this aspect of eligibility does not apply. VCS allows the use of smaller project areas and captures them as afforestation, reforestation and revegetation projects. This PD includes discrete project areas that are less than the minimum area to allow the inclusion of even the smallest small-hold farmer. VCS ARR also allows deviation from the 30% crown cover requirement to allow continued subsistence farming in the project areas.

The additional demonstrations required by Annex 18 are based on the results of TIST's baseline monitoring of each project area and are presented on the "Grove Summary" worksheet. The information is collected on-site, through direct observation and measurement and through direct discussion with the landowner and members of his/her Small Group. Additional evidence is based on information discussed below and demonstrates adherence to these requirements.

a) *Demonstrate that the land at the moment the project starts does not contain forest by providing transparent information that:*

   (i) *Vegetation on the land is below the forest thresholds (tree crown cover or equivalent stocking level, tree height at maturity in situ, minimum land area).*

[5] TIST IN PD-VCS-Ex 05 CDM Withdrawal.pdf
[6] UNFCCC, "Procedures to Demonstrate the Eligibility of Lands for Afforestation and Reforestation CDM Project Activities", CDM Executive Board Meeting 35, Annex 18, 2007. Accessed November 17, 2010 at http://cdm.unfccc.int/EB/035/eb35_repan18.pdf. See Exhibit 06.

The physical survey of each parcel taken during the baseline monitoring indicates the lands were barren, cropland and/or covered with grass, shrub or litter and therefore did not meet the requirements for crown cover or height. Existing trees were identified by species and counted. As shown in the Section 3.1, the average stem density is well below the forest threshold.

*(ii) All young natural stands and all plantations on the land are not expected to reach the minimum crown cover and minimum height chosen by the host country to define forest.*

As shown in Section 3.1, there were relatively few existing trees when project activities began and most were found as isolated trees along the border of individual parcels. Given the history of continued deforestation, as indicated by the maps and satellite images and described in Section 2.4, and continued use of the land by the project members, it is not expected that this area will revert to natural forest without intervention.

*(iii) The land is not temporarily unstocked, as a result of human intervention such as harvesting or natural causes.*

The baseline monitoring indicates these areas have a history of cultivation ("Grove Summary" worksheet).

*b) Demonstrate that the activity is a reforestation or afforestation project activity:*

(i) *For reforestation project activities, demonstrate that the land was not forest by demonstrating that the conditions outlined under (a) above also applied to the land on 31 December 1989.*

The project areas did not contain a forest on 31 December 1989. This is demonstrated by the "Grove Summary" worksheet. As part of collecting the baseline information, the landowners are questioned about whether their project area was forested in 1990. 100% of them responded that it was not forested. In addition, baseline monitoring was conducted on each individual project area to confirm that there had not been deforestation of a parcel since that time. This generally included looking for stumps or evidence of recent harvest activity and looking at the surrounding lands to see of there were indications that the project areas were cleared of native ecosystems within the ten-year period prior to the proposed Project Start Date. Nothing was observed to indicate there had been deforestation activity.

Historical imagery from 1990[7] and 2000[8] was also looked at. Because the discrete project areas tend to be very small, the resolution is too coarse on both images to conduct a detailed analysis of each project area. However, both images confirm that the project areas are situated on lands that have a history of human occupancy and farming. The protected forests can be seen on both images, to contrast with the areas where the project areas are located. These observations support the statements by the landowners and field observations by TIST personnel that the project areas were not deforested since 31 December 1989, or that project areas were cleared of native ecosystems within the ten-year period prior to the proposed Project Start Date.

**Grouped Project Eligibility Criteria.** Each instance, present and future, will meet the CDM requirements. This includes eligibility (Section 1.13.1), applicability (Section 2.2), additionality thresholds (Section 2.5), the technologies and measures used (Section 1.8), baseline scenario and determination (Section 2.4), boundary determination (Section 2.3) and monitoring (Section 4.0), all as described, herein.

[7] Landsat 4 and 5 composite circa 1990, 30 meters per pixel resolution. See Appendix 01.
[8] Landsat 7 composite circa 2000, 15 meters per pixel resolution. See Appendix 02.

In addition to the above, there are two other eligibility criteria for inclusion of new instances of each project activity. The first is that it must be in the geographic area defined in Section 1.9 (i.e. be in India).

The second is that the ex ante carbon estimates for each project area (i.e. instance) must be below the pertinent capacity limits. In this case, the CDM small scale AR methodology has a 16,000 tonne per year average limit on a project. This equates to 480,000 tonnes $CO_2e$ for a 30-year project life. VCS places a one percent limit on each instance and requires instances that exceed this limit to be divided into clusters. To be eligible for this PD, each project area shall either be at or below the one percent level (4,800 tonnes $CO_2e$), or will meet the requirements for inclusion as a cluster.

For the subset of TIST project areas that are in this PD, all of the instances are less than the one percent threshold. This is documented in the "Proj Life Ex ante CO2e" column of the "Grove Summary" worksheet. The calculations are based on the ex ante estimates for each strata in the "Strata" worksheet. The results were further modified to adjust for project areas that, because of the area (ha), exceeded the ex ante estimates, but, because of the stem density, does not. All of the documentation is presented in a transparent and verifiable manner in the worksheets.

### 1.13.2 Leakage Management

Leakage will be minimized as follows:

**Fossil fuel emission:** TIST owns no fossil fuel vehicles or equipment. Quantifiers and staff use public transport, walking and bicycles to go to various project areas. Use of Palm computers and the Internet allows Quantifiers to upload their data at local Internet cafés or by using mobile phone technology, reducing travel and use of public transportation back to TIST offices.

**Displacement of people:** TIST member's plant trees, on their own lands. The Greenhouse Gas Agreement among the Small Group members and the Project Participant does not give the Project Participant any right to the Small Group's land, or require that they leave. TIST does not displace any people.

**Displacement of farming activities:** TIST small hold farmers only plant trees to the extent that they can afford to, given their reliance on the remainder of their land for subsistence agriculture. The value of their crops far exceeds the GhG revenues that are available. In addition, where Small Groups have adopted improved farming practices, crop yields have improved.

**Displacement of primary fuel supply:** TIST tree growing activities do not cause leakage in the form of harvesting wood outside the project area. First, a large numbers of the residents in the subject districts already use wood as their primary source of fuel, an activity that has resulted in regional deforestation. Second, TIST best practices call for the planting and management of sustainable woodlots, that allows for the continuing growth of carbon stocks and the use of deadfall, or tree wood, available through managed thinning. TIST will not cause leakage from this activity; it helps mitigate it.

### 1.13.3 Commercially Sensitive Information

Commercially sensitive information that has been made available to the Validator but is being excluded from the public is:

- The International Small Group and Tree Planting Program, Carbon Credit Sale Agreement, Exhibit 03: TIST IN PD-VCS-Ex 03 TIST SG CO2 Contract IN Nila.pdf.
- Agreement between TIST India and CAAC, Exhibit 04: TIST IN PD-VCS-Ex xx CAAC TIST India Contract 090309.pdf

- CAAC's proprietary financial model, Exhibit 07: TIST IN PD-VCS-Ex 07 Financial Plan.xls (referenced in Non-Permanence Risk Report).

### 1.13.4 Further Information

Not applicable.

# 2 APPLICATION OF METHODOLOGY

## 2.1 Title and Reference of Methodology

The approved baseline and monitoring methodology applied to the proposed VCS project activity is CDM AR-AMS0001 Version 06: Simplified baseline and monitoring methodologies for small-scale A/R CDM project activities implemented on grasslands or croplands with limited displacement of pre-project activities.[9] Also used were the following tools:

- Procedures for the demonstration of land eligibility, AR-AMS0001, Appendix A.
- Procedures for the assessment of additionality, AR-AMS0001, Appendix B.

## 2.2 Applicability of Methodology

The proposed project activity fulfills all of the applicability conditions stated by AR-AMS0001:

- The simplified baseline and monitoring methodologies are applicable if the conditions (a) - (d) mentioned below are met.

  a) *Project activities are implemented on grasslands or croplands*. As indicated on "Grove Summary" worksheet,[10] project activities are implemented on grasslands and croplands. See Table 3.1.A for a summary.

  b) *Project activities are implemented on lands where the area of the cropland, within the project boundary, displaced due to the project activity is less than 50 per cent of the total project area*. This condition was deemed met through a survey of the individual members that farm the land and through field observations. Landsat imagery was also reviewed, but the resolution was too coarse to provide any meaningful data (see imagery in Appendix 01 and Appendix 02). In the surveys, 100% of the farmers indicated there was no displacement of cropland. Field observation shows that some of the farmers have chosen to plant trees along property lines, to plant their trees widely spaced in their fields and practice agro forestry and/or plant trees on steep hillside less suitable for agriculture. There were no observations that indicate that this condition was not met. In addition, all of this is supported by the overriding fact that TIST members are subsistence farmers that rely on their land for household food production. Carbon has little value compared to food, so they only plant in areas that will not cause them to displace higher value activities such as farming. Also see Section 4.3.3, "C. Ex post estimation of leakage."

  c) *Project activities are implemented on lands where the number of displaced grazing animals is less than 50 percent of the average grazing capacity of the project area*. This condition was deemed met through a survey of the individual members that farm the land and through field observations. Landsat imagery was also reviewed, but the resolution was too coarse to provide any meaningful data (see imagery in Appendix 01 and Appendix 02). In the surveys, only 4.2% of the average grazing capacity was utilized prior to the project and 100% of the farmers indicated there was no displacement. Field observation showed no evidence that grazing is significant in the project areas, or in the entire area, in which the project areas are located. Some farmers do keep a few head of cattle, but the overall impact on grazing capacity is minor. There were no observations that indicate that this condition was not met. See "Misc Calc" worksheet for survey

[9] UNFCCC, "AR-AMS0001, Version 6: Simplified baseline and monitoring methodologies for small-scale A/R CDM project activities implemented on grasslands or croplands with limited displacement of pre-project activities," CDM Executive Board Meeting 56, 2010. ("AR-AMS0001"). Accessed 20 October 2011 at http://cdm.unfccc.int/methodologies/DB/91OLF4XK2MEDIRIWUQ22X3ZQAOPBWY. See Exhibit 08.

[10] All worksheets referenced in PD are in Appendix 04, Excel spreadsheet.

calculations.

d) *Project activities are implemented on lands where 10 percent of the total surface project area is disturbed as result of soil preparation for planting*. The minimum spacing recommended for the trees is two meters x two meters, or four square meters. The recommended size of the holes is 0.3 meters in diameter, or 0.07 square meters. The calculated area disturbed, as a result of soil preparation for planting, is less than 2%. See "Misc Calc" worksheet. Plowing does take place for intercropping, as part of the baseline activity and is not considered by the CDM AR Working Group to be part of the project activity.

- Carbon pools are above- and below-ground tree and woody perennials biomass. See Section 2.3.2, this document.
- Project emissions are considered insignificant and therefore neglected. See Section 3.2.5, this document, for ex ante estimates.
- The project areas are eligible for the A/R project activity, using procedures for the demonstration of land eligibility contained in Appendix A of AR-AMS0001. See Section 1.13.1, this document.
- The project activity is additional, using the procedures for the assessment of additionality contained in Appendix B of AR-AMS0001. See Section 2.5, this document.

## 2.3 Project Boundary

### 2.3.1 Project Boundaries

The project area is a complex area of thousands of discrete individual project areas spread out over thousands of square kilometers (see Section 1.1 for a summary). As such, the project boundaries are presented in Appendix 03, project area boundaries in a Google Earth KML file.

### 2.3.2 Project and Baseline GhG Sources

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Baseline tree growth | $CO_2$ | n/a | Not required by methodology, see Section 3.1 |
| | | $CH_4$ | n/a | Not required by methodology, see above |
| | | $N_2O$ | n/a | Not required by methodology, see above |
| | | Other | n/a | |
| Baseline | Baseline non-woody growth | $CO_2$ | n/a | Not required by methodology, see Section 3.1 |
| | | $CH_4$ | n/a | Not required by methodology, see above |
| | | $N_2O$ | n/a | Not required by methodology, see above |
| | | Other | n/a | |
| Project | Trees | $CO_2$ | Yes | Above and below ground biomass, see Section 3.2 |
| | | $CH_4$ | n/a | Not required by methodology, see above |
| | | $N_2O$ | n/a | Not required by methodology, see above |
| | | Other | n/a | |

## 2.4 Baseline Scenario

**Most Likely Scenario.** The methodology requires justification that "the most likely baseline scenario of the small-scale A/R CDM project activity is considered to be the land-use prior to the implementation of the project activity, either grasslands or croplands."[11] The baseline field observation as detailed in the "Grove Summary" worksheet indicates the project areas are grassland and cropland prior to implementation of the project activity. That this is also the most likely use of the project areas, without the project activity, is supported by:

- The project areas are private lands owned by subsistence farmers conducting the project activity. They have a history of farming and use of the land, other than natural forest or long-term forestry.
- These lands are located in an area populated by subsistence farmers, who use wood for their primary fuel. As supported by the references below, wood use, agriculture and increasing population have been key factors in deforestation.
- These factors lead to the conclusion that there is little reason to believe that the project areas will revert to forest without intervention.
- There are no alternative uses of this land that can be reasonably expected.

**Literature Regarding Changes in Baseline Carbon Stocks.** There is a clear pattern of rural firewood use and forest degradation in India and Tamil Nadu that supports the case that carbon stocks on each individual project area would be expected to decline or, at best, are increasing at a rate of less than 10% compared to the expected removal by sinks. The lands of and surrounding the project areas have been degrading for decades, due to human intervention.

Despite 20 years of programmatic efforts by the Indian and Tamil Nadu governments[12], forestry today is in an extremely precarious position in the TIST areas.

Overall, fuel wood accounts for about 60% of the total fuel consumption in rural India.[13] In estimating fuel wood consumption, the Forest Survey of India showed only 17 million tonnes to be available on a sustainable basis and 86 million tonnes were not.[14] Rural fuel wood consumption in Tamil Nadu was estimated at 172 kg/year.[15] With a rural population of about 33 million, it equates to a demand of 5.7 million tonnes per year. An unpublished report of the Commissioner of Statistics found that about 53% of the total fuel wood consumed in Tamil Nadu was freely collected and 13.3% came from "own land."[16]

These pressures have resulted in deforestation:

- The Forest department is custodian of 22,870 square kilometers of forest land, which constitute 17.584% of the geographic area, as against 33.33% required under National Forest Policy, 1988.[17]

- Nearly half of the forest area is subjected to heavy degradation on account of biotic pressure.[18]

[11] AR-AMS0001, Section II.5.
[12] See Exhibit 02.
[13] Devendra Pandey, "Fuelwood Studies in India, Myth and Reality," Center for International Forestry Research (2002): 37. See Exhibit 09.
[14] Ibid, 18
[15] Ibid, 47
[16] Ibid, 83
[17] See Exhibit 02.
[18] Government of Tamil Nadu, Environment and Forests Department, Policy Note 2005 – 2006 Demand No. 14. See Exhibit 10.

- Heavy biotic pressure from abutting villages is the main cause of degradation of forests.[19]

- The forest wealth of the State is vulnerable to damage and destruction by elicit felling of trees, ganja cultivation, fire, encroachment and poachers of wildlife." [20]

- The areas where TIST operates are even more deforested. Most groups are in the Kancheepuram District, where only 9.7% of the land is classified as forest.[21] This extreme deforestation has an exacerbating impact on the water quality and quantity available to all residents in areas already noted for a water deficit and wastewater discharge into surface waters.

- The Tamil Nadu Forest Department has identified "degradation on account of biotic pressure" one of the pressures affecting the State.[22]

- According to the Environmental Profile of the Thiruvallur District, "land, soil, water, air, and the life support system like forests… are threatened by serious levels of degradation."[23]

The specific project areas are part of this environment. They are lands owned and used by the rural residents and are subject to constant pressure to provide fuel wood, food and livelihood for these subsistence-level farmers.

### 2.4.1 Additionality

Additionality of the proposed project activity is proven, using the "Assessment of Additionality" contained in Appendix B of AR-AMS0001, which demonstrates that the project activity would not have occurred in the absence of the proposed project activity.

From the Project Participant's perspective, TIST has numerous investment barriers. TIST does not create or sell any products, other than GhG credits, associated with carbon sequestration. The trees and their products are owned by the Small Groups. Any revenue generated by the tree products belongs to the Small Groups. The TIST GhG "business" has been funded by Clean Air Action Corporation (CAAC), as an investor, based solely on future GhG revenues. There is no business or business case without carbon revenues. There is no payback or ROI, without carbon revenues. But for the expectation of a carbon market and the expectation of the sale of GhG credits from the project activity, CAAC would not have invested in TIST. Without carbon revenues, TIST is not viable or sustainable.

From the Small Groups or member's perspectives, there are barriers that have prevented reforestation of these lands:

**Investment barrier.** Tree plantations require investment to obtain seedlings and, in the case of TIST farmers, to take land out of current revenue production activities, such as cropland, for long-term gain. Investment requires access to credit. However, due to their low income, the farmers participating in TIST have little opportunity for investment loans or capital. Banks tend to be reluctant to lend to those living at the subsistence level, because they have few assets for collateral and little disposable income available for debt service. According to The International

[19] Ibid
[20] Ibid
[21] Kanchipuram District Profile. See Exhibit 11.
[22] State of the Environment Report 2005, Government of Tamil Nadu, Department of the Environment, downloaded 8 April, 2008, page 25. See Exhibit 12.
[23] Environmental Profile of Thiruvallur District, Government of Tamil Nadu, Department of the Environment, 8 April, 2008. See Exhibit 13.

Fund for Agricultural Development (IFAD), "more than one billion people – 90 percent of the world's self-employed poor – lack access to basic financial services, depriving them of the means to improve their incomes, secure their existence, and cope with emergencies."[24]

At a more local level, World Bank recognised the lack of credit available to the poor when they set up the Tamil Nadu Empowerment and Poverty Reduction program.[25] While the program has made credit available to approximately 3 million impoverished women, there are another 9 million people in the State that live on less than US$1.00 per day that have no access to credit.

TIST members are the people described above. They are subsistence farmers with little access to the credit required for a plantation. Table 2.5.A is based on community data supplied by Village Administrative Officers of TIST Program Area (Tamil Nadu State Government Officers) and indicates that most TIST members make less that US$1.00 per day.

**Table 2.5.A. Annual Income Brackets**

| Income Level (Rs) | | Income Level US$ | | Pct of Groups |
|---|---|---|---|---|
| Min | Max | Min | Max | |
| 1,000 | 12,000 | $21 | $250 | 41% |
| 12,001 | 15,000 | $251 | $313 | 19% |
| 15,001 | 20,000 | $314 | $417 | 13% |
| 20,001 | 25,000 | $418 | $521 | 21% |
| 25,001 | and up | $522 | and up | 6% |

While the trees can have a long-term financial benefit without the carbon component, day-to-day household expenses prevent these farmers from spending their minuscule income on reforestation projects. For example, seedlings cost Rs 0.20 to Rs 5.50 per seedling. Since each farmer is expected to plant a minimum of 500 trees, the total up front cost is Rs 100 to Rs 2,750 per farmer which can easily exceed 10% of their annual income.[26] To compound the situation, the marginal and small farmers that make up the TIST members typically make less money than they earn[27] leaving no "additional" income for investment.

The following table provides an example of the initial costs, to the farmers, to start a plantation. Without TIST, the farmer must buy the seedlings and incur labor costs. Without TIST, an investment is required, but there is no credit available to fund it. TIST overcomes the investment barrier two ways. First, it provides training that reduces the capital required to develop a tree plantation. The training teaches TIST members how to obtain seeds and build nurseries at zero cost, thereby, reducing the need for credit. Second, under the terms of the Project Participant's contracts with the TIST Small Groups, the farmers receive an annual advance on their potential carbon revenues, which eliminates the need for credit.[28] These payments are paid at least annually based on the number of live trees counted each year. The payments are $0.033, per

[24] Accessed 22 September 2010 at http://www.ifad.org/media/press/2004/38.htm. See Exhibit 14.
[25] The World Bank, Project Appraisal Document on a Proposed Credit In the Amount of SDR 7.49 Million to the Republic of India, for the Tamil Nadu Empowerment and Poverty Reduction "Puthu Vazhvu" Project, June 7, 2005, pages 1 and 2. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/06/23/000090341_20050623101639/Rendered/PDF/31806a.pdf. See Exhibit 15.
[26] Additional information about the cost of tree planting to the members is provided in an attached spreadsheet, "TIST IN PDD-CDM-01 Data 090531.xls, Plantation Cost."
[27] "A Special Program For Marginal and Small Farmers", National Commission for Enterprises in the Unorganised Sector, New Delhi 2008, Table A8. See Exhibit 16.
[28] See Exhibits 03.

tree, per year, and are initially of greater value than the value of the carbon. Ultimately, the Small Groups will receive 70% of the net carbon revenues.

**Table 2.5.B Start-up Cost Comparison: 1 ha Plantation**[29]

| | Without TIST | With TIST |
|---|---|---|
| Live Trees | 500 | 500 |
| Income | $ - | $ 17 |
| Cost of a 500 Tree Plantation | | |
| Seedlings | $ 30 | $ - |
| Labor | $ 29 | $ - |
| Total Yearly Cost | $ 59 | $ - |
| Income/(Loss) | $ (59) | $ 17 |

While financial projections can vary significantly based on cost and revenue assumptions, advanced payment made to TIST farmers will exceed the net value of the carbon for the first 10 years of the project. In other words, TIST uses advanced payments farmers that are based on the expectation of carbon revenues to overcome their inability to get credit.

**Barriers due to social conditions, lack of organization.** Planting large plantations requires more than a single individual. The local communities lack the organizational structure to put together a volunteer effort to plant trees. This statement is supported by the fact that both India and Tamil Nadu have had a National Policy in effect since 1988 to address the problem of deforestation but are still seeing annual losses in forest cover. (see Section 2.4). TIST and the Small Group approach provide the organizational structure necessary to overcome this barrier. TIST provides the training and the member's Small Group provides the necessary manpower and support.

**Laws and regulations requiring tree planting.** The trees are planted on private lands and there are no laws or regulations that require the TIST farmers to plant them.

**Common Practice.** There are cases in the area where farmers have planted fast rotation trees without the carbon incentive. These farmers have no incentive to maintain the trees; indeed, their incentive is to harvest them as soon as possible to get the revenue. In contrast, TIST is using the annual tree payment to encourage and promote long-term, managed tree stands. The TIST GhG Agreement requires the members to "plant a minimum of 1,000 trees and raise them to maturity", "replant trees that die, for any reason, each year for the next" 20;[30] and to "not cut down trees, except when implementing best practices for agroforestry developed by TIST." This is only possible because of the potential carbon revenues.

**Conclusion.** The extension activities implemented by TIST that allow the project participants to overcome these barriers, and the incentive payments TIST provides that support their decision to participate, are entirely dependent on the carbon market. These kinds of activities are not possible, without external financing of some kind. TIST's operational budget for the project is funded through an investment from CAAC, which is contingent on returns of future GhG revenues. Without carbon revenues, on which its funding solely depends, the TIST project is neither viable, nor sustainable.

[29] See Appendix 04, "Plantation Costs" worksheet for assumptions and references.
[30] The contract in Exhibit 03 is for 50 years.

## 2.5 Methodology Deviations

The project and project monitoring plan meet all of the requirements of the methodology and does not deviate from the baseline scenario, additionality determination, or inclusion of project GhG sources, sinks and reservoirs.

As noted in Section 1.13, TIST has many project areas that do not meet the host country definition of a forest. However, since VCS allows for afforestation, reforestation and revegetation, this is not an issue for this project or PD. Therefore, there are no applicable deviations to the methodology.

# 3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 3.1 Baseline Emissions

The methodology allows the change in baseline carbon stocks to be deemed zero, in the absence of the project activity. Therefore, this section will 1) calculate the baseline carbon stocks and 2) demonstrate that the project meets the requirements that allow the change to be considered zero.

### 3.1.1 Equations to calculate estimated baseline carbon stocks

The methodology is applied in the context of the project activity using the following formula:[31]

$$B_{(t)} = \sum_{i=1}^{I} (B_{A(t)i} + B_{B(t)i}) * A_I \qquad \textbf{Eq. 3.1.a}$$

Where:

$B_{(t)}$ = carbon stocks in the living biomass within the project boundary at time *t* in the absence of the project activity (t C)
$B_{A(t)\,i}$ = carbon stocks in above-ground biomass at time *t* of stratum *i* in the absence of the project activity (t C/ha)
$B_{B(t)\,i}$ = carbon stocks in below-ground biomass at time *t* of stratum *i* in the absence of the project activity (t C/ha)
$A_i$ = project area of stratum *i* (ha)
*i* = stratum *i* (*I* = total number of strata)

The above-ground biomass ($B_{A(t)}$) is calculated per stratum *i* as follows:[32]

$$B_{A(t)} = M_{(t)} * 0.5 \qquad \textbf{Eq. 3.1.b}$$

Where:

$B_{A(t)}$ = carbon stocks in above-ground biomass at time t in the absence of the project activity (t C/ha)
$M_{(t)}$ = above-ground biomass at time t that would have occurred in the absence of the project activity (t d.m./ha)
*0.5* = carbon fraction of dry matter (t C/t d.m.)

[31] For application, see spreadsheet Appendix 04, worksheet "Table 3.3.B", columns D and E. The Area is pulled in from the Grove Summary worksheet and the carbon comes from "3.1 Baseline Trees" column D. Since the formula in column D is combined AG and BG biomass, the addition step was not necessary.
[32] For application, see spreadsheet Appendix 04, worksheet "3.1 Baseline Trees," column E.

The below-ground biomass $(B_{B(t)})$ is calculated per stratum *i* as follows:[33]

$$B_{B(t)} = 0.5 * (M_{grass} * R_{grass} + M_{woody\ (t=0)} * R_{woody}) \quad \textbf{Eq. 3.1.c}$$

Where:

$B_{B(t)}$ = carbon stocks in below-ground biomass at time t that would have occurred in the absence of the project activity (t C/ha)
$M_{grass}$ = above-ground biomass in grass on grassland at time t that would have occurred in the absence of the project activity (t d.m./ha)
$M_{woody\ (t=0)}$ = above-ground biomass of woody perennials at t=0 that would have occurred in the absence of the project activity (t d.m./ha)
$R_{woody}$ = root to shoot ratio of woody perennials (t d.m./t d.m.)
$R_{grass}$ = root to shoot ratio for grassland (t d.m./t d.m.)

The baseline net GhG removals by sinks is calculated using:

$$\Delta_{CBSL,t} = (B_{(t)} - B_{(t-1)})*(44/12) \quad \textbf{Eq. 3.1.d}$$

Where:

$\Delta_{CBSL,t}$ = baseline net GHG removals by sinks (t $CO_2$-e)
$B_{(t)}$ = carbon stocks in the living biomass pools within the project boundary at time t in the absence of the project activity (t C)

As allowed by the methodology, the change in carbon stocks that would be expected in the absence of the project activity is zero, meaning $B_{(t)}$ and $B_{(t-1)}$ are equal. Therefore:

$\Delta C_{BSL,t} = (B_{(t)} - B_{(t-1)})*(44/12)$
$\Delta C_{BSL,t} = (0)*(44/12)$
$\Delta C_{BSL,t} = 0$

### 3.1.2 Baseline Strata

Table 3.1.A shows the strata selected for the baseline calculations. It includes the hectares and percent of area of each strata and the appropriate factors needed to determine whether the changes in baseline carbon stocks is expected to exceed 10% or not.

**Table 3.1.A Baseline Strata**

| | | | AG and BG Biomass t $CO_2$e/ha[34] | | |
|---|---|---|---|---|---|
| **Baseline Strata** | **Hectare** | **Area** | **Non-woody** | **Trees** | **Total** |
| Cropland, annual crops | 23.5 | 3.5% | 18.3 | 0.9 | 19.2 |
| Grassland as grassland | 648.3 | 96.5% | 16.0 | 0.9 | 16.8 |
| Total | 671.8 | 100.0% | | | |

Assumptions:

[33] For application, see spreadsheet Appendix 04, worksheet "3.1 Baseline Trees," column D. It is the factor 1.48, where 0.48 is the belowground component. See seventh assumptions for PDD Table 3.1.A Baseline Strata.
[34] AG = Above Ground, BG = Below Ground.

- Hectares of cropland are based on field estimates made for each individual project area as listed in "Grove Summary" worksheet. Where active farming was identified (a "Y" in the "cultivated" column), the area for that project area was multiplied by the "% Barren" plus annual crop columns. The remainder of the project areas was determined to be grassland.
- Annual cropland non-woody stocks = 5 t C/ha above and below ground = 18.3 t $CO_2e$/ha.[35]
- Tropical dry grassland non-woody stocks = 8.7 t d.m./ha above and below ground = 16.0 t $CO_2e$/ha.[36]
- Woody biomass stocks represented by trees at a density of 2.2 stems per ha (1,499 trees over 671.8 ha). The numbers of baseline trees was determined by a physical count of each tree.[37]
- Average DBH of pre-existing trees = 20.2 cm from inventory of pre-existing trees.[38]
- Aboveground tree biomass calculated applying equation from for dry forest, where Kg dry mass = exp(-1.996+2.32*ln(DBH cm)).[39]
- Root:shoot ratio of 0.48.[40]
- Carbon fraction of dry biomass = 0.5

### 3.1.3 Change in Carbon Stocks without the Project Activity

The methodology requires documentation to justify whether, in the absence of the project activity, the change, in carbon stocks, in the living biomass, of woody perennials and the below ground biomass of grasslands, are expected to:

- increase by less than 10% of the ex ante actual GhG removals by sinks (methodology case 6.(a)),
- decrease (case 6.(b)), or
- increase by more than 10% of the ex ante actual GhG removals by sinks (case 6.(c)).

As croplands and grassland under active human intervention, the carbon stock in the living biomass pool of woody perennials and below ground biomass of grassland is not expected to exceed 10% of the ex ante actual net GhG removals by sinks (case 6.(a)) and would quite possibly decrease in the absence of the project activity (case 6.(b)). In either case, the methodology allows the change in baseline carbon stocks to be deemed zero, in the absence of the project activity.

To determine if the change in baseline carbon stocks could exceed 10% of the net GhG removals from the project activity, Table 3.1.B was prepared. As shown, the combined area of cropland or the area of grassland, with generous assumptions concerning growth in the woody biomass carbon stocks, is not expected to exceed 10% of the ex ante actual net GhG removals. The Baseline Carbon Stocks begin at (20.7 t + 569.3 t =) 590.1 t.

[35] International Panel on Climate Change, "2006 Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture and other Land Use," Chapter 5, "Cropland", Section 5.3.1.2, Table 5.9, 2006. ("IPCC 2006 AOLU")
[36] IPCC 2006 AOLU, Chapter 6, "Grassland", Section 6.3.1.2, Table 6.4, 2006.
[37] Appendix 04, "Baseline Strata" worksheet.
[38] Ibid.
[39] Brown, S. 1997. "Estimating biomass and biomass change of tropical forests: a primer." FAO Forestry Paper 134, Rome, Italy. Section 3, "Methods for Estimating Biomass Density from Existing Data." Citing Brown et al. (1989). Accessed 22 September 2010 at http://www.fao.org/docrep/W4095E/W4095E00.htm. Also See of AR-AMS0001, Appendix C
[40] GPG-LULUCF, Annex 3A.1 Biomass Default Tables for Section 3.2 Forest Land, Table 3A.1.8, Woodland/savannah. See Exhibit 17.

| Table 3.1.B Change in Baseline Carbon Stocks | | | | | | |
|---|---|---|---|---|---|---|
| Year | Woody Biomass Stocks (AG and BG) t CO2e/ha (1)[41] | | Woody Biomass Stocks (AG and BG) t CO2e (2) | | Cumulative Baseline Removals t CO2e | % of Net GHG Removals from Project Activity (3) |
| | cropland | grassland | cropland | grassland | | |
| 2004 | 0.9 | 0.9 | 20.7 | 569.5 | | |
| 2005 | 0.9 | 0.9 | 21.9 | 602.7 | 34.5 | 0.0% |
| 2006 | 1.0 | 1.0 | 23.1 | 637.1 | 70.0 | 0.0% |
| 2007 | 1.0 | 1.0 | 24.4 | 672.5 | 106.7 | 0.0% |
| 2008 | 1.1 | 1.1 | 25.7 | 709.0 | 144.6 | 0.0% |
| 2009 | 1.2 | 1.2 | 27.1 | 746.6 | 183.5 | 0.1% |
| 2010 | 1.2 | 1.2 | 28.5 | 785.3 | 223.7 | 0.1% |
| 2011 | 1.3 | 1.3 | 29.9 | 825.1 | 264.9 | 0.1% |
| 2012 | 1.3 | 1.3 | 31.4 | 866.1 | 307.4 | 0.1% |
| 2013 | 1.4 | 1.4 | 33.0 | 908.2 | 351.0 | 0.1% |
| 2014 | 1.5 | 1.5 | 34.5 | 951.4 | 395.8 | 0.1% |
| 2015 | 1.5 | 1.5 | 36.1 | 995.8 | 441.8 | 0.1% |
| 2016 | 1.6 | 1.6 | 37.8 | 1,041.3 | 489.0 | 0.1% |
| 2017 | 1.7 | 1.7 | 39.5 | 1,088.0 | 537.4 | 0.2% |
| 2018 | 1.8 | 1.8 | 41.2 | 1,135.9 | 587.0 | 0.2% |
| 2019 | 1.8 | 1.8 | 43.0 | 1,185.0 | 637.8 | 0.2% |
| 2020 | 1.9 | 1.9 | 44.8 | 1,235.2 | 689.8 | 0.2% |
| 2021 | 2.0 | 2.0 | 46.7 | 1,286.6 | 743.1 | 0.2% |
| 2022 | 2.1 | 2.1 | 48.6 | 1,339.2 | 797.7 | 0.2% |
| 2023 | 2.1 | 2.1 | 50.5 | 1,393.0 | 853.4 | 0.3% |
| 2024 | 2.2 | 2.2 | 52.5 | 1,448.0 | 910.4 | 0.3% |
| 2025 | 2.3 | 2.3 | 54.6 | 1,504.3 | 968.7 | 0.3% |
| 2026 | 2.4 | 2.4 | 56.7 | 1,561.7 | 1,028.3 | 0.3% |
| 2027 | 2.5 | 2.5 | 58.8 | 1,620.4 | 1,089.1 | 0.3% |
| 2028 | 2.6 | 2.6 | 61.0 | 1,680.4 | 1,151.2 | 0.3% |
| 2029 | 2.7 | 2.7 | 63.2 | 1,741.5 | 1,214.6 | 0.4% |
| 2030 | 2.8 | 2.8 | 65.5 | 1,804.0 | 1,279.3 | 0.4% |
| 2031 | 2.9 | 2.9 | 67.8 | 1,867.6 | 1,345.2 | 0.4% |
| 2032 | 3.0 | 3.0 | 70.1 | 1,932.5 | 1,412.5 | 0.4% |
| 2033 | 3.1 | 3.1 | 72.5 | 1,998.7 | 1,481.1 | 0.4% |
| | | | | | | |
| **Notes:** | | | | | | |
| (1) AG = Above Ground, BG = Below Ground | | | | | | |
| (2) Biomass for all project areas | | | | | | |
| (3) Project ex ante tonnes = | | | **331,410** | | | |

Assumptions:

[41] Appendix 03, "Baseline Trees" worksheet.

- Carbon stocks in non-woody vegetation are constant.
- Woody biomass stocks are based on the number of baseline trees, as determined by a physical count of each tree. See "Baseline Strata" worksheet.
- Average DBH of pre-existing trees was determined during the baseline evaluation. See "Baseline Strata" worksheet.
- The biomass of the baseline trees was grown at a diameter increment of 0.5 cm.[42] See "Baseline Trees" worksheet.
- Aboveground tree biomass calculated applying equation for dry forest in India, where Kg dry mass = exp(-1.996+2.32*ln(DBH cm))[43]
- Root:shoot ratio of 0.48.[44]
- Carbon fraction of dry biomass = 0.5
- Project ex ante tonnes are from Table 3.2.C.

**Application of methodology to support Cases 6.(a) and 6.(b).** While there may be ample evidence to support a case of decreasing baseline carbon stocks absent the project activity (see Section 2.4), a conservative case was demonstrated above. As shown in Table 3.1.B, if the baseline carbon stocks are assumed to increase absent the project activity, the increase is less than 10% of the ex ante project tons and meets the conditions of Case 6.(a). As such, the change in baseline carbon stocks shall be assumed to be zero.

## 3.2 Project Emissions

### 3.2.1 Equations for ex ante project removals

The carbon stock within the project boundary is calculated using the following equation:[45]

$$N_{(t)} = \sum_{i=1}^{I} (N_{A(t)i} + N_{B(t)i}) * A_i \qquad \textbf{Eq. 3.2.a}$$

Where:

$N_{(t)}$ = total carbon stocks in biomass at time *t* under the project scenario (t C)
$N_{A(t)\,i}$ = carbon stocks in above-ground biomass at time *t* of stratum *i* under the project scenario (t C/ha)
$N_{B(t)\,i}$ = carbon stocks in below-ground biomass at time *t* of stratum *i* under the project scenario (t C/ha)
$A_i$ = project activity area of stratum *i* (ha)
*i* = stratum *i* (*I* = total number of strata)

For above-ground carbon stocks, $N_{A(t)\,i}$ is calculated per stratum *i* as follows:[46]

$$N_{A(t)\,i} = T_{(t)i} * 0.5 \qquad \textbf{Eq. 3.2.b}$$

Where:

$N_{A(t)\,i}$ = carbon stocks in above-ground biomass at time t under the project scenario (t

[42] David Shoch, TerraCarbon LLC, personal communication, 2009.
[43] Brown, S. 1997.
[44] GPG-LULUCF, Annex 3A.1 Biomass Default Tables for Section 3.2 Forest Land, Table 3A.1.8, Woodland/savannah.
[45] For application, see spreadsheet Appendix 04, worksheets "3.2 Ex-Ante Carbon Est" and "3.2 Ex-Ante Strata Est". NA and NB are derived in "3.2 Ex-Ante Carbon Est" (example see columns E, F and G). The area is applied in "3.2 Ex-Ante Strata Est".
[46] For application, see spreadsheet Appendix 04, worksheet "3.2 Ex-Ante Carbon Est", column E.

C/ha)
$T_{(t)i}$ = above-ground biomass at time t under the project scenario (t d.m./ha)
*0.5* = carbon fraction of dry matter (t C/t d.m.)

Where volume tables are used to calculate the aboveground biomass, the following equation is used:[47]

$$T_{(t)i} = SV_{(t)i} * BEF * WD \quad \textbf{Eq. 3.2.c}$$

Where:

$T_{(t)i}$ = above-ground biomass at time *t* under the project scenario (t d.m./ha)
$SV_{(t)i}$ = stem volume at time *t* for the project scenario (m3 /ha)
*BEF* = biomass expansion factor (over bark) from stem to total above-ground biomass (dimensionless)
*WD* = basic wood density (t d.m./m3)

For below-ground biomass, $N_{B(t)}$ is calculated per stratum *i* as follows:[48]

$$N_{B(t)\,i} = T_{(t)} * R * 0.5 \quad \textbf{Eq. 3.2.d}$$

Where:

$N_{B(t)\,i}$ = carbon stocks in below-ground biomass at time *t* under the project scenario (t C/ha)
$T_{(t)}$ = above-ground biomass at time *t* under the project scenario (t d.m./ha)
*R* = root to shoot ratio (t d.m./t d.m. )
0.5 = carbon fraction of dry matter (t C/t d.m.)

For removals by sinks, $\Delta C_{PROJ,t}$ is calculated as follows:[49]

$$\Delta C_{PROJ,t} = (N_{(t)} - N_{t-1)})*(44/12)/\Delta t \quad \textbf{Eq. 3.2.e}$$

Where:

$\Delta C_{PROJ,t}$ = Removal component of actual net GHG removals by sinks per annum (t CO2-e/year)
$N_{(t)}$ = Total carbon stocks in biomass at time t under the project scenario (t C)

[47] For application, see spreadsheet Appendix 04, worksheet "3.2 Ex-Ante Carbon Est". There are different columns for different species groups. Examples:
T(t)i = example column D
SV(t)i = example column B
BEF = example column C
WD = example column D

[48] For application, see spreadsheet Appendix 04, worksheet "3.2 Ex-Ante Carbon Est". The factors are in different columns for different species groups. Examples:
T(t) = example column F
R = example column F
0.5 = example column E

[49] For application, see spreadsheet Appendix 04. The value for Nt comes from column G of worksheet "3.2 Ex-Ante Carbon Est." It is transferred to the appropriate cell in the strata array set up in worksheet "3.2 Ex-Ante Strata Est." The values for similar age strata are summed in (example) column L. The values of the age strata of the species are summed in column AY. This is still Nt but now summed. Nt-1 is to symbolize time difference and is not needed because all this is done on an annual basis. (44/12) is multiplied in column AZ. Δt is done in column BA. The value for Δ CPROJ is cell BA35.

$\Delta t$ Time increment = 1 (year)

For removals by sinks, $\Delta C_{PROJ,t}$ is calculated as follows:[50]

$$\Delta C_{Actual,t} = \Delta C_{PROJ,t} - \Delta GHG_{PROJ,t} \quad \textbf{Eq. 3.2.f}$$

Where:

$\Delta C_{Actual,t}$ = Ex ante actual net greenhouse gas removals by sinks in year t (t CO2-e/year)
$\Delta C_{PROJ,t}$ = Project GHG removals by sinks (t CO2-e/year)
$\Delta GHG_{PROJ,t}$ = Project emissions (t CO2-e/year)

### 3.2.2 Strata for ex ante project removals

For the purpose of calculating ex ante actual net GhG removals, the area of project activity has been stratified by major species and age class.[51] The primary species are stratified separately, and the minor species are aggregated into one species class.

**Table 3.2.A Ex Ante Strata**

| Scientific Name | Age Class | Hectare | Area % |
|---|---|---|---|
| Tectona grandis | 2004 | 0.0 | 0.0% |
| Tectona grandis | 2005 | 2.2 | 0.3% |
| Tectona grandis | 2006 | 7.4 | 1.1% |
| Tectona grandis | 2007 | 48.6 | 7.2% |
| Tectona grandis | 2008 | 75.0 | 11.2% |
| Tectona grandis | 2009 | 78.6 | 11.7% |
| Tectona grandis | 2010 | 74.6 | 11.1% |
| Tectona grandis | 2011 | 48.4 | 7.2% |
| Tectona grandis | 2012 | 0.0 | 0.0% |
| Gmelina Arborea | 2004 | 0.0 | 0.0% |
| Gmelina Arborea | 2005 | 0.0 | 0.0% |
| Gmelina Arborea | 2006 | 0.0 | 0.0% |
| Gmelina Arborea | 2007 | 2.9 | 0.4% |
| Gmelina Arborea | 2008 | 5.8 | 0.9% |
| Gmelina Arborea | 2009 | 21.3 | 3.2% |
| Gmelina Arborea | 2010 | 15.0 | 2.2% |
| Gmelina Arborea | 2011 | 3.2 | 0.5% |
| Gmelina Arborea | 2012 | 0.0 | 0.0% |
| Mangifera indica | 2004 | 0.0 | 0.0% |
| Mangifera indica | 2005 | 0.0 | 0.0% |
| Mangifera indica | 2006 | 9.0 | 1.3% |
| Mangifera indica | 2007 | 43.3 | 6.4% |
| Mangifera indica | 2008 | 49.9 | 7.4% |

[50] See spreadsheet Appendix 04. As noted in PD Section 3.2.5, $GHG_{PROJ}$ = zero. Therefore $\Delta C_{Actual,t} = \Delta C_{PROJ,t}$ which is in cell BA35, "3.2 Ex-Ante Strata Est."
[51] Appendix 04, "Strata" worksheet and "Misc Calc" worksheet.

| Table 3.2.A Ex Ante Strata | | | |
|---|---|---|---|
| **Scientific Name** | **Age Class** | **Hectare** | **Area %** |
| Mangifera indica | 2009 | 47.2 | 7.0% |
| Mangifera indica | 2010 | 9.2 | 1.4% |
| Mangifera indica | 2011 | 12.8 | 1.9% |
| Mangifera indica | 2012 | 0.9 | 0.1% |
| Other Asia, Dry Tropical | 2004 | 0.0 | 0.0% |
| Other Asia, Dry Tropical | 2005 | 0.7 | 0.1% |
| Other Asia, Dry Tropical | 2006 | 1.4 | 0.2% |
| Other Asia, Dry Tropical | 2007 | 16.4 | 2.4% |
| Other Asia, Dry Tropical | 2008 | 12.8 | 1.9% |
| Other Asia, Dry Tropical | 2009 | 39.1 | 5.8% |
| Other Asia, Dry Tropical | 2010 | 30.4 | 4.5% |
| Other Asia, Dry Tropical | 2011 | 15.3 | 2.3% |
| Other Asia, Dry Tropical | 2012 | 0.3 | 0.0% |
| | | | |
| **Total ha** | | **671.8** | **100.0%** |

### 3.2.3 Factors for ex ante project removals

The factors used for estimating the actual net GhG removals, for the four tree classes, are shown below.

*Tectona grandis*

$l_v$ = 12 $m^3$/ha/yr.[52]
Where: $l_v$ = annual increment in volume based on over the bark log volumes.
BEF = 1.5.[53]
WD = 0.5 t.d.m/$m^3$.[54]
R = 0.27[55]

*Gmelina arborea*

$l_v$ = 31 $m^3$/ha/yr.[56]
Where: $l_v$ = annual increment in volume based on over the bark log volumes.
BEF = 1.5.[57]
WD = 0.41 t.d.m/$m^3$.[58]

[52] GPG-LULUCF, Table 3A.1.7. Average Annual Above Ground Net Increment in Volume in Plantations By Species, *Tectona grandis*.
[53] GPG-LULUCF, Table 3A.1.10, Default Values Of Biomass Expansion Factors (BEF), Tropical, Broadleaf.
[54] GPG-LULUCF, Table 3A.1.9-2, Basic Wood Densities (D) of Stemwood (Tonnes Dry Matter/M3 Fresh Volume) for Tropical Tree Species, Tropical Asia, *Tectona grandis*.
[55] GPG-LULUCF, Table 3A.1.8, Tropical/Sub-tropical dry forest.
[56] GPG-LULUCF, Table 3A.1.7. Average Annual Above Ground Net Increment in Volume in Plantations By Species, *Gmelina arborea*.
[57] GPG-LULUCF, Table 3A.1.10, Default Values Of Biomass Expansion Factors (BEF), Tropical, Broadleaf.

R = 0.27[59]

*Mangifera indica*

$I_v$ = 6.45 $m^3$/ha/yr.[60]
Where: $I_v$ = annual increment in volume based on over the bark log volumes.
BEF = 1.5.[61]
WD = 0.52 t.d.m/$m^3$.[62]
R = 0.27[63]

Other Asia, Dry Tropical

$N_A$ = 6.45 t.d.m/ha/yr.[64]
Where: $N_A$ = annual increment of above ground biomass, t.d.m/ha/yr
BEF = 1.5.[65]
WD = 0.76 t.d.m/$m^3$.[66]
R = 0.27.[67]

[58] GPG-LULUCF, Table 3A.1.9-2, Basic Wood Densities (D) of Stemwood (Tonnes Dry Matter/M3 Fresh Volume) for Tropical Tree Species, Tropical Asia, *Gmelina arborea*.
[59] GPG-LULUCF, Table 3A.1.8, Tropical/Sub-tropical dry forest.
[60] GPG-LULUCF, Table 3A.1.6, Annual Average Above Ground Biomass Increment in Plantations By Broad Category, Asia, Other Species, Dry.
[61] GPG-LULUCF, Table 3A.1.10, Default Values Of Biomass Expansion Factors (BEF), Tropical, Broadleaf.
[62] GPG-LULUCF, Table 3A.1.9-2, Basic Wood Densities (D) of Stemwood (Tonnes Dry Matter/M3 Fresh Volume) for Tropical Tree Species, Tropical Asia, *Mangifera spp*.
[63] GPG-LULUCF, Table 3A.1.8, Tropical/Sub-tropical dry forest.
[64] GPG-LULUCF, Table 3A.1.6, Annual Average Above Ground Biomass Increment in Plantations By Broad Category, Asia, Other Species, Dry.
[65] GPG-LULUCF, Table 3A.1.10, Default Values Of Biomass Expansion Factors (BEF), Tropical, Broadleaf.
[66] A sample set of tree counts by species planted by TIST farmers in India was obtained from the TIST database. The wood densities were obtained and a weighted average was calculated. See Table 3.2.B.
[67] GPG-LULUCF, Table 3A.1.8, Tropical/Sub-tropical dry forest.

| Table 3.2.B Other Tree Density Estimate | | | | |
|---|---|---|---|---|
| **Species** | **Count** | **Density (D)** | **Count*D** | **Reference Code[68]** |
| Azadirachta indica | 2,424 | 0.69 | 1,673 | 5 |
| Citrus sinensis | 511 | 0.74 | 378 | 4 |
| Grevillea robusta | 3,665 | 0.62 | 2,272 | 6 |
| Melia azedarach | 4,955 | 0.82 | 4,063 | 6 |
| Psidium guajava | 16,830 | 0.75 | 12,623 | 6 |
| Phyllanthus emblica | 2,260 | 0.76 | 1,718 | 1 |
| Toona ciliata | 120 | 0.44 | 53 | 4 |
| Aniba Rosaedora | 21,046 | 0.73 | 15,364 | 3 |
| Citrus limonum | 800 | 0.64 | 512 | 4 |
| Pterocarpus Marsupium Roxbo | 16,438 | 0.62 | 10,192 | 3 |
| Pterocarpus santalinus | 14,703 | 1.07 | 15,698 | 3 |
| Pouteria sapota | 6,208 | 0.81 | 5,028 | 3 |
| Bombax ceiba | 605 | 0.33 | 200 | 5 |
| Endiandra glauca | 508 | 0.54 | 274 | 3 |
| Tamarindus indica | 58 | 0.75 | 44 | 5 |
| Zanthoxylon chalybeum | 118 | 0.78 | 92 | 6 |
| | | | | |
| Grand Total, Other | 91,249 | 0.77 | 70,182 | |

### 3.2.4 Ex ante project removals

Table 3.2.C provides the cumulative and annual ex ante actual net GhG removals by sink as carbon and as $CO_2$ equivalent. The table is based on the calculations shown in "Ex Ante Carbon Est" worksheet and "Ex Ante Strata Est" worksheet derived using the equations, strata and factors, above.

[68] Table 3.2.B References:

1. IPCC-GPG, 2003. Table 3A.1.9-2, Basic Wood Densities (D) of Stemwood (Tonnes Dry Matter/M3 Fresh Volume) for Tropical Tree Species.
2. IPCC-GPG, 2003. Table 3A.1.9-1, Basic Wood Densities (D) of Stemwood (Tonnes Dry Matter/M3 Fresh Volume) for Boreal and Temperate Species.
3. Zanne, A.E., Lopez-Gonzalez, G.*, Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B., Swenson, N.G., Wiemann, M.C., and Chave, J. 2009. Global wood density database. Dryad. Accessed October 24, 2011 http://datadryad.org/bitstream/handle/10255/dryad.235/GlobalWoodDensityDatabase.xls
4. Ministry of Water, Lands and Environment, Forest Department, National Biomass Study, 2002, Local data for wood density, Reference No. 16a. Accessed October 24, 2011 http://cdm.unfccc.int/UserManagement/FileStorage/B7Y5L3VPMSJN0ODWU2HARC41Z9XG8I
5. Browne, Sandra. Estimating biomass and biomass change in tropical forests, FAO Forestry Paper 134, Appendix 1 - List of wood densities for tree species from tropical America, Africa, and Asia, 1997. Accessed October 24, 2011 at http://www.fao.org/docrep/W4095E/W4095E00.htm
6. World Agroforestry Centre, Wood Density Data Base. Accessed October 24, 2011 at http://www.worldagroforestrycentre.org/Sea/Products/AFDbases/wd/index.htm

| Table 3.2.C Ex Ante Project Removals | | | |
|---|---|---|---|
| **Year** | **Ex Ante Carbon** | **Ex Ante $CO_2$** | **Ex Ante $CO_2$** |
| **Planted** | **t (cum)** | **t (cum)** | **Yearly t** |
| 2004 | 0 | 0 | 0 |
| 2005 | 16 | 58 | 58 |
| 2006 | 114 | 418 | 360 |
| 2007 | 752 | 2,759 | 2,341 |
| 2008 | 2,096 | 7,686 | 4,927 |
| 2009 | 4,478 | 16,420 | 8,734 |
| 2010 | 7,625 | 27,958 | 11,538 |
| 2011 | 11,221 | 41,142 | 13,185 |
| 2012 | 14,814 | 54,317 | 13,174 |
| 2013 | 18,412 | 67,510 | 13,193 |
| 2014 | 22,010 | 80,705 | 13,195 |
| 2015 | 25,609 | 93,900 | 13,195 |
| 2016 | 29,208 | 107,095 | 13,195 |
| 2017 | 32,806 | 120,290 | 13,195 |
| 2018 | 36,405 | 133,485 | 13,195 |
| 2019 | 40,004 | 146,680 | 13,195 |
| 2020 | 43,602 | 159,875 | 13,195 |
| 2021 | 47,201 | 173,070 | 13,195 |
| 2022 | 50,800 | 186,265 | 13,195 |
| 2023 | 54,398 | 199,460 | 13,195 |
| 2024 | 57,997 | 212,655 | 13,195 |
| 2025 | 61,596 | 225,850 | 13,195 |
| 2026 | 65,194 | 239,045 | 13,195 |
| 2027 | 68,793 | 252,240 | 13,195 |
| 2028 | 72,391 | 265,435 | 13,195 |
| 2029 | 75,990 | 278,630 | 13,195 |
| 2030 | 79,589 | 291,825 | 13,195 |
| 2031 | 83,187 | 305,020 | 13,195 |
| 2032 | 86,786 | 318,215 | 13,195 |
| 2033 | 90,385 | 331,410 | 13,195 |

### 3.2.5 Project emissions

In accordance with the conditions of the approved baseline and monitoring methodology AR-AMS0001, "project emissions are considered insignificant and therefore neglected."[69] While no test or analysis of project emissions are required, the following comments are provided:

- **Fertilizers.** The policy of TIST is for the farmers to refrain from using chemical fertilizers and instead to rely on dung and plant material. Neither of these are the result of project activity and need not be considered. However, if considered, the nitrogen emissions from natural fertilizers are estimated to be less than 0.1% of the actual net greenhouse gas removal by sink and may be considered de minimis. See "Misc Calc" worksheet.

- **Nitrogen-fixing species.** Emissions from nitrogen fixing species are also insignificant. Though present, the nitrogen-fixing trees are a minor component of the overall tree inventory. Because any deadwood will be used for domestic fuel, the trees will not be left to rot or

[69] AR-AMS0001, Section I.3, Section II.26 and Section VI.47.

decay. The lands where the trees are being planted are degraded and likely have a nitrogen deficit.

- **Fossils Fuels.** There will be no burning of fossil fuels or biomass for site preparation, monitoring, tree harvesting, or wood transportation; nor does TIST involve any industrial processes, as all labor is manual. Thus, no other GHGs are expected to be emitted as a result of the implementation of the proposed project.

## 3.3 Leakage (ex ante)

**Methodology defines leakage.** The methodology provides that if project participants demonstrate that the project does not result in displacement of activities, or people, or does not trigger activities outside the project boundary that would increase GhG emissions, an ex ante leakage estimate is not required.[70] It also states that, if evidence can be provided that, if displacement of pre-project activities does not cause deforestation, leakage can be considered zero.[71] Furthermore, the CDM Executive Board has determined that, if moving to ones own existing farm plot "does not trigger activities outside the project boundary that would be attributed to the small-scale afforestation or reforestation project activity under the CDM, such that the increase in greenhouse gas emissions by a source occurs, a leakage estimation is not required."[72]

As discussed in Section 1.13.2, Leakage Management, the project does not have fossil fuel emissions and does not displace people. As discussed in Section 3.2.5, Project Boundary, project emissions that could cause leakage are de minimis and "therefore neglected."[73]

**Leakage relating to displacement of farming activities.** As discussed in Section 1.13.2, Leakage Management, TIST farmers are small hold farmers that rely on their land for subsistence agriculture. Since they need most of their land to grow foods and because the value of their crops and livestock far exceeds the GhG revenues that are available, displacement of farming activities is limited. As part of the data collection for the baseline activity, Small Groups are asked, "Will any activities be displaced?" This question is asked in the context of the CDM Executive Board's interpretation that, if moving to ones own existing farm plots "does not trigger activities outside the project boundary that would be attributed to the small-scale afforestation or reforestation project activity under the CDM, such that the increase in greenhouse gas emissions by a source occurs, a leakage estimation is not required."[74] A survey of TIST members controlling the project areas indicated that activities were displaced on 0.0 hectares.

Based on the above, an ex ante leakage calculation is not necessary.

## 3.4 Summary of GHG Emission Reductions and Removals

The procedure for quantifying net GhG removals is to:

[70] AR-AMS0001, Section IV. Leakage (ex ante)
[71] Ibid.
[72] UNFCCC, "Simplified Baseline And Monitoring Methodologies For Selected A/R Small-Scale CDM Project Activity Categories," CDM AR Working Group Meeting 5, Page 5. Accessed 22 September 2010 at http://cdm.unfccc.int/Panels/ar/ARWG05_repan1_simplified%20AR_SSC_meths.pdf.
[73] AR-AMS0001, Section I.3, Section II.26 and Section VI.47.
[74] Ibid.

1. determine the GhG removals per Section 3.2;
2. subtract the net baseline removals which per Section 3.1 are zero;
3. subtract the project emission which per Section 3.2.5 are zero; and
4. subtract the project leakage, which per Section 3.3 are zero.

The required formula is:

$$ER_{AR\ CDM,\ t} = \Delta C_{PROJ,t} - \Delta C_{BSL,t} - GHG_{proj,t} - L_t$$

Where:

$ER_{AR\ CDM,\ t}$ = net anthropogenic GHG removals by sinks (t $CO_2$e/year)
$\Delta C_{PROJ,t}$ = project GhG removals by sinks at time t (t $CO_2$e/year)
$\Delta C_{BSL,t}$ = baseline net GhG removals by sinks (t $CO_2$e/year)
$GHG_{proj,t}$ = project emissions (t $CO_2$e/year)
$L_t$ = leakage from project (t $CO_2$e/year)

The following was used to make the CDM formula fit the table format required by VCS.

$ER_{AR\ CDM,\ t}$ = "Estimated net GHG emission reductions or removals (tCO2e)"
$\Delta C_{PROJ,t}$ = "Estimated project emissions or removals (tCO2e)"
$\Delta C_{BSL,t}$ = "Estimated baseline emissions or removals (tCO2e)"
$GHG_{proj,t}$ = not included in table
$L_t$ = "Estimated leakage emissions (tCO2e)"

**Table 3.4. Estimated Net GhG Removals**

| Years | Estimated baseline emissions or removals (tCO2e) | Estimated project emissions or removals (tCO2e) | Estimated leakage emissions (tCO2e) | Estimated net GHG emission reductions or removals (tCO2e) |
|---|---|---|---|---|
| Year 2004 | 0 | 0 | 0 | 0 |
| Year 2005 | 0 | 58 | 0 | 58 |
| Year 2006 | 0 | 360 | 0 | 360 |
| Year 2007 | 0 | 2,341 | 0 | 2,341 |
| Year 2008 | 0 | 4,927 | 0 | 4,927 |
| Year 2009 | 0 | 8,734 | 0 | 8,734 |
| Year 2010 | 0 | 11,538 | 0 | 11,538 |
| Year 2011 | 0 | 13,185 | 0 | 13,185 |
| Year 2012 | 0 | 13,174 | 0 | 13,174 |
| Year 2013 | 0 | 13,193 | 0 | 13,193 |
| Year 2014 | 0 | 13,195 | 0 | 13,195 |
| Year 2015 | 0 | 13,195 | 0 | 13,195 |
| Year 2016 | 0 | 13,195 | 0 | 13,195 |
| Year 2017 | 0 | 13,195 | 0 | 13,195 |

| Table 3.4. Estimated Net GhG Removals | | | | |
|---|---|---|---|---|
| Years | Estimated baseline emissions or removals (tCO2e) | Estimated project emissions or removals (tCO2e) | Estimated leakage emissions (tCO2e) | Estimated net GHG emission reductions or removals (tCO2e) |
| Year 2018 | 0 | 13,195 | 0 | 13,195 |
| Year 2019 | 0 | 13,195 | 0 | 13,195 |
| Year 2020 | 0 | 13,195 | 0 | 13,195 |
| Year 2021 | 0 | 13,195 | 0 | 13,195 |
| Year 2022 | 0 | 13,195 | 0 | 13,195 |
| Year 2023 | 0 | 13,195 | 0 | 13,195 |
| Year 2024 | 0 | 13,195 | 0 | 13,195 |
| Year 2025 | 0 | 13,195 | 0 | 13,195 |
| Year 2026 | 0 | 13,195 | 0 | 13,195 |
| Year 2027 | 0 | 13,195 | 0 | 13,195 |
| Year 2028 | 0 | 13,195 | 0 | 13,195 |
| Year 2029 | 0 | 13,195 | 0 | 13,195 |
| Year 2030 | 0 | 13,195 | 0 | 13,195 |
| Year 2031 | 0 | 13,195 | 0 | 13,195 |
| Year 2032 | 0 | 13,195 | 0 | 13,195 |
| Year 2033 | 0 | 13,195 | 0 | 13,195 |
| **Total (t CO2e)** | 0 | 331,410 | 0 | 331,410 |

# 4 MONITORING

## 4.1 Data and Parameters Available at Validation

| Data Unit / Parameter: | **Location of project area** |
|---|---|
| Data unit: | Latitude and longitude |
| Description: | Single point location of a discrete project area. |
| Source of data: | GPS |
| Value applied: | See "Grove Summary" worksheet, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | Direct measurement of latitude and longitude of a point within a project area using a GPS. Used to provide a simple location of a discrete project area. |
| Any comment: | None |

| Data Unit / Parameter: | **Boundary of project area** |
|---|---|
| Data unit: | Latitude and longitude |
| Description: | Multiple points of latitude and longitude that describe the boundary of a discrete project area. |
| Source of data: | GPS |
| Value applied: | See KML file, Appendix 3, for all results. |
| Justification of choice of data or description of measurement methods and procedures applied: | Direct measurement of points of latitude and longitude along the boundary of each discrete project area. The points are collected with a GPS while walking the perimeter of the project area. |
| Any comment: | None |

| Data Unit / Parameter: | **Area of project area** |
|---|---|
| Data unit: | Hectares |
| Description: | Size of the area where the project activity has been implemented |
| Source of data: | GPS |
| Value applied: | See "Grove Summary" worksheet, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | A calculated quantity based on the latitude and longitude values collected with the GPS to determine each project area boundary. |
| Any comment: | None |

| Data Unit / Parameter: | **Ownership of project area** |
|---|---|
| Data unit: | Name |
| Description: | Ownership of land of project area |
| Source of data: | “Carbon Credit Sale Agreement” |
| Value applied: | Not applicable |
| Justification of choice of data or description of measurement methods and procedures applied: | Each Small Group member is a signatory to a “Carbon Credit Sale Agreement.” |
| Any comment: | None |

| Data Unit / Parameter: | **Baseline trees** |
|---|---|
| Data unit: | Count of baseline trees |
| Description: | The number of trees existing in a project area, |

| | |
|---|---|
| | before the planting of project trees, is counted. |
| Source of data: | Trees are physically counted in the field. |
| Value applied: | See "Baseline Strata" worksheet, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | Each baseline tree is counted by strata. The count is used to calculate average stem density to determine if the change in baseline carbon stocks is expected to exceed 10% of the project removals. See Section 3.1. |
| Any comment: | None |

| Data Unit / Parameter: | **Baseline tree circumference** |
|---|---|
| Data unit: | Centimeters |
| Description: | The circumference of trees existing in a project area, before the planting of project trees, is counted. |
| Source of data: | Trees are physically measured in the field. |
| Value applied: | See "Baseline Strata" worksheet, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | The circumference of each tree in each strata are measured and averaged and placed in a 50 cm bin. The average diameter of all baseline trees is calculated. The average is used as part of the procedure to determine if the change in baseline carbon stocks is expected to exceed 10% of the project removals. See Section 3.1. |
| Any comment: | None |

| Data Unit / Parameter: | **Baseline strata** |
|---|---|
| Data unit: | Hectares |
| Description: | The area of cropland or grassland at baseline. |
| Source of data: | Estimate based on visual field observations. |
| Value applied: | See "Grove Summary" worksheet, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | The percent of cropland and grassland are estimated for each individual project area. The percent is multiplied by the area of the project area. The product is used as part of the procedure to determine if the change in baseline carbon stocks is expected to exceed 10% of the project removals. See Section 3.1. |

| | |
|---|---|
| Any comment: | None |

| Data Unit / Parameter: | **Project trees** |
|---|---|
| Data unit: | Count of tree |
| Description: | The number of trees per age and species strata in each project area. |
| Source of data: | Trees are physically counted in the field. |
| Value applied: | See "Grove Summary" and "Strata" worksheets, Appendix 4, for each result. |
| Justification of choice of data or description of measurement methods and procedures applied: | The tree count by strata is used to extrapolate the ex ante GhG removals. See Section 3.2. |
| Any comment: | None |

## 4.2 Data and Parameters Monitored

| Data Unit / Parameter: | **Number of trees** |
|---|---|
| Data unit: | Trees |
| Description: | Number of trees in a project area by strata |
| Source of data: | Physical counts |
| Description of measurement methods and procedures to be applied: | Physical count of the trees in each stratum by Quantifiers with each visit |
| Frequency of monitoring/recording: | Ongoing measurement taken by Quantifiers as they visit project areas. Each project area could be visited as much as once per year. |
| Value monitored: | Tree count by strata |
| Monitoring equipment: | Customized handheld computer |
| QA/QC procedures to be applied: | Part of overall QA/QC procedures discussed in Section 4.3. |
| Calculation method: | Not applicable |
| Any comment: | None |

| Data Unit / Parameter: | **DBH** |
|---|---|
| Data unit: | cm |
| Description: | Diameter of tree at breast height (1.30 m) |
| Source of data: | Physical measurements |
| Description of measurement methods and procedures to be applied: | TIST measures DBH of up to 20 representative trees of each age/species stratum in different |

| | |
|---|---|
| | project area. |
| Frequency of monitoring/recording: | Ongoing measurement taken by Quantifiers as they visit project areas. |
| Value monitored: | Representative circumference of trees in a strata. |
| Monitoring equipment: | Measuring tape and customized handheld computer. |
| QA/QC procedures to be applied: | Part of overall QA/QC procedures discussed in Section 4.3. |
| Calculation method: | Not applicable |
| Any comment: | None |

| Data Unit / Parameter: | **Total $CO_2$** |
|---|---|
| Data unit: | Tonnes |
| Description: | Total $CO_2e$ sequestered by the trees |
| Source of data: | Calculation |
| Description of measurement methods and procedures to be applied: | Allometric equations are assigned to each stratum. DBH values are applied to the allometric. Average biomass of a tree in each stratum is calculated and multiplied by number of trees in each stratum. Biomass is converted to $CO_2e$ and the $CO_2e$ of the stratum are totaled. |
| Frequency of monitoring/recording: | Calculation takes place with each monitoring report |
| Value monitored: | Above and below ground biomass |
| Monitoring equipment: | Computer and database |
| QA/QC procedures to be applied: | Part of overall QA/QC procedures discussed in Section 4.3. |
| Calculation method: | Not applicable |
| Any comment: | None |

## 4.3 Description of the Monitoring Plan

### 4.3.1 Monitoring roles and responsibilities

The Small Groups manage themselves based on a covenant among the members of each Small Group. They manage and oversee their own trees. They contract with Clean Air Action Corporation (CAAC) to sell their carbon, receive payments, and receive training. The GhG component of TIST is managed by CAAC, who developed the database, web site and procedures for monitoring the GhG. CAAC is responsible for this project description and for selling any GhGs that become available.

The operational processes for monitoring the actual GhG removal by the sinks are for TIST Quantifiers to visit each grove once per year and, at minimum, once every five years to count trees and collect circumference, GPS and other data. Quantifiers transmit the monitoring data via the Internet to the TIST website, where it is managed by CAAC. CAAC oversees the data and conducts QA/QC reviews. Feedback is provided to the TIST Quantifiers and office staff. CAAC is responsible for tabulating carbon stocks.

The India staff has oversight of the Quantifiers. They also conduct internal audits of Quantifier performance.

The TIST Data System stores all of the current and archived data. CAAC managers use customized reports to analyze the data and look for trends, missing data or obvious errors. TIST managers visit selected project areas and observe quantifications and audits.

Allometric equations will come from literature research. Leakage monitoring will come from surveys of the TIST members in charge of an individual project area.

### 4.3.2 TIST Data System

Each project area is owned and managed by a different group of people that TIST calls a Small Group. The areas are discrete parcels of land spread out over many districts and villages. The Small Groups select the species of trees, the number of trees to plant and the planting schedule. They also maintain the trees. While TIST works with the groups to develop best practices that can be shared and adopted by everyone in the organization, the fact remains that each project area is different. The difference is such that the monitoring system required is different than typical forest monitoring protocols.

TIST has met the challenge of obtaining accurate information from a multitude of small discrete project areas, in remote areas, where roads are poor and infrastructure is minimal, by combining high-tech equipment and low-tech transportation within its administrative structure. The TIST Data System is an integrated monitoring and evaluation system currently deployed in India and three other countries. On the front end, is a handheld computer-based platform supported by GPS technology that is utilized by field personnel (Quantifiers, auditors, trainers and host country staff) to collect most project information. This includes data relating to registration, accounting, tree planting, baseline data, improved farming, stoves, GPS plots and photographs. The data is transferred to TIST's main database server via the Internet and a synchronization process, where it is incorporated with historical project data. The server provides information about each tree grove on a publicly available website, www.tist.org. In addition, the other data is available to TIST staff through a password-protected portal.

The handheld computers have been programmed with a series of custom databases that can temporarily store GPS data, photographs, and project data. The interface is designed to be a simple to use, checklist format, that ensures collection of all of the necessary data. It is simple enough for those unskilled in computers and high-tech equipment to be able to operate, after a short period of training. The interface can also be programmed for data collection not specific to the project. The handhelds are "off the shelf," keeping their costs relatively low.

The synchronization process takes place using a computer Internet connection. While office computers are used where available, field personnel commonly use cyber cafes, reducing travel time and improving data flow. Where available, cell phones using GPRS technology are now allowing synchronization from remote tree groves and project areas, providing near real-time data.

The TIST Data Server consists of a public side, accessible by anyone over the Internet and a private side only accessible through a password-protected portal. On the public side, a dynamic

database is used to constantly update the displayed data. Changes can be seen daily as new synchronizations come in. By mapping the project data with photos and GPS data, the results of each Small Group can be seen on a single page. The GPS data has been programmed with Google Maps to locate project activities anywhere in the world on satellite imagery. See Section 1.9 for detailed instructions on accessing grove data.

On the private side, confidential accounting data, archive data and data not currently displayed is available. This is the source data for the custom reports and tables necessary for project managers.

The TIST database is off-site and has an off-site backup. The information collected and used for this monitoring program will be archived for at least two years following the last crediting period.

### 4.3.3 Method for Calculating Carbon Stocks

**A. Ex post estimation of the baseline net greenhouse gas removals by sinks**

No monitoring of the baseline is required. As demonstrated in Section 4.2, the change in baseline carbons stocks is below the threshold that would require monitoring. Because only the trees planted as part of the project are counted in the estimation of project removals, the baseline carbon stocks are fixed at zero.

**B. Ex post estimation of the actual net greenhouse gas removals by sinks**

**Step 1.** Because of the difference in species and age of the trees and location, ownership and management of the project areas, each project area shall be monitored. They are documented in "Grove Summary" and "Strata" worksheets, Appendix 04. The boundary of the project area has been obtained with a GPS (Appendix 03), the area calculated and displayed in the "Grove Summary" worksheet.

**Step 2.** The strata for the ex post estimation of the actual net greenhouse gas removals will be by species and year, similar to the ex ante estimate, as described in Section 3.2. Stratification is done within each individual project area. The area of a stratum in a project area ("area of a stratum (ha)") is determined by multiplying the area of project area (see Step 1) by the percentage of trees of that stratum in the respective project area.

**Step 3.** Where a tree species exceeds 10% of the total tree inventory, it will be assigned to a Major Strata. All other tree species will be assigned to an "Other" strata.

**Step 4.** Allometric equations will be used to convert DBH values to biomass. An allometric equation for each Major Stratum will be identified. If a species specific equation for a Major Strata is unavailable, it will use the "Other" equation as a default. Based on research, the following are examples of the Major Strata and the allometric equations that may be used. The list will be updated as new, or more appropriate ones, become available.

*Tectona grandis*[75]: $Y = 0.153 \cdot DBH^{2.382}$
*Gmelina arborea*[76]: $Y = 0.153 \cdot DBH^{2.217}$

[75] GPG-LULUCF Annex 4A.2 Examples of allometric equations for estimating aboveground biomass and belowground biomass of trees, Table 4.A.3. Examples of Allometric Equations for Estimating Above Ground Biomass (kg of dry matter per tree) of some Individual Species Commonly Used in the Tropics, *Tectona grandis*. See Exhibit 18.
[76] Regina N. Banaticla, Renezita F. Sales and Rodel D. Lasco, Biomass Equations for Tropical Tree Plantation Species Using Secondary Data from the Philippines, Australian Centre for International Agricultural Research (ACIAR) Smallholder Forestry Project, ASEM 200/008 redevelopment of a timber

*Mangifer indica*: no species specific equations, will use "Other" equation
Other (default)[77]: $Y = \exp[-2.289 + 2.649 \bullet \ln(DBH) - 0.021 \bullet (\ln(DBH))^2]$

Where:

Y= aboveground dry matter, kg (tree)-1
DBH = diameter at breast height, cm
ln = natural logarithm
exp = e raised to the power of

**Step 5.** The DBH of up to 20 trees per stratum, per project area, will be measured. Height will not be measured, or used, in the allometric equations. Each DBH value, for each tree measured, will be applied to the appropriate allometric equation and the biomass of each, per tree, in the stratum, will be obtained and averaged to determine the "average above ground biomass per tree (kg)" of a stratum.

**Step 6.** For each stratum, in each project area, the average above ground biomass, per tree, will be multiplied times the number of trees, to yield the "above ground biomass in stratum (kg)." The results will be divided by 1,000, to obtain "above ground biomass in stratum (t)."

**Step 7.** The methodology requires the use of tons of biomass, per hectare, in a subsequent step. It is determined by dividing the "above ground biomass in stratum (t)" from Step 6, by the "area of the stratum" from Step 2.

$$\text{above ground biomass (t/ha)} = \frac{\text{above ground biomass in stratum (t)}}{\text{area of the stratum (ha)}}$$

**Step 8.** The above ground biomass of each stratum will be multiplied by 0.5, to convert biomass to carbon. The result is "above ground carbon" (t/ha).

**Step 9.** The carbon stocks of the below ground biomass of each stratum (t/ha) are calculated by multiplying the above ground biomass of each stratum (t/ha), by the appropriate roots to shoot ratio and by 0.5, the carbon fraction of the biomass. A root to shoot factor of 0.27 will be used.[78] The result is "below ground carbon" (t/ha).

**Step 10.** The total carbon stocks ($CO_2e$) are determined by adding the above and below ground carbon (C) of each stratum in each project areas, multiplying each sum by the respective area of that stratum, converting the result to CO2e and summing the products. The following is the general equation required by the methodology.

$$P(t) = \sum_{i-I}^{I} (PA(t)\ i + PB(t)\ i) * Ai*(44/12)$$

Where:

industry following extensive land clearing: Proceedings from the end-of project workshop, Ormoc City, Philippines 19-21 August 2004, Table 5, page 122. See Exhibit 19.

[77] GPG-LULUCF Annex 4A.2 Examples of allometric equations for estimating aboveground biomass and belowground biomass of trees, Table 4.A.1. Allometric Equations for Estimating Aboveground Biomass (kg dry matter per tree) of Tropical and Temperate Hardwood and Pine Species, Tropical moist hardwoods. See Exhibit 18.

[78] GPG-LULUCF, Table 3.A.1.8

$P_{(t)}$ = carbon stocks within the project boundary at time *t* achieved by the project activity (t $CO_2e$)
$PA_{(t)}I$ = carbon stocks in above-ground biomass at time *t* of stratum *i* achieved by the project activity during the monitoring interval (t C/ha) from Step 8.
PB(t)I = carbon stocks in below-ground biomass at time *t* of stratum *i* achieved by the project activity during the monitoring interval (t C/ha) from Step 9.
Ai = project activity area of stratum *i* (ha) from Step 2.
I = stratum *i* (*I* = total number of strata)

**C. Ex post estimation of leakage**

In accordance with the methodology, ex ante leakage is assumed to be zero. For ex post leakage, the methodology requires the monitoring of cropland, domesticated grazing animals and domesticated roaming animals displaced by the project activity during the first crediting period. If the indicators are less than 10%, leakage is set to zero.[79] The CDM Executive Board also provided additional guidance regarding grazing which, among other things, established a 50 hectare threshold on the monitoring of grazing.[80] It stated:

> The approach in this document can be used to determine whether the increase in emissions of greenhouse gases due to displacement of pre-project grazing activities attributable to the A/R CDM project activity is insignificant and may be accounted as zero.

The required monitoring was conducted through the use of a survey of the TIST members during baseline monitoring, the results of which are presented in the "Grove Summary" worksheet. The pertinent column titles are:

- Cultivated: A "Y" in this column indicates this was cropland and subject to the leakage monitoring.
- Activity Displaced: The farmers were asked if any activity was displaced which includes farming and grazing. A "Y" indicates they responded an activity was displaced.
- Grazing: Farmers were also asked specifically if grazing was displaced.

The procedures used to collect this data are part of the overall TIST program. Quantifiers go to the Small Groups and interview them about the specific circumstances regarding each individual project area. They also look around and collect the required information. The Quantifiers have been trained that this is critical information and that it must be accurate and is subject to audit both internally and during validation and verifications. In addition, as evidenced by the GhG contracts, the Small Groups are bound by the TIST values of accuracy and honesty.

An analysis for the croplands displaced was conducted in the "Misc Calc" worksheet. Using the DSUM spreadsheet function, the "Grove Summary" worksheet was queried to find the sum of the project areas that was both cultivated, and is therefore cropland, and where displacement was indicated. The results are that there were 0.0 hectares of cropland displaced.

An analysis of grazing displacement was conducted and it was shown to be below the 10% threshold.

- This is not an area where domesticated roaming animals are present, so any incidental roaming animals are included in the domesticated grazing animals category.

[79] AR-AMS0001, Section VI, 48.
[80] UNFCCC, "Guidelines On Conditions Under Which Increase In GhG Emissions Related To Displacement Of Pre-Project Grazing Activities In A/R CDM Project Activity Is Insignificant," CDM Executive Board Report 51, Annex 13, December 2009. See Exhibit 20.

- As discussed in Section 2.2, these project areas are not primarily used for domesticated grazing animals.
- The farmers indicated there was no displacement. Since grazing tends to be restricted to a few cows and goats, adding new trees to an active farming area would not necessarily result in "displacement" of grazing activities.

In spite of the above, an analysis was conducted to quantify the displacement that might be associated with grazing (see "Grove Summary" worksheet). The area of grazing land for each project area was determined by multiplying the area of the project area by the percent grassland determined for the baseline (see "Grazing Land (ha)" column). The following conservative numerical values were assigned to weight the intensity of grazing described in the "Grazing" column.

Never = zero
Rarely = 10%
Sometimes = 25%
Often = 50%

The results for each project areas are in the "Grazing Displaced" column and total 4.2% of the project.

The monitoring results indicate cropland and grazing leakage is below the thresholds that require further monitoring and that the ex post leakage can be set at zero.

**Beneficial "leakage" from project activities:** The program is designed to allow sustainable thinning within the project boundary by the members, which will reduce the need for fuel wood from external sources. The trees are owned by the Small Group members and as the trees die, either naturally or through thinning, they can be used as fuel wood by the members.[81] This is in addition to the biomass maintained for the calculation of actual net GhG removals by sinks (since ex post carbon calculations are based on current tree counts, any trees lost to harvest, etc., are automatically excluded from the calculation). The project activity will have a beneficial effect on area deforestation; instead of causing it, it will ameliorate it.

### 4.3.4 Data to be monitored

The data to be monitored for monitoring actual net GhG removals by sinks are the number of trees in each project area and representative circumference. Because of the potential difference among project areas, the tree count of each project area is monitored. TIST has a staff of trained Quantifiers that visit each and every project area periodically. When quantifying a project area, they:

- Identify or confirm identification of the project area by its unique name combination of Small Group name and grove name (grove is the vernacular used by the project for a project area).
- Determine the latitude and longitude of the approximate center point of the project area with a GPS. It is automatically logged into the hand-held computer database for temporary storage.
- Map the boundaries of the project area by walking the perimeter using a GPS. The data is stored in the hand-held computer database for temporary storage.

[81] Thinning will be used to give surviving trees more opportunity to grow. While thinning will result in a dip in the carbon stocks below that present prior to thinning, the carbon stocks of the project area will not go below baseline levels. In addition, because of the different species, different growth rates and different planting schedules it is expected that the carbon stocks of the entire project will always be increasing.

- Count each tree in the project area by age and species strata. This data is entered by the operator directly into the handheld computer database for temporary storage.
- Measure the circumference of up to 20 trees in the age and species strata of a project area. Data will not be collected at all locations. The operator enters it into the handheld computer database for temporary storage.
- The data on the handheld computer database is uploaded to the TIST server, through the Internet, for additional processing and permanent storage.

### 4.3.5 Managing data quality

TIST will use the following QA/QC procedures:

- **Quantifier Training:** Quantifiers receive explicit training in regard to TIST's Standard Operating Procedures, so that quantifications are performed in a standard and regular fashion. The Quantifier field manual/handbook is available online at www.tist.org under "Documents to Download" and is updated to reflect changes in internal procedures. Quantifiers meet monthly to discuss questions or problems that they may have and receive training and software updates when necessary. Quantifiers are not dedicated to a grove for the life of that grove and may be rotated to other groves.

- **Staff Audits:** TIST staff members are trained to quantify groves and have handheld devices that are programmed to conduct audits. A requirement of their job is to periodically audit Quantifiers, including an independent sampling of tree counts and circumference measurement.

- **Multiple Quantifications:** TIST's internal goal is to quantify each project area once per year. Inaccurate data and errors are self-correcting with the subsequent visits. If trees have died or have been removed, a new count will reflect the current population. The growth of the trees, as indicated by increased DBH, is monitored with these subsequent visits. If a species is mislabeled, it will arise as a conflict when different Quantifiers attempt to perform tree counts for that grove that do not match the previous one. Comparisons are made over time, to determine whether a particular quantification or tree count appears unrealistic.

- **Multiple Tracks:** In order to ensure that the location and perimeter of each discrete project area is accurate, each GPS track of the parcel is measured at least twice, or until two tracks that reliably define the project area are obtained. Quantifiers will be required to re-trace the tract with each quantification, to verify that they are at the correct project area and that they are counting the correct trees.

- **Double Counting:** To ensure that the same project area is not counted more than once, an overlap script is used that compares the outline of all project areas. If an overlap is detected, the project areas are visually compared. If an overlap is determined, the overlapping project area is removed from the PD.

- **Data Quality:** TIST Quantifiers count every tree in each discrete project area. Counting each tree is 100% sampling and provides greater than 1% precision, at the 95% confidence level. Up to 20 circumference readings, for each strata, in a project area, will be taken and archived to develop a localized database of growth data by strata. This data will provide the circumference data for each stratum. This sampling will exceed the 10% precision at the 95% confidence level required by the methodology. The confidence and precision levels will be assessed in future monitoring.

- **TIST Data System:** The data system is an integral part of TIST's quality assurance and quality control plan. The handheld devices are programmed in a manner that requires the data to be collected in a step-by-step manner, increasing the likelihood that all the data will

be collected. Data field characteristics are defined to force the use of numbers, text or special formats. Drop down menus are used to restrict answers to certain subsets (e.g. a TIST Small Group name comes from a drop down menu). Some data fields are restricted to a range of data (e.g. negative numbers are not allowed). The data is uploaded within a few days to the main database, providing timely reporting and secure storage of the data.

- **Desk Audit:** TIST has developed analytical tools for reviewing data, as it comes in from the field, to look at track data, tree counts, and completeness of data.

- **Transparency:** By providing the quantification data online and available to anyone with an Internet connection, TIST is open to audit by anyone, at any time. By providing the location, boundaries, tree count by species and circumference, any interested party can field check TIST data. This transparency and the actual visits that have already taken place provide a further motive to make sure the field data is correct.

- **Data Storage:** The data will be stored in an electronic format on the TIST server. Currently, the server hardware is operated by a third party company that specializes in web and data hosting.

# 5 ENVIRONMENTAL IMPACT

## 5.1 Environmental assessment

The A/R CDM project activity does not have any negative environmental impact because the project activity is highly environmental friendly. This is supported by the India domestic national authority (DNA) for CDM. A subset of TIST India was validated and registered under CDM[82] and part of the process included:

> Environmental wellbeing: This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; biodiversity friendliness; impact on human health; reduction of levels of pollution in general.[83]

CDM approval indicates the DNA believes the TIST program meets the necessary environmental threshold.

In addition, TIST India has been recognized by the Tamil Nadu Forest Department for its work, and was awarded "Best Planting in Private Lands" under Institutional Category for "The International Year of Forests 2011".[84] TIST India farmers in Tiruvallur District received three additional awards for forestry outreach and awareness creation.

As noted in this document, TIST has similar operations in four other countries. In Kenya, TIST hired a registered third party to conduct an environmental assessment. There conclusions are given below. [85]

**Table 5.1.A Existing Positive Impacts**

| Project Component | Existing Positive Impacts |
|---|---|
| -Promotion of tree planting through carbon credit programs and conservation farming<br>-Promotion of compost manure | Increased tree cover |
| | Improved incomes at the household level, through cash remuneration, to groups and individual households, based on the number of trees in farms |
| | Reduction of global warming through increased sink for Greenhouse Gases (GHG), hence a mitigation against sudden climate change |
| | High potential for the program activities to attract further/future carbon credit markets, hence income generation |
| | Improved farming methods that prevent carbon dioxide ($CO_2$) from escaping into the atmosphere, while trees act as carbon sinks |
| | Increased tree variety, hence wood based products |
| | Enhanced biodiversity, hence increased ecosystem services such as pollination for food |
| | Improved opportunity to get rid of unsuitable trees for Agroforestry such as Eucalyptus spp through appropriate awareness creation activities |
| | Increased availability and access to tree products such as firewood and timber products |
| | Improved soil fertility, hence improved crop production through planting of nitrogen fixing shrubs and trees |

[82] See Exhibit 21. CDM Approval.
[83] See Exhibit 22. CDM Approval Process
[84] See Exhibit 23. Award for Best Tree Planting
[85] NAREDA Consultants, Environmental Audit Report For TIST Project Activities, Final Report, April 2010. Page 16-20. ("NAREDA"). See Exhibit 24.

| Table 5.1.A Existing Positive Impacts | |
|---|---|
| **Project Component** | **Existing Positive Impacts** |
| | Improved food security and nutritional status through increased crop production and growth of fruit trees, as well as adoption of improved conservation farming (some farmers reported an increase of production from two to three bags to eight, from a quarter of farm after adopting conservation farming |
| | Diversification of livelihood sources, i.e. training in beekeeping |
| | Possible replication of the project activities in other areas, following successful implementation |
| | Management of water catchment areas through promotion of tree planting |
| | Increase in groundwater recharge, as a result of increase in vegetation cover that minimizes surface runoff and improves infiltration. |
| | Increased tree-based environmental services such as moderation of local climate, reduced soil erosion and aesthetic values associated with trees |

| Table 5.1.B Potential Positive Impacts | |
|---|---|
| **Project Component** | **Potential Positive Impacts** |
| Promotion of tree planting through carbon credit programs | High potential of program activities to attract carbon markets |
| | Improved farming methods prevent carbon dioxide ($CO_2$) from escaping into the atmosphere, while trees act as carbon sinks |
| | Possible replication of the project activities in other areas |
| | Increase in groundwater recharge, as a result of increase in vegetation, that minimizes surface runoff and improves nutrition |
| | Possible introduction of other nature based activities, like bee keeping, due to increased foliage material, thus contributing to maintenance and enhancement of the biodiversity through pollination by bees |
| | Increased population of native species through TIST training |
| Conservation farming | Possible increased incomes as a result of improved farm productivity |
| | Possible improved food security |
| | Possible replication and adoption of conservation farming both within the project area (those farmers that are not group members) and outside the project area |
| | Improved farm productivity and environmental improvement through appropriate farming practices |
| | Possible reduced soil erosion as farmers increasingly adopt organic farming |

The tables below present the existing and potential negative impacts of program activities

| Table 5.1.C Existing Negative Impacts and their Mitigation Measures | | |
|---|---|---|
| **Project Component** | **Existing Negative Impacts** | **Proposed Mitigation Measures** |
| Promotion of tree planting through the carbon credit program | High expectations from farmers which TIST may not be able to meet or are outside its scope of coverage | -TIST to continue and improve awareness creation on TIST policies of support to specific activities through increasing seminars/ training aimed at developing best practices with and empowerment of TIST |

| Table 5.1.C Existing Negative Impacts and their Mitigation Measures | | |
|---|---|---|
| **Project Component** | **Existing Negative Impacts** | **Proposed Mitigation Measures** |
| | | farmers<br>-Conduct participatory techniques to identify farmers concerns and use these forums for feedback |
| | Farmers' dissatisfaction due to delayed payment | -Improve review of group payments, and target paying each group at least twice per year<br>-Improve awareness creation of TIST policies, such as the 500 trees rules among group members and the fact that payment is made based on available man hours<br>-Improve awareness on TIST's policy/value of "low budget big results"<br>-Educate farmers that payments will increase once the GHG credit is initialized, when farmers will receive 70% of the income after in-country costs |
| | Inadequate information dissemination of information between TIST staff and group members | -Streamline the information dissemination mechanisms between TIST staff at the project area level and those at the grassroots<br>-Ensure regular trainings of TIST grassroots staff to update them on the latest TIST policies<br>-Ensure regular and consistent meetings at the groups level<br>-Ensure adequate awareness creation among TIST grassroots staff and group members on TIST's institutional structure |
| | Poor awareness among farmers on how to join TIST activities leads them to believe that they have been excluded from TIST activities | -Improve awareness creation on TIST policies in the registration of members<br>-Conduct participatory techniques to identify farmers concerns and use these forums as feedback forums |

| Table 5.1.D Potential Negative Impacts and their Mitigation Measures | | |
|---|---|---|
| **Project Component** | **Potential Negative Impacts** | **Proposed Mitigation Measures** |
| Promotion of tree planting | Possible negative changes in soil properties as litter becomes dominated by one or a few tree species and decomposition dynamics are altered. | -Encourage farm crop rotations that incorporate use of indigenous tree species<br>-Interplant exotic with native tree species<br>-Continue with the TIST campaign of encouraging the planting of more indigenous tree species |
| Promotion of conservation farming | Farmers resistant to retain chemical fertilizers and pesticides utilization for perceived high yields | -TIST promotes awareness on usefulness and benefits derived from organic fertilizers and pesticides |

The report concludes "drawing from the positive and negative impacts as highlighted above, the former outweighs the latter by far, an observation clearly pinpointed by community, especially during the focused group discussions."

TIST has reviewed the mitigation measures and finds that they are part of the existing program. Most refer to constant outreach to the member to increase awareness. TIST provides regular training in the abovementioned activities through seminars, cluster meetings, Small Group meetings and the newsletter. In addition, TIST Quantifiers are trained in most aspects of the program and they try to visit each Small Group once a year. While their primary purpose is quantification, they can also provide answers to some questions while on site.

## 5.2 Socio-economic impacts

An analysis of the socio-economic impacts is provided:

**Administration.** TIST requires a Host Country staff to operate. There are currently 17 staff employees. TIST personnel travel by public transportation and buy food and supplies from local merchants, bolstering the local economy. TIST uses Host Country professionals, such as accountants and lawyers. TIST staff is trained to use the handheld computers and GPS and how to collect data. They synchronize their devices in cyber cafés, requiring the use of personal computers.

**Direct Effects to Small Groups.** TIST benefits thousands of Small Group members by providing a new source of income. Small Group members are paid for each tree they plant and maintain. Ultimately, they will receive 70% of the net carbon revenues.

**Small Group Structure.** Empowerment of Small Groups and creation of "best practices" improves farm production, health, and farmer life. Small Groups use "rotating leadership" which supports gender equality and develops the capacities of each member. The visible success of the TIST groups and the availability of wood, shade, lumber, fruit, and improved crop yields provides the entire community with positive examples.

**Additional benefits for Small Group members and their families:**

- Fruits and nuts from tree plantings
- Wood products and limited timber from trees
- Natural medicines and insecticides from trees
- Capacity building on agricultural improvements, business skills, nursery development, and reforestation
- Animal fodder
- Small Groups organize to deal with other social and economic problems such as famine, AIDS, inadequate water supply
- Improved beauty of the landscape
- Surpass "sustainability" in that people meet their needs today in ways that improve the next generation's ability to meet its needs in the future

The project will create a positive socio-economic impact.

# 6 STAKEHOLDER COMMENTS

## 6.1 Description of how comments are obtained

Membership in TIST is completely voluntarily. The actions that members take are on their own land. They maintain ownership of the land, the trees planted for sequestration and all the products that the trees yield. TIST exists for the local farmers and only grows if the local farmers support it. The rapid growth of TIST is a reflection of the positive reaction that the farmers and other stakeholders have had about TIST.

When TIST begins in an area, they contact community leaders, village heads/village leaders, local NGOs and local government officials to determine if there is an interest in the program. If there is an interest, TIST holds a public seminar to present the program, answer questions, address concerns and receive comments. Regular and on-going meetings the public is invited to attend follow this. TIST representatives have met with numerous State, District and Village officials seeking comments and showing them the project. Since TIST is organic in its growth, this process continues as it expands to new villages. In addition to the meetings, information about TIST is disseminated by word of mouth; using "Chezhimai," a bilingual (Tamil and English) newsletter published by TIST India and direct contact with community leaders and government officials.

The original TIST program was started in Tanzania, in late 1999, to meet local needs in a sustainable way, while at the same time addressing climate change. On 31 May, 2002, India became the second country to introduce TIST. On 22 June and 23 June of that year, a seminar was conducted in Vedal where local citizens were invited to learn about TIST, ask questions and make comments. Those interested in joining TIST were invited to join. The seminar was documented in the January 2003 "Chezhimai" newsletter.

As a result of the initial expression of interest and support from the community and farmers, TIST reached out through word of mouth and direct contact to two more villages, Jambodai and Andiseruvallur. As also documented in the January 2003 "Chezhimai," this resulted in favourable comments from villagers, agricultural officers, the postmaster of Vedal, Panchayat Head of Vedal and other private citizens.

Since January 2003, TIST India has published 54 newsletters that document an ongoing dialogue and support with members of the community, both inside and outside the program. These documents are available to the public in a transparent form on the internet at tist.org.[86]

At the Small Group level, member farmers meet with TIST representatives regularly where they have an opportunity to ask more questions and make more comments. Since one of TIST's main focuses is adopting best practices, these are forums to review what is working about the program and how it can be improved. Changes to the program are announced in the "Chezhimai."

The result of this stakeholder process has led to numerous invitations for TIST to come to new villages and numerous positive comments about TIST. The following section will summarise written comments.

## 6.2 Summary of the comments received

Stakeholder comments have been received from:

1. Numerous Small Groups participants.

[86] http://www.tist.org/moreinfo.php

2. Eight members of the Tamil Nadu Forest Department including the Principle Chief Conservator, Conservator (Vellore District) & Deputy Conservator (Tiruvannamalai District) and the District Forest Officer of Thiruvallur.
3. Nineteen Village Administrative Officers from villages in Kancheepuram, Tiruvannamalai, and Thiruvallur.
4. Forty-six Village Panchayat Heads (village council).
5. Eighteen Women's organisations.
6. Two Men's Groups.
7. Six other organizations.

Specifically, letters from the following people have been received and are available from TIST.

| Letter issued by | Panchayat / Village | District |
|---|---|---|
| Village Panchayat Head | Semboondy | Kanchipuram |
| Village Panchayat Head | L Endathur | Kanchipuram |
| Village Panchayat Head | Achirapakkam | Kanchipuram |
| Village Panchayat Head | Kadambur | Kanchipuram |
| Village Panchayat Head | Keeranallur | Kanchipuram |
| Councilor | Pallipattu | Thiruvallur |
| Village Panchayat Head | Samanthavada | Thiruvallur |
| Village Panchayat Head | Nedungal | Thiruvallur |
| Village Panchayat Head | Pettai Kandigai | Thiruvallur |
| Village Panchayat Head | Placepalayam | Thiruvallur |
| Village Panchayat Head | Timmabubalapuram | Thiruvallur |
| Village Panchayat Head | Poondi | Thiruvallur |
| Village Panchayat Head | Katchur | Thiruvallur |
| Village Panchayat Head | Ambakkam | Thiruvallur |
| Village Panchayat Head | Gunipalayam | Thiruvallur |
| Village Panchayat Head | Allikuzhi | Thiruvallur |
| Village Panchayat Head | Perunchery | Thiruvallur |
| Village Panchayat Head | Vellathukottai | Thiruvallur |
| Village Panchayat Head | Keelnarma | Tiruvannamallai |
| Village Panchayat Head | Narmapallam | Tiruvannamallai |
| Village Panchayat Head | Sengaadu | Tiruvannamallai |
| Village Panchayat Head | Ilangadu | Tiruvannamallai |
| Village Panchayat Head | Pazhanchur | Tiruvannamallai |
| Village Panchayat Head | Esakolathur | Tiruvannamallai |
| Village Panchayat Head | Kolipuliyur | Tiruvannamallai |
| Village Panchayat Head | Mangalam | Tiruvannamallai |
| Village Panchayat Head | Thurinjapuram | Tiruvannamallai |
| Village Panchayat Head | Velungnanthal | Tiruvannamallai |
| Village Panchayat Head | Kadambai | Tiruvannamallai |
| Village Panchayat Head | Karippur | Tiruvannamallai |
| Village Panchayat Head | Ragunathasamuthiram | Tiruvannamallai |
| Village Panchayat Head | Nadukuppam | Tiruvannamallai |
| Village Panchayat Head | Mel Kodungalur | Tiruvannamallai |
| Village Panchayat Head | Ulundhai | Tiruvannamallai |

| | | |
|---|---|---|
| Village Panchayat Head | Marudadu | Tiruvannamallai |
| Village Panchayat Head | Badhur | Tiruvannamallai |
| Village Panchayat Head | Punnai | Tiruvannamallai |
| Village Panchayat Head | Kallankuthu | Tiruvannamallai |
| Village Panchayat Head | Vazhur | Tiruvannamallai |
| Village Panchayat Head | Kil Kodungalur | Tiruvannamallai |
| Village Panchayat Head | Irumbedu | Tiruvannamallai |
| Village Panchayat Head | Ariyathur | Tiruvannamallai |
| Village Panchayat Head | Vizhudhupattu | Tiruvannamallai |
| Village Panchayat Head | Koyilkuppam | Tiruvannamallai |

| **Invitation letter from the Principal Chief Conservator of Forests, Tamilnadu** |
|---|
| District Forest Officer, Thiruvallur, Thiruvallur District |
| Forester, Allikuli, Thiruvallur District |
| Forest Range Officer, Thiruvallur Range, Thiruvallur District |
| Forest Range Officer, Forest Station, Thiruvallur District |
| Forest Range Officer, TAP Range, Thiruvallur District |

| **Letter issued by** | **Organisation** |
|---|---|
| Head Placepalayam Village | Roja Womens Organization |
| President | Inner Wheel Club of Adyar (Rotary Club) |
| Branch Manager | Indian Overseas Bank, L Endathur |

**Summary Forest Department Comments**

- TIST has wide knowledge and experience in the area of tree planting. This will help the objectives of Tamil Nadu Forest Department outside the state forests.
- TIST members have planted species like Mango, Jack, Teak, Lemon, Cashew, Red sanders, Rose Wood, Teak, etc. in their own land dry lands. These trees are maintained well.
- TIST is forming Small Groups and enabling them to generate additional revenue.
- TIST program is useful for the environment.
- We participated in TIST meetings and explained Forest Department tree planting plans to TIST members.
- TIST India is helping Tamilnadu Forest Department in “Tree Culture (Cultivation) in Private Land” project
- We wish all the best for TIST program and would like this program to spread all over Tamil Nadu – congratulations.

**Summary of Village Administrative Officers Comments**

- TIST has formed several Small Groups in our village area.
- TIST is encouraging the villagers (TIST members) to plant trees in those lands where agricultural activities are not possible due to less rain fall/no water.
- TIST program is healing the ecology.
- Our village is looking good because of TIST.
- Our area villagers have a lot of wastelands. We feel that if tree-planting activities are carried out in these wastelands, it will be very useful for the villagers. Since these villagers are very poor, the revenue from TIST tree planting activity would be helpful.
- The socio-economic situation of the region will improve due to TIST program.
- We hope that this program grows more and more.

- Villagers are getting good revenue in this program.
- This program helps in sustainable development.
- We request that the Indian Government help TIST to spread and grow.

**Summary on Village Panchayat Head Comments**

- TIST has formed several Small Groups in our village area.
- TIST is encouraging the villagers (TIST members) to plant trees in those lands where agricultural activities are not possible due to less rainfall.
- Due to TIST program, our village is turning green.
- This program will reduce global warming.
- TIST helps achieve local forestry goals.
- TIST is making payments to the Small Groups for their trees.
- Poor and rich are treated equally in this program.
- Our blessing and thanks to their encouraging tree planting activity.

**Summary on TIST Small Groups Comments**

- We have joined TIST as Small Groups and are planting trees in the program.
- Our land was kept idle for more than 10 years. Now after joining TIST, we see vegetation in our land.
- We are planting trees in our own land where we are not able to do agriculture due to less rain fall / no water.
- We are following the best practices of TIST. We have planted trees like, teak, eucalyptus, mango, and guava.
- We are improving our environment in this program.
- TIST is helping to improve the socio-economic situation in our area.
- We are getting income from trees and our economy is growing.
- We have planted long-standing trees; moreover, TIST will be with us for decades.
- TIST pays regular incentive once in three months, which is beneficial to us.
- Government should give necessary approval to TIST to expand more.
- Poor people have and will benefit from TIST.

**Other Stakeholders Comments**

- Several hundred families have voluntarily joined in TIST program.
- We see a large number of enthusiastic, well-informed women members in TIST program who were being encouraged.
- The members are maintaining the trees well.
- TIST program is very useful to the small farmers and villagers.
- We have distributed free seedlings to TIST members. We will contribute more in the coming years.

**Women's Association / Women Self Help Group Comments**

- By planting trees, the farmer's socio-economic situation is improving.
- The trees are helping the environment. More trees should be planted in all barren lands.
- Women and men work together in this tree planting activity.
- We believe this will help improve personal financial needs.
- TIST provides financial, agricultural and social benefits.
- If we get free seedlings, it will be of great help for small villagers.
- We receive voucher payments from TIST program.
- Mango, Team, Gooseberry trees have been planted by TIST members.

- We have participated in several TIST node meetings. This program is of great help to villagers.

**Non Governmental Organization Comments**

- Villagers who are not able to do agriculture due to low rainfall are organised in Small Groups and are encouraged to participate in tree planting activities.
- Groups have planted longstanding trees like, mango, jack, teak, sandalwood, team, and guava in this program.
- TIST is making stipend payment for the trees every three months and encouraging the groups.
- Members of our women's self help group joined in TIST program and benefited.
- Our agriculture experts are helping by giving good ideas for TIST program.
- TIST is taking good suggestions and advice from other social service organisation.
- We wish the TIST program would spread throughout Tamil Nadu

Some examples of specific comments are:

- The President of Vedal Panchayat, V. S. Sagalagunam, wrote an article for TIST's Chezhumai newsletter sent to Small Groups. The article entitled "Your Panchayat Head Supports TIST" included the following:[87]

  "For growing and maintaining these trees, TIST provides incentives to the members of the Small Groups. I strongly encourage the public of Vedal Panchayat to avail from this wonderful opportunity of cultivating these trees to beautify our area and also obtain the incentives provided by TIST for your economic benefit. As your Panchayat leader, I humbly request everyone to join and support the TIST program in our area…"

- Support from Mr. Narayanan, Postmaster of the Vedal Post Office, was also carried in the same issue:[88]

  "This program is helping the people who live below the poverty line by providing Small Groups that plant and maintain trees with cash incentives. Small Groups are also opening savings accounts in our post office through which they will receive payments for their plantings from TIST. I encourage all Small Groups to approach me at the post office to open their savings accounts…"

- The Assistant Agricultural officer, Elumalai Arumugam, also provided information and encouragement to the TIST Small Group program members:[89]

  "TIST brings to our deforested and drought prone area an opportunity and potential to bring about tremendous benefits and development through reforestation, conservation farming, community education, new technology and most importantly bringing people together by working in Small Groups for a common goal. I request you all to join and support TIST and plant lots of trees to improve our land cover and bring rains back to this once fertile and prosperous part of Tamil Nadu."

- The Deputy Conservator of Forest, Tiruvannamalai District has mentioned through TIST Chezhumai July 2008 that "The Major activity of TIST India is same as Forest Department, to

[87] http://www.tist.org/moreinfo.php, p. 1, Chezhumai newsletter - February 2003 Issue, Documents to Download, "9. Newsletters Published in India," TIST India.
[88] Ibid., p. 3.
[89] http://www.tist.org/moreinfo.php, p. 4, Chezhumai newsletter – September 2003 Issue, Documents to Download, "9. Newsletters Published in India," TIST India.

increase the green cover and to benefit the villagers with additional revenue, and ultimately increase the carbon sequestering.[90]

Written comments are maintained by TIST India and are available for review.

## 6.3 How due account was taken of comments received

TIST has not received any negative comments to take into account.

When Small Groups report success, TIST's partners work together to communicate that success and the basis of that success to the other Small Groups. TIST is built upon sharing best practices. When Small Groups find a benefit of planting trees, we communicate this learning to the other program participants through the TIST newsletter, through monthly node meetings, and we discuss it at annual seminars.

When digging holes provided a tangible way of boosting survival rates, we communicated this to all groups – that digging holes not only starves the weeds at the surface for water, but also collects what little there is for the tree seedlings or the crops to enable them to survive when traditional tree plantings may not.

When groups needed more room to plant trees than where they already owned, TIST participants found that they needed to communicate their intentions and work with local government officials. This was helpful in two ways – it procured more land to plant trees, and it strengthened the understanding that officials had of the TIST program and its benefits.

One of the highlights of how TIST celebrates Small Groups' feedback and success came when the activities of Small Groups from the Vedal area were mentioned in an audiovisual presentation made at the World Summit on Sustainable Development in Johannesburg, South Africa in 2002.[91]

When we hear the encouragement of the program from participants and local officials, it spurs us to work even harder to secure a long-term GhG income stream for these Small Group members.

## 6.4 Ongoing communication with stakeholders

TIST will maintain communications with stakeholders several ways.

- As a community-based project, the thousands of members represent a cross section of the population. These are stakeholders, both because they are members, and because they represent the community.
- TIST's aforementioned communication structure (seminars, Cluster meeting, Small Group meetings, regular visits by Quantifiers, trainers and newsletter) will provide avenues for ongoing dialogue.
- TIST has a full time staff of Indians that are part of the community. They liaise with the community, government officials and other NGOs.
- TIST membership includes government officials, church leaders and members of other NGOs.

[90] http://www.tist.org/moreinfo.php, p. 4, Chezhumai newsletter – September 2003 Issue, Documents to Download, "9. Newsletters Published in India," TIST India.
[91] http://www.tist.org/moreinfo.php, p. 3, Chezhumai newsletter - January 2003 Issue, Documents to Download, "9. Newsletters Published in India," TIST India.

- The TIST website allows direct communication with the US office. The US office answers questions, addresses concerns and can direct the India staff to issues that have been raised.