WOODLOT TECHNICAL SPECIFICATION

For

TREES OF HOPE PROJECT

{A Plan Vivo Payment for Ecosystem Services Project (PES)}

Clinton Development Initiative

Off Mphonongo Road

Plot No. 10/42

Lilongwe

Malawi

JUNE 2011

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SUMMARY

This technical specification has been developed for use by Trees of Hope Project, a Plan Vivo Payment for Ecosystem Services (PES) project involving rural communities participating in Malawi. Through the Plan Vivo system communities may be able to access carbon finance by land use change activities that involve afforestation and reforestation.

This technical specification sets out the methods that should be used to estimate the carbon benefits from planting and managing woodlots on small holding farms and community land in Malawi. This technical specification also details the management requirements for this system over a long period of time, and the indicators to be used for monitoring the delivery of the carbon benefit. The technical specification aims to summarise the best available evidence about the environmental benefits associated with the sustainable management of this land use system. Further information and research is welcome and will be incorporated periodically.

This land use system has been developed in consultation with communities and individual farmers in Neno and Dowa districts of southern and central Malawi respectively. Other valuable contributions to the development of this system have been received from Clinton Development Initiative (CDI) staff, national and district government officials, forestry and agricultural extension workers. The inputs have been received through a structured process of meetings and interviews with these key stakeholders between September 2007 and October 2008.

The objective of establishing woodlots is to provide a sustainable source of fuelwood, poles and building materials. In the long term this tree planting system may be used to help re-establish or restore degraded areas of miombo woodland. Additional benefits will include improved soil and water conservation, enhanced biodiversity and beekeeping in the longer term. The carbon finance will make a critical difference in allowing for the implementation of this system by providing tree seedlings, increasing capacity in managing this tree planting system and putting in place frequent monitoring to ensure compliance with the technical specification that will create the carbon sink.

The project in which this technical specification is part is being piloted in Neno and Dowa districts but during the scale up phase, the project will spread to other districts with similar agro-ecological

conditions like temperature regimes, rainfall pattern, edaphic (soil) factors as described in section 5.0 of the Project Design Document (PDD) and where the tree species to be used are known to traditionally grow and have positive impact on local livelihoods. Within the districts where this technical specification will be established, it is important to ensure that appropriate pockets of land are chosen for the system to avoid unintended negative impacts on the socio-economic and environmental well being of the communities. Table 1 below offers a guideline to the eligibility of different land types to establishment of the woodlot technical specification.

Table 1: Land type eligibility for woodlot technical specification

Land type	**Basic characteristics**	**Eligibility**
Natural forest	➢ Covered with trees (government controlled or under customary control).	➢ Not eligible.
Cultivated land	➢ Generally of high fertility and production potential. ➢ Less prone to erosion. ➢ Slopes of not more than 12%. ➢ Grown to food crops annually for the household.	➢ Not eligible.
Degraded land	➢ Low soil fertility with low production potential. ➢ Shallow soils. ➢ High soil erosion hazard. ➢ Rarely put to arable cropping.	➢ Eligible only in cases where the household has enough more productive land elsewhere for production of food crops for its food security.
Neglected land	➢ Very low soil fertility and productive capacity. ➢ Shallow rocky soils with high erosion hazard. ➢ Abandoned for arable crop production. ➢ Slopes of over 12%.	➢ Eligible but any existing trees on site should only be planted around and not cut down.
Wetlands	➢ Permanent wetness.	➢ Not eligible.

The woodlot technical specification, like others in the project, can be established by individuals or communal groups. However, wherever this technical specification is established, farmers should demonstrate possession of sufficient land so that the establishment of the system does not negatively interfere with the household's food production system by taking land out of production of food crops.

The net carbon benefit of this system above the baseline (with 20% set aside as risk buffer) is calculated to be 50.8 tonnes of carbon per hectare as a long-term average over 50 years. This is equivalent to 145 tonnes of carbon dioxide per hectare.

ACKNOWLEDGEMENTS:

This work has been undertaken by Edinburgh Centre for Carbon Management (ECCM) for Trees of Hope Payment for Ecosystem Services (PES) of the Clinton Development Initiative (CDI), formerly Clinton Hunter Development Initiative (CHDI) in Malawi. It has only been possible because of the financial support received from the Hunter and Clinton Foundations. ECCM wish to acknowledge the contribution made by all the staff of CDI Malawi, and all the other stakeholders engaged during the participatory planning process used to design and collect data for this technical specification.

1.0 DESCRIPTION OF LAND USE SYSTEM

This system involves the planting of a variety of indigenous and naturalised hard wood tree species on degraded or neglected land. The trees planted as part of this system should be managed primarily to meet local needs for woodfuel, building materials and other livelihood needs. In the long term this system may be used to re-establish miombo woodland and to restore degraded areas of woodland.

1.1 Tree species

Table 2: Tree species for the woodlot technical specification

Botanical name	Common name (English)	Range
Khaya anthoteca	Red mahogany	Indigenous
Azadirachta indica	Neem	Naturalised
Albizia lebbeck	Woman’s tongue, Siris tree	Naturalised
Afzelia quanzensis	Pod mahogany, lucky bean	Indigenous
Senna spectabilis	Cassia	Naturalised
Senna siamea	Pheasant wood, Siamese senna	Naturalised
Toona ciliata	Toon tree, Australian red cedar	Naturalised
Melia azederach	China berry, Siringa, Persian liliac	Naturalised

2.0 ECOLOGY

2.1 Altitudinal range.

Table 3: Altitudinal range for the tree species in the woodlot technical specification

Botanical name	Altitudinal range
Khaya anthoteca	Will grow up to 1,000 m.a.s.l.
Azadirachta indica	Azadirachta indica is normally found at elevations between sea level and 700 m. It can grow at higher altitudes up to 1500 m, as long as the temperatures remain moderate as it cannot withstand cold or frost
Albizia lebbeck	Will grow up to 1,800 m.a.s.l.
Senna spectabilis	Will grow up to 2,000 m.a.s.l.
Senna siamea	Will grow up to 1,600 m.a.s.l.
Toona ciliata	Prefers an altitudinal range of 0 to 1500 m.a.s.l.
Melia azederach	A tree of the subtropical climate zone. The natural habitat of *M. Azederach* is seasonal forest, including bamboo thickets and *Tamarindus* woodland.

2.2 Climatic factors

Table 4: Brief climatic requirements for the tree species for the woodlot technical specification

Botanical name	Climatic factors
Khaya anthoteca	*Khaya anthoteca* requires mean annual temperature between 18 - 28^{0}C and mean annual rainfall between 600 – 1,600 mm.
Azadirachta indica	*Azadirachta indica* is very drought resistant. Normally it thrives in areas with sub-arid to sub-humid conditions, with an annual rainfall between 400 and 1,200 mm. It can grow in regions with an annual rainfall below 400 mm, but will rely largely on the ground water levels. It is a typical tropical/subtropical tree and exists at annual mean temperatures between 21 - 32 °C. It can tolerate high to very high temperatures. It does not tolerate temperature below 4 °C which may cause leaf shedding and death.
Albizia lebbeck	*Albizia lebbeck* prefers annual rainfall of 1,300-1,500 mm and a very dry winter. It is tolerant of long, hot, dry periods and cold winters. Will tolerate annual rainfall between 500 to 2,500 mm. *Albizia lebbeck* requires mean annual temperature between 19 - 35^{0}C.
Senna spectabilis	Does well in cool conditions (15-25 Deg. Celcius) and an elevation of up to 2000m. Requires a mean rainfall of between 800mm – 1000mm.
Senna siamea	Grows all over the tropics from sub-humid to semi-humid and even arid zones, 0 – 1600m.
Toona ciliata	Prefers mean annual rainfall of between 750 to 4000mm and well drained soils. It does not do well on compacted, wet or poor sandy soils.
Melia azederach	Prefers an altitudinal range of 0 to 1800 m.a.s.l with a mean annual temperature range of 23 to 27 Deg. Celcius and a mean annual rainfall of between 350 to 2000mm.

2.3 Habitat requirements.

Table 5: Habitat requirements for the main tree species for woodlot technical specification.

Botanical name	Habitat requirements
Khaya anthoteca	*Khaya anthoteca* will grow best on moist, well-drained and deep alluvial soils. Typically it is found along water courses.
Azadirachta indica	*Azadirachta indica* can grow in many different types of soil, but it thrives best on well drained deep and sandy soils (pH 6.2-7.0).
Albizia lebbeck	*Albizia lebbeck* establishes well on fertile, well-drained loamy soils but poorly on heavy clays. Tolerates acidity, alkalinity, heavy and eroded soils and waterlogged conditions.
Senna spectabilis	Prefers deep, moist sandy or loamy soils and is also drought resistant.
Senna siamea	It prefers a deep, fairly fertile, well drained and neutral or alkaline soils. Does better in a high water table but will tolerate extended drought and a variety of soil types.
Toona ciliata	Prefers well drained soils. Does not do well on poor sandy, or wet and compacted soils.
Melia azederach	Deep, fertile sandy loam soils support the best growth. It is highly adaptable and tolerates a wide range of conditions including frost.

2.4 Growth habit.

Table 6: Growth habit of the main tree species for the woodlot technical specification

Botanical name	Growth habit
Khaya anthoteca	*Khaya anthoteca* is a fast growing tree species (with a large spreading evergreen crown) which may attain heighths of up to 60m under favourable conditions. Has upright growth form and does not pollard and coppice well.
Azadirachta indica	*Azadirachta indica* (neem) is a fast-growing tree that can reach 15-20 m (rarely to 35-40 m). It is evergreen but under severe drought conditions it may shed most of its leaves. The branches are wide spread. The fairly dense crown is roundish or oval and may reach a diameter of 15-20 m in old, free-standing trees. The trunk is relatively short, straight and may reach a diameter of 1.2 m. It pollards well.
Albizia lebbeck	*Albizia lebbeck* can attain heights of 30 m with a Diameter at Breast Hieght (dbh) of 1m. It is fast growing and responds well to pollarding, coppicing and lopping.
Senna spectabilis	Fast growing in good sites; pollards and coppices well. A small rounded deciduous tree generally less than 10m tall. The bole is short and tend to fork near the ground. The species is resistant to termites and is not browsed much so it is easily established.
Senna siamea	Fast growing; pollards and coppices well. An evergreen tree up to 20m, more upright than *S. Spectabilis*. The species is resistant to termites and is not browsed much so it is easily established.
Toona ciliata	Flowers are functionally unisexual. In tropical climates it sheds foliage for part of the year and can grow up to 12m but does not tolerate drought when young.
Melia azederach	It is a deciduous tree that can grow up to 45m tall; bole fluted below when old, up to 30 to 60cm in diameter, with a spreading crown and sparsely branched limbs.

3.0 MANAGEMENT OBJECTIVES OF WOODLOT LAND USE SYSTEM

This system is managed for: timber, fuel wood, soil conservation, wind protection and land delimitation. This system may also provide secondary benefits such as improved water quality, beekeeping, increased biodiversity etc.

4.0 COSTS OF IMPLEMENTATION

4.1 Nursery costs

There will be 2,500 seedlings per hectare spaced at 2m x 2m. The activities and costs during the setting up of the nursery are:

- Seeds.
- Digging and mixing of the soil.
- Pot filling, transfer, and topping.
- Seed pre-treatment and sowing.
- Thinning to one seedling per tube (thinned seedlings can be pricked out and transferred to empty tubes).
- Watering, weeding, root pruning every two weeks and general sanitation.
- Cost of one wheelbarrow, hoes, spades, machete, poles, and water.
- Cost of polythene tubes, watering cans and strings.

The total cost of these activities is estimated to be $300.

4.2 Establishment cost

The activities in the establishment phase would include:

- Demarcation.
- Bush clearing.
- Chaining/marking.
- Pitting and pruning.

The total cost for this phase per hectare would be $214.

4.3 Maintenance cost

Operations for year one are grass slashing, spot weeding, firebreaks, uprooting shrubs. The cost per hectare will be $175 while year two operations that will include grass slashing, spot weeding, firebreaks maintenance, and uprooting shrubs are estimated to cost $108. Operations for years 3, 4, and 5 are maintaining of firebreaks which will cost $240 per hectare ($80/year). Other costs would go to buying equipments such as one slasher, one hoe, one machete, a pair of boots, and one overall coat. This will cost $50. In total, the maintenance cost will be $575 and the full cost profile is presented below:

Table 7: Nursery, establishment and short-term maintenance cost profile for the woodlot technical specification

Activity	Cost (per hectare of woodlot)
Nursery costs	$300
Establishment	$214
Maintenance year 1	$175
Maintenance year 2	$108
Maintenance year 3	$80
Maintenance year 4	$80
Maintenance year 5	$80
Operations	$50
Total	**$1087**

5.0 POTENTIAL INCOME

The figures provided for potential income are only intended to be indicative. These figures are based on 2008 market values. Market prices may fluctuate. Yields will be affected both by local environmental conditions and stand management and the estimated values of the main tree products from this technical specification are shown below:

Fuelwood. Fuelwood harvesting will occur on a six year rotation, yielding a crop with a value of up to $1,700 per hectare at each harvest.

Poles. Poles may be harvested between years 8 to 12. Each harvest may yield a crop with a value of up to $4,600 per hectare.

Timber. Timber may be harvested between years 20 to 50. The value of the timber crop may be as high as $8,000 per hectare.

Other income may be derived from NTFP's such as beekeeping, medicine etc.

6.0 MANAGEMENT OPERATIONS[1]

6.1 Establishment

Minimal land preparation should be done at the site of planting to facilitate digging of holes and making of basins around the trees. Any existing trees on site should not be cut but only planted around and all plots showing wholesale clearing of vegetation will be disqualified. Create basins of 1m by 1m around each tree so that water is trapped and percolates into the soil instead of running off. Apply mulch in the basins to assist in moisture conservation and weed suppression but the mulch should stay clear of the root collar. Holes should be made 60cm wide and 60cm deep. When digging the holes, put top soil on one side of the hole and the subsoil on the other and when filling the hole at planting, start putting the topsoil in the hole before the subsoil. Trees should be planted in discreet species blocks and producers in the project can plant any combination of the tree species in the technical specification to allow flexibility. Though the spacing ideally varies with tree species as shown in Table 8 below, the average spacing of 2m by 2m will be used in establishing this technical specification.

Table 8: Spacing requirements for individual tree species for the woodlot technical specification

Botanical name	Planting density
Khaya anthoteca	4x4
Azadirachta indica	2x2
Albizia lebbeck	4x4
Afzelia quanzensis	4x4
Senna spectabilis	2x2
Senna siamea	2x2

[1] Most management operations are according to Total Land Care publication entitled "Land Care Practices in Malawi" by Bunderson et al., 2000.

Toona ciliata	2×2
Melia azederach	2×2

Note: Intimate mixing of tree species in a woodlot is not recommended since fast growing trees will suppress the slow growing trees and therefore retard their growth rates. Trees should be planted in tree species specific blocks and any trees that already exist on the site should not be cleared but rather planted around with the new trees.

When planting:

- Water seedlings before out-planting in the field to hold nursery soil together and to increase soil moisture in the pot.
- Planting should be done on a wet day wet there is adequate moisture in the soil to minimize establishment failure.
- Care should be taken handling plants so as not to cause damage to shoots, buds or bark.
- Only remove plastic from around root-ball at the time of planting. Care should be taken to remove all the plastic. Use open-ended tubes which can be compressed with hands to loosen the tube around the soil and then lifted over the seedling without disturbing the root ball and soil.
- Prune back roots regularly so that the seedlings do not anchor too deep in the soil to risk damage to the tap root when pulling for out-planting.
- Plant to depth of root collar (i.e., for bagged plants, to level of existing nursery soil). Never plant deeper than in nursery leaving no roots exposed.

Ensure that soil is replaced firmly around trees (i.e., well heeled in).

6.2 Maintenance

Minimal weeding and slashing will be required twice a year for the first three to five years after planting, or until the trees have reached a height of 1.5 - 2 m. Weeding intensity can be reduced to once per year after the fourth year until approximately the sixth year (or once the trees are no longer in competition with weeds).

Prune side branches of timber trees to create clean boles of high value. Off-cuts can be used for fuel wood.

No burning is allowed at any time. Any foliage should be worked into the soil. Fire breaks should also be maintained between woodlots and woodlot with cultivated land.

6.3 Thinning and harvesting

Table 9 below presents recommendations for harvesting and thinning schedules and intensity for the tree species in the woodlot technical specification.

Table 9: Thinning and harvesting recommendations for the tree species in the woodlot technical specification

Tree species	Thinning intensity and year	Harvesting time (years)
Khaya anthoteca	50% at year 12	30
Azadirachta indica	50% at year 5 and a further 50% at year 12	20
Albizia lebbeck	50% at year 10	20
Senna spectabilis	50% at year 4 and another 50% at Year 8	15
Senna siamea	50% at year 5 and another 50% at Year 9	15
Toona ciliata	Thinning up to 50% at year 4 and thereafter 25% every 5 years.	20
Melia azederach	50% at year 4 and another 50% at Year 8	15

Note: All trees should be re-established after harvest.

7.0 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL BENEFITS

- Woodlots will provide a local and sustainable source of firewood, poles and timber.
- Reduced pressure on other forest resources (potentially resulting in positive leakage – see below).
- Income diversification through timber, poles and other Non Timber Forest Products (NTFP's) like bee-keeping, medicines, mushrooms etc.
- Soil conservation - particularly the prevention of soil erosion associated with heavy rainfall events and siltation of water courses. Basins measuring 1m by 1m will be made around each tree and mulch put therein which will trap the water giving it time to percolate into the soil instead of running off causing soil loss through erosion.
- Hydrological benefit – harvesting of incidental moisture and encouragement of water infiltration which will help to reduce flooding (climate change adaptation benefit) through the percolating water which will aid in recharging ground water systems and helping to raise the water table.
- Biodiversity benefit – through the protection of wildlife habitat as trees in a woodlot will generally present a habitat for different fauna and flora both below and above ground through their positive influence on the microenvironment. Planted woodlots will also reduce pressure on natural forests through provision of forest products including fuelwood, charcoal, medicines and poles which have otherwise been largely sourced from natural forests thereby preserving the biodiversity therein.
- Shading for humans and livestock.

8.0 DESCRIPTION OF ADDITIONALITY

A key factor is that the emissions reductions from a project activity or intervention should be additional – i.e. the intervention would not have occurred in the absence of the carbon derived finance. Additionality can be demonstrated through an analysis of the barriers to the implementation of activities in the absence of intervention. In this case the barriers to the permanent establishment of woodlots that are overcome through the project activity and receipt of carbon finance are:

- Community mobilisation and participation in planning processes.
- Capacity (on improved land use management systems and silviculture).
- Awareness in role of tree planting in climate change management and livelihood improvement.
- Production of seedlings for establishing the woodlot technical specification.
- Opportunity cost of not cultivating land.
- Training to enable long term sustainability of the programme through participatory monitoring and evaluation.

As there are no formal means by which communities can access funding to cover these costs, the effect of Plan Vivo carbon finance is strongly additional.

9.0 LEAKAGE ASSESSMENT

Leakage is unintended loss of carbon stocks outside the boundaries of a project resulting directly from the project activity. In the case of establishing woodlots this is most likely to occur where farmers are establishing trees on cultivated land (many of these tree species are not suitable to be grown in combination with other cultivated food crops). If this were to occur it may result in displacement.

The Plan Vivo system requires that potential displacement of activities within the community should be considered and that activities should be planned to minimise the risk of any negative leakage. These actions should include:

- All farmers should be assessed individually to demonstrate that they retain sufficient land to provide food for themselves and their families.
- Signatories to Plan Vivo activities will be contractually obliged not to displace their activities as a result of the tree planting.

- A plan to monitor leakage on specific other woodland areas to ensure leakage is not occurring.
- Formation of community based ‘policing’ to ensure that leakage resulting from displaced activities does not occur.

Where communities have a satisfactory plan for managing leakage risk resulting from the establishment of woodlots, there should be no assumption of leakage. In all probability, the most likely outcome of establishing woodlots is positive leakage as a result of reduced pressure on other forest resources.

10.0 PERMANENCE AND RISK MANAGEMENT

The project recognizes the importance of permanence of its activities (carbon stocks) so that they are not only initiated but also become sustained in the community and further realizes that risks exist that could threaten this intention. These risks have been foreseen and risk management measures put in place to minimize any effects. One of the threats to sustainability of project activities is the mere lack of sense of ownership of the project by the participating communities. To minimize this threat, the project has a deliberate policy of striving to involve the communities in all project processes coupled with frequent exchange of updated program information through a rigorous participatory training program. The project further, attaches highest priority to community groups and individuals that are self-selected. Other risks to permanence are also foreseen and are presented in Table 10 below along with their management measures.

Table 10: Risks to permanence, their levels and management**.**

Permanence risk	Level of risk	Management measure
Forest fires	High	- Adoption of recommended fire protection measures including establishment of fire breaks around plantations and incorporating into the soil all weeds and dry trash from within the plantation. - Civic education to communities and their leaders on the dangers of bush fires to the environment and livelihoods. - Formation of community-based fire monitoring committees in the villages.
Pests and diseases (largely fungal infections and leaf-eaters and damping-off disease in the nursery). Termites in some sections cause damage soon after planting out.	Low	- Selection of indigenous tree species which are hardy to most known pathological problems. - Recommended pest and disease management silvicultural practices both in the nursery and in the field following an integrated approach to pest and disease management. - Implement an effective pest and disease surveillance system led by Local Program Monitors (LPMs), a system of farmer volunteers based in the communities.
Livestock damage	Low	- Education of communities on recommended livestock management practices like tethering and zero grazing during periods when trees are vulnerable to livestock damage. - Placement of protective structures (normally thorny fences) around plantations or individual trees where feasible. - Enforcement of community by laws by traditional leaders that regulate movement of livestock in communities. - In certain cases, establishment of tree species that are not vulnerable to livestock damage through browsing.

Table 10: Management of risks to permanence of project activities (*continued*).

Permanence risk	Level of risk	Management measure
Overreliance on external support**.**	Low	- Capacity building on all technical aspects of tree establishment and management including community based seedling production. - Broadening income streams to producers over and above carbon finance. - Encouraging communities to contribute all locally available materials and labour for tree seedling production, with the project only providing materials that are difficult to source at community level. The latter materials will later also be the responsibility of the communities through carbon finance.
Drought	Medium	- Early planting of strong, healthy seedlings. - Good silvicultural practices like deep pitting and use of organic manure which promotes better soil moisture retention. - Promotion of irrigation where applicable.

Based on the risks outlined above, the project will withhold 20% of carbon services generated from sale to form a carbon buffer (reserve of unsold carbon).

11.0 BASELINE CARBON EMISSIONS

The '**baseline**' refers to carbon sequestered and stored in any existing vegetation (excluding food crops) on a site at the time of planting. When calculating the number of Voluntary Emission Reductions (VER's) that a farmer has generated, the baseline carbon stock is subtracted from the carbon sink achieved by the project activity. The procedure used to quantify the "baseline" carbon emissions that would be associated with land management expected in the absence of the establishment of woodlots is set out in '*Assessment of Net Carbon Benefit of CDI Land Use Activities' (Camco, 2010)*. It is assumed that this system will be used only on neglected and degraded land with an estimated carbon baseline of 7.6 tonnes per hectare in the absence of project activities.

12.0 QUANTIFICATION OF CARBON SINK

The approach used for estimating the long-term carbon benefit of afforestation for Plan Vivo VERs is based on average net increase of carbon storage (sink) in biomass and forest products over a 50 year period relative to the baseline. A three-staged approach is used as outlined below:

- Calculate tree growth rates based on tree measurement data captured within the project area
- The carbon uptake of each species is calculated using the CO2FIX-V3 model (Mohren et al 2004).
- These model outputs are then used to build the result for the technical specification based on the numbers of species in each system and the length of rotations.

The procedure used to calculate the potential carbon sink created by woodlots is set out in '*Assessment of Net Carbon Benefit of CDI Land Use Activities' (Camco, 2010)*. The potential carbon sink created by this land use system (based on long-term average carbon storage over 50 years) is calculated to be 50.88 tonnes of carbon per hectare.

13.0 BUFFER

Twenty percent (20%) of all VER's generated by the project activities are maintained as a risk buffer. Records of all buffer stock should be maintained in the database. It has yet to be decided at what stage the right to trade these VER's will return to the farmer.

14.0 CALCULATION OF CREDITS

For purposes of quantifying Plan Vivo certificates (carbon offset), the net carbon benefit of this tree planting system in addition to the baseline has been calculated. In accordance with Plan Vivo standards (http://www.planvivo.org/) 20% of all the carbon offset (i.e. net carbon benefit) is set aside to be kept as a risk buffer (i.e. non tradable carbon asset). Records of all buffer stock should be maintained in the database. The net carbon benefit, buffer stock and tradable carbon offsets (Plan Vivo certificates) generated by the woodlot land use system (technical specification) is presented in the table below extracted from the carbon modelling report entitled "*Assessment of Net Carbon Benefit of CDI Malawi Land Use Activities (Camco, 2011).*

Table 11: The net carbon benefit and tradable carbon offset for the woodlot land use system.

Technical Specification	Sink (tC/ha)	Baseline (tC/ha)	Net benefit (tC/ha)	Net benefit (tCO_2/ha)	Buffer (%)	Tradeable (tCO_2/ha)
Woodlot	51	1.43	49.57	187	20%	150

The figure below shows the long-term average carbon sink over the simulation period (50 years).

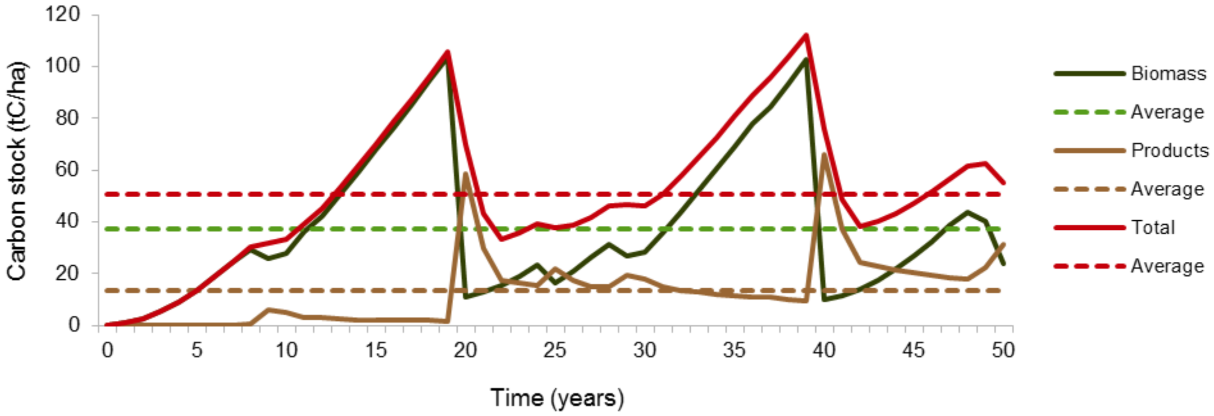

Figure 1: Woodlot technical specification carbon sequestration potential over 50 years.

15.0 MONITORING

Monitoring targets for the first 4 years are based on establishment whereby the whole plot must be established by the fourth year with at least 90% survival of trees. Thereafter monitoring targets are based on growth rates indicated by the Diameter at Breast Height (DBH). The expected DBH at the time of monitoring is based on a predicted mean annual diameter increment on which carbon sequestration estimates are based. Table 12 below shows the monitoring schedule (in years) and the corresponding key indicators or targets that are expected to be met by producers to warrant receipt of carbon finance upon selling of their carbon credits.

Table 12: Monitoring milestones at different monitoring periods

Year	Monitoring Indicator
1	At least 50% plot established.
2	At least 75% plot established.
3	Whole plot established with 85% survival of trees.
4	Whole plot established with at least 90% survival of trees.
5	Average DBH not less than 4cm.
7	Average DBH not less than 8cm.
10	Average DBH not less than 15cm.

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