PANDA MITI KIBIASHARA
PRIVATE FORESTRY PROGRAMME

PRIVATE FORESTRY PROGRAMME

END-OF-DRY SEASON WOODLOT ASSESSMENT 2016/17

United Republic of Tanzania
MINISTRY OF NATURAL RESOURCES AND TOURISM
Forestry and Beekeeping

FORMIN.FINLAND.FI

MINISTRY FOR FOREIGN AFFAIRS OF FINLAND

PANDA MITI KIBIASHARA
PRIVATE FORESTRY PROGRAMME

End-of-Dry-Season woodlot assessment 2016/17

Survey report

Iringa, Tanzania, 2017

United Republic of Tanzania
MINISTRY OF NATURAL RESOURCES AND TOURISM
Forestry and Beekeeping Division

FORMIN.FINLAND.FI
EMBASSY OF FINLAND
DAR ES SALAAM

End-of-Dry-Season woodlot assessment 2016/17

Survey report

Recommended citation:
End-of-Dry-Season woodlot assessment 2016/17. Survey report. PFP 2017, Iringa, Tanzania.

Private Forestry Programme – Panda Miti Kibiashara
Plot no.21, Block 1, Zone 1A
Gangilonga
P.O. Box 2244, Iringa.

www.privateforestry.or.tz

TABLE OF CONTENTS

LIST OF ANNEXES

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

GPS	Global positioning system
KVTC	Kilombero Valley Teak Company
NFC	New Forests Company
OSP	Outgrower support programme
PFP	Private Forestry Programme
PPI	Progress out of Poverty Index
TGA	Tree Growers' Association
TGIS	Tree Grower Incentive Scheme

EXECUTIVE SUMMARY

This report summarises findings of the PFP woodlot quality and growth assessment conducted at the end of dry season 2016/17. The aim of the study was to visit and assess all woodlots established through the PFP Tree Grower Incentive Scheme (TGIS) in-kind support during the first two years of the programme. Additionally, woodlots from two PFP-supported outgrower support programmes (OSP) by two forestry companies (Kilombero Valley Teak Company and New Forests Company) were included.

Stand density, survival rate of trees, height growth and observed level of weeding activities were recorded in the survey. Additionally, about half of the beneficiaries were interviewed for assessment of their socioeconomic status through Progress out of Poverty Index (PPI) score. A summary of the woodlot results is shown in table below.

Summary of recorded mean woodlot figures by support model

Support scheme	Mean stand density (stems/ha)	Survival-%	Mean height (m) (1st year)	Mean height (m) (2nd year)	Circle weeding score (scale 0–3)	Slash weeding score (scale 0–3)
TGIS in-kind	1,065	79.1%	0,51	1.57	0.57	0.52
KVTC-OSP	780	86.1%	0.43	2.01	1.93	2.04
NFC-OSP	1,198	70.3%	0.55	n/a	0.70	1.01

The level of weeding had positive correlation with tree survival rate, with mean difference up to 14 percent points between no weeding and good weeding, depending of the age, species group and weeding type. The level of weeding also had generally positive correlation with height growth. However, apart from the KVTC-OSP, the recorded mean weeding levels were below silvicultural standards as promoted by the programme. Eucalyptus was found to suffer more from the lack of weeding in terms of both tree survival and height growth. Distribution of the data within the support models was generally wide concerning all recorded variables.

The recorded mean PPI score was 40 in TGIS-in-kind (relatively good for rural Tanzania) and 27 in KVTC-OSP (on the lower side), indicating a significant difference between the socioeconomic background within the beneficiaries of the two support models. NFC-OSP mean result of 45 was not comparable due to low number of observations. The socioeconomic status as indicated by PPI score was not found to have an effect on the level of conducted weeding activities.

1. INTRODUCTION

1.1 Background

The Private Forestry Programme (PFP) aims at increasing rural income in the Southern Highlands of Tanzania through developing sustainable and profitable forestry and value addition in the entire production value chain from quality seeds to quality products in the markets. The programme is funded by the Ministry for Foreign Affairs of Finland and the Ministry of Natural Resources and Tourism of Tanzania.

Among the core activities of the programme is supporting establishment of high-quality smallholder plantations. The total area target for the first four-year phase of the programme is 15,000 ha. A total of close to 3,000 ha was achieved during the first two years of planting. The smallholder plantation establishment is supported through different tree growing incentive schemes (TGIS), which during the first two years included the following three major distinctive support models. Further details of different components included in the TGIS models are given in Table 1.

a. ***The programme standard TGIS in-kind:*** Beneficiaries organised under Tree Growers' Associations (TGAs) were supported to plant pine and eucalyptus;

b. ***Outgrower Support Programme (OSP) of the Kilombero Valley Teak Company (KVTC):*** A previously existing OSP of KVTC was expanded through the PFP support in 2014/15 and 2015/16. Beneficiaries were supported by KVTC to plant and grow teak. The OSP was implemented through the company;

c. ***Outgrower Support Programme (OSP) of the New Forests Company (NFC):*** A new OSP implemented since 2015/16 planting season. Beneficiaries were supported by NFC to plant pine. The OSP was implemented through the company.

Table 1 Support provided to beneficiaries by main TGIS model

Category	Description of the support provided to beneficiaries	TGIS model		
		TGIS in-kind	KVTC-OSP	NFC-OSP
Capacity building	VLUP preparation support	x		
	Assistance in TGA / outgrower group formulation and official registration	x		x
	Training provision on administration	x		x
	Training provision on silviculture	x		x
Technical support	Extension support person made available	x	x	x
In-kind support	Provision of herbicides	x[a]	x	
	Provision of fertilizer	x	x	x
	Free distribution of improved seedlings for planting	x	x[b]	x
	Free distribution of improved seedlings for blanking upon need	x	x	x
	Firefighting equipment made available	x		x
Labour cost support	Tree growers paid 50% of standard unit rates for conducting silvicultural activities on their woodlots as per management regime		x	
End product market	Guaranteed market provided for the end product (assuming quality standards met)		x	x
	Right reserved to company for 25% of the end product and first right of refusal to the rest of the end product		x	

[a] *Applied during season 2014/15*
[b] *Up to a maximum of 50 ha per beneficiary*

A number of smaller support schemes have also been applied by PFP. These include seed orchard establishment, establishment of TGA based demo plots and planting woodlots for the vulnerable groups within the supported communities. In the breakdown of the results in this report, the plantation establishment for the vulnerable groups has mostly been included as a separate support model in addition to the three major support models.

Additionally, a cash incentive enhancement to the TGIS in-kind was piloted in the two villages of Lusala and Mgala during planting season 2015/16. It included provision of cash to the beneficiaries according to standard unit rates of labour cost given that the woodlot weeding had been done according to acceptable standards by the time of a final verification survey.

1.2 Scope of the survey

The End-Of-Dry-Season 2016/17 assessment was designed and carried out in order to assess the quality and survival of the woodlots established through the different PFP-supported planting schemes during the first two years of the programme. The exercise targeted visiting and measuring all of the established (and surviving) woodlots from the TGIS in-kind planting 2014/15 and 2015/16 and NFC-OSP 2015/16. Demo plots and plantations established for the vulnerable groups were also included in the exercise. The established two seed orchard sites were left out of the scope of the study.

Additionally, the survey targeted visiting and measuring a reasonably large sample of the KVTC-OSP woodlots.

1.3 Objectives of the survey

The exercise had three primary objectives:

1. Assess the performance, survival, and level of management of the woodlots established through the different support mechanisms engaged by PFP during the first two years of the programme.
2. Verify the status of the woodlots included in the PFP database.
3. Collect PPI scores from supported beneficiaries for socioeconomic comparison and later impact assessments.

The objective 1 was also intended to enable comparison of the woodlot performance between the different TGIS support mechanisms.

The objective 2 refers to writing off woodlots demonstrating unacceptable condition in relation to the programme targets. It also included writing off any non-existing woodlots included in the database based on erroneous information (typically pre-planting data), and adding information of any established woodlots that were found to be missing from the database.

2. METHODOLOGY

2.1 Sampling

In accordance with the object 2 of the exercise, the target sample size of the field assessment of woodlots was 100%. Hence, no general sampling methodology was applied with woodlots.

The exception in the woodlot sampling was the KVTC-OSP, where the OSP woodlots located in the Kilombero DC established in 2014/15 and 2015/16 were chosen as the target population. This was done both for logistical reasons and due to the area share of this woodlot pool in relation to all of the OSP woodlots, approximately matching the PFP share of funding in the joint OSP.

Concerning the PPI score interviews with supported tree growers, the selection of interviewees was based on availability of the beneficiaries and the field team capacity to conduct interviews in addition to the woodlot measurements. Initially, 75% of the beneficiaries was applied as a target guideline. This was later often adjusted into 50% in individual villages, based on the encountered circumstances.

2.2 Variables assessed in the study

2.2.1 Woodlots

The exercise included measuring a set of variables from a fixed area sample plot placed in the woodlot. Other variables were assessed visually concerning the whole woodlot area. Figure 1 shows an illustration of the set-up. The complete list of variables recorded from the woodlots is included in Table 2.

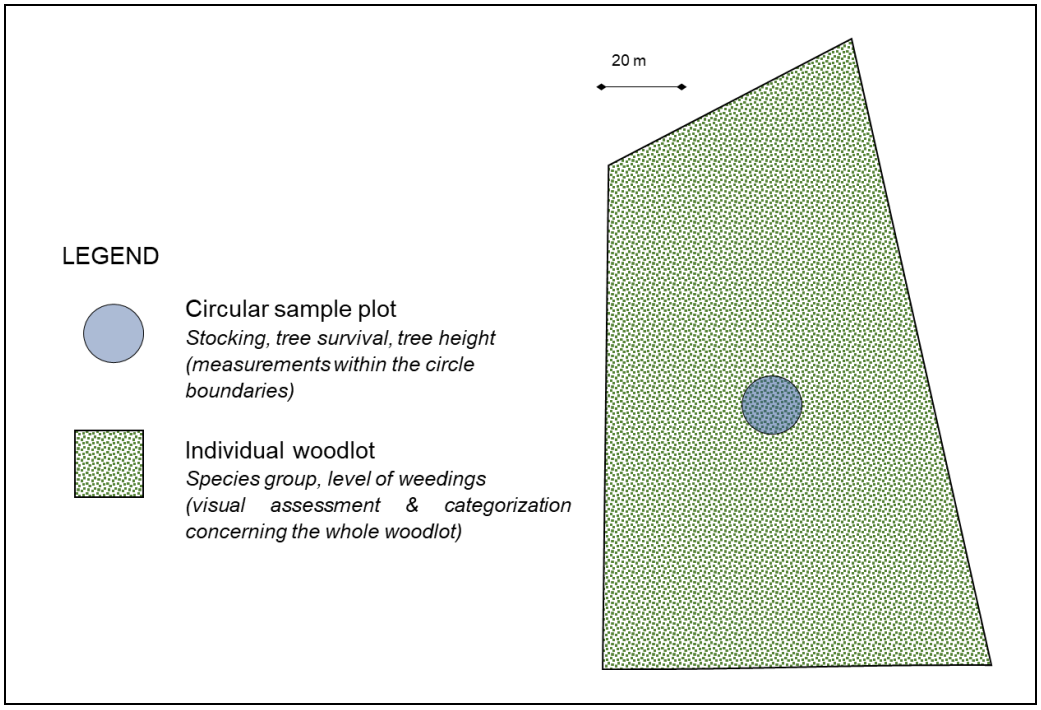
Table 2 List of woodlot variables recorded in the assessment

No.	Variable	Collection method	Data type
1	Woodlot location	Background information	attribute
2	Woodlot owner	Background information	attribute
3	Species group (pine/euca/teak)	Visual for whole woodlot	attribute
4	Level of circle weeding	Visual for whole woodlot	attribute
5	Level of slash weeding	Visual for whole woodlot	attribute
6	Number of alive trees	Sample plot	attribute
7	Number of dead trees	Sample plot	attribute
8	Height of the two tallest trees	Sample plot	attribute
9	Cause of seedling/tree death	Sample plot	attribute
10	Sample plot centre coordinates	GPS	spatial
11	Sample plot boundaries *	GPS	spatial

* *Note: Recorded in the case of missing or erroneous pre-existing boundaries only.*

If the owner of the woodlot was not found to be previously included in the PFP database, the full name and contact information of the owner were also recorded.

Figure 1 Illustration of the woodlot assessment set-up



2.2.2 PPI interviews

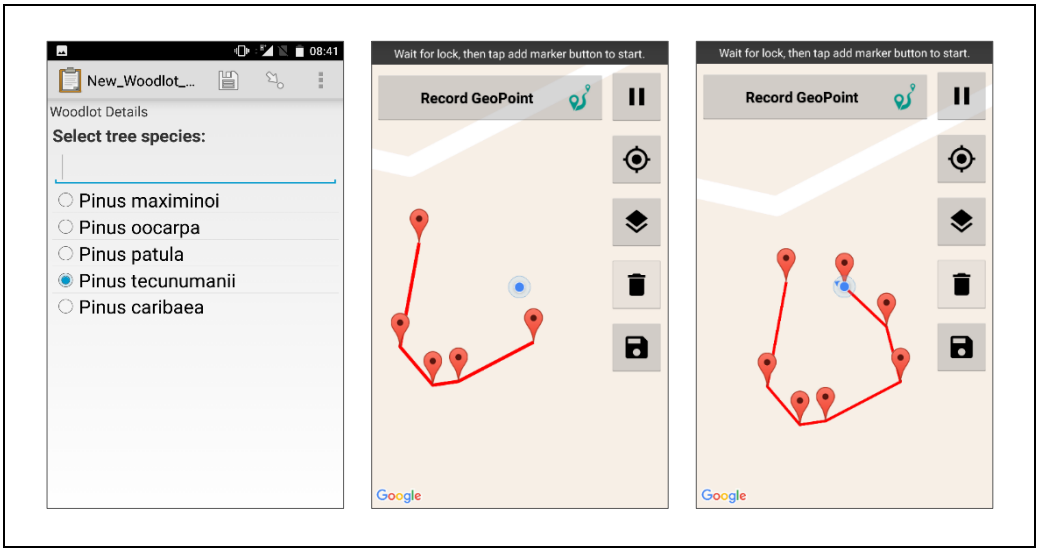
PFP has previously applied PPI score for assessment of socioeconomic status of the beneficiaries. The PPI scores recorded during this exercise were collected using the PPI for Tanzania 2011, which incorporates a revised questionnaire created in June 2016. The new PPI version applies an updated definition of poverty, being hence compatible with the current Tanzanian measurement standard. The transition however also rendered direct comparison between the previous and the new PPI score results unfeasible.

Since the PPI score questionnaire is created to be applied with households, the institutional beneficiaries of PFP were excluded from the interviews.

2.3 Data collection tools

The exercise utilised free and open source smartphone application ODK Collect as the main data collection tool. It was used for both the attribute and spatial data collection from the woodlots (Table 2, Figure 2), and for the PPI score questionnaire. Additionally, external GPS units were used to provide improved accuracy compared to the regular smartphone GPS in the spatial data collection.

Figure 2 **Examples of woodlot attribute data (left) and spatial data (centre and right) recording with smartphone using ODK Collect**



2.4 Field procedures

The field work took place during December 2016 and January 2017. The teak woodlots of KVTC-OSP were assessed in early February 2017.

A flowchart used to follow the assessment procedure during the field work is included as Annex 2.

2.4.1 Navigation and placement of sample plots

The field teams used GPS in navigation to the woodlots. They were provided both with the woodlot centroid coordinates and the pre-existing boundary data of the woodlot visualised in the ODK Collect map viewer (Figure 2). Each team was also always accompanied with at least one local TGA representative acting as a guide (with KVTC-OSP the teams were guided by a company OSP representative). In some cases, the woodlot owner was willing to join the team in the field.

Each woodlot had a pre-determined sample plot location placed in its centroid (Figure 1), and the teams had instructions to place their sample plots either on that very location or its vicinity. The GPS coordinates were recorded for the realised sample plot centres. In 2015/16 woodlots, the teams also placed a metal bar of about 10 cm length underground in the sample plot centres to enable precise later centre location identification with a metal detector. In 2014/15 woodlots this was not done, since the majority of them had been marked with an underground metal bar already during the 2014/15 survival ang quality assessment[1].

In the following cases, the sample plot was always placed manually by the survey team within the woodlot: i) no pre-existing woodlot boundary information; ii) centroid falling outside the woodlot or next to the border of the woodlot; and iii) centroid falling on an anomaly within the woodlot. A single sample plot was measured per each woodlot.

[1] http://www.privateforestry.or.tz/en/resources/view/survival-and-quality-assesment-of-smallholder-plantations-established-with

2.4.2 Sample plot measurements

Circular sample plots with a radius of 7.57 m were used in the exercise. The radius was set so that with the 3 x 3 m planting density (1,111 trees per ha) applied in all PFP support models there would be 20 trees in the sample plot area. Circular sample plot type was selected to be used due to its cost-effectiveness in taking a large number of temporary sample plots.

The teams used ropes cut to 7.57 m length in determining the sample plot boundaries. Number of alive trees and number of dead trees were counted within the sample plot area, and the heights for the two tallest trees on the sample plot were measured with 10 cm precision using a measurement pole for determination of the dominant height. In the case of dead trees in the sample plot, if the teams were able to identify the likely main cause of death they categorised it according to Table 3.

Table 3 Classification for causes of tree death

Category no.	Cause of death
1	N/A
2	Suppression by weeds
3	Fire damage
4	Disease
5	Insect damage
6	Cattle trampling
7	Drought stress
8	Other

2.4.3 Assessment of the level of weeding

The level of circular weeding and the level of slash weeding in a woodlot were assessed separate from each other, based on visual interpretation from the whole woodlot area rather than the sample plot only. The both weeding types were given individual scores depending on the observed level of performance of the activity. The assessment of the level of both weeding types followed the same four-tier classification presented in Table 4.

This methodology was adopted to maintain compatibility with the field study assessing the TGIS cash mechanism pilot in May 2016. It should be noted that while the classification (Table 4) uses the phrase “acceptable”, no support decisions were done this time related to the assessed level of weeding neither as a part of this exercise nor based on its results.

Table 4 Classification for the level of weeding

Category/ Score	Title	Definition
0	No weeding done	There are practically no signs of weeding activities done during the past rainy season
1	Some weeding done, but not acceptably	There is clear evidence of weeding activities taken place during the past rainy season; however they have not been done sufficiently to ensure tree survival, good quality and good growth in the woodlot.
2	Weeding activities done acceptably	There are some shortcomings in the weeding activities, but the overall level is clearly sufficient to help ensure tree survival, good quality and good growth in the woodlot.
3	Weeding activities done completely	There are practically no signs of shortcomings, and all weeding activities appear to be conducted throughout the woodlot.

The classification was reflected against the technical guidelines for circle and slash weeding as presented in the PFP TGIS guidelines[2]. These require:

i. Circle weeding: 50 cm radius around the tree to be cleared of weeds without damage to the tree

ii. Slash weeding: all living weeds cut lower than 30 cm height.

2.5 Challenges

A large share of the woodlots assessed in the exercise could not be linked with the preceding woodlot attribute data with certainty due to the shortcomings that occurred with woodlot ID recording during the preceding season's spatial data collection. Hence the exercise used tree species group (pine/eucalyptus/teak) instead of the exact tree species, and it was not possible to conduct performance comparison based on individual woodlots' planting dates within the exercise.

2.6 Calculations and statistical analysis

The following statistics were calculated based on the variables measured in the study:

i. ***Stand density (stems/ha):*** the number of live trees plus number of dead trees in the sample plot, extended into a figure per hectare.

ii. ***Survival rate:*** the share of live trees of the total number of trees in the sample plot.

iii. ***Stand height:*** Average calculated from the two tallest tree heights measured in the sample plot. Assuming 3 x 3 m planting density, the figure represents the average height of 100 tallest trees in a hectare, hence corresponding with the dominant height of the stand.

The statistical analysis of the data was conducted as follows:

i. ANOVA for determination of statistical significance of the differences between the means of different data groupings. Tukey's honest significant difference test was applied to minimise the risk resulting for simultaneous comparison of multiple groups. 95% confidence interval was applied and equal variances were assumed between the compared groups.

ii. Linear regression for determining correlation between chosen two variables.

[2] http://www.privateforestry.or.tz/en/resources/view/pfp-tree-growing-incentive-scheme-guidelines-for-2016-17

3. RESULTS

3.1 Number of surveyed woodlots

A total of 1,956 woodlots owned by 1,329 beneficiaries were surveyed in the study. The figure consists of:

a. 1,708 TGIS in-kind woodlots owned by 1,163 beneficiaries, including:

   i. 18 woodlots established for the vulnerable groups (counted as a single beneficiary);

   ii. 3 demo plots (counted as a single beneficiary);

b. 73 NFC-OSP woodlots owned by 65 beneficiaries;

c. 129 KVTC-OSP woodlots owned by 101 beneficiaries; and

d. 46 woodlots that were found to be destroyed by fire.

Breakdown of the figures by scheme and village is included in Table 5, Table 6 and Table 7.

Many of the woodlots destroyed by fire were scheduled for replanting during 2016/17, and apart from Table 8, their data has been excluded from the calculations and results presented in this report. Since fire damage was considered a special case, data from the woodlots that demonstrated 0% survival for reasons other than fire was included in the results.

Table 5 Observations from TGIS in-kind woodlots

Village	Number of beneficiaries	Number of woodlots	No. of woodlots established in 2014/15		No. of woodlots established in 2015/16		Total area (ha)
			Pine	Euca	Pine	Euca	
Amani	39	41	-	-	-	41	65.0
Iboya	47	127	59	13	35	20	344.0
Ikang'asi	49	77	10	49	-	18	126.7
Itambo	31	45	2	24	-	19	81.8
Kifanya	68	126	74	19	27	6	206.6
Kiyowela	18	20	-	-	19	1	28.1
Lugema	14	18	-	-	13	5	81.3
Lugolofu	88	98	-	-	97	1	80.6
Lusala	99	195	160	5	30	-	129.1
Madope	122	146	-	-	138	8	179.5
Magunguli	32	48	-	-	29	19	81.3
Masimbwe	29	36	-	-	27	9	141.6
Matembwe	11	11	11	-	-	-	6.0
Mavanga	101	169	93	-	76	-	68.5
Mgala	21	38	16	4	14	4	239.9
Ngalanga	55	80	30	5	42	3	248.8
Ng'elamo	37	57	29	7	13	8	55.4
Nhungu	70	84	-	-	83	1	99.1
Ukwama	159	166	-	-	166	-	93.5
Usagatikwa	28	38	10	1	26	1	31.6
Utilili	60	88	-	-	84	4	157.1
TOTAL	1,163	1,708	494	127	919	168	2,545.5

Out of the 21 studied villages that received PFP TGIS in-kind support during 2014/15 and 2015/16, a 100% or a near-100% sample was achieved in all apart from Lusala. Lusala remained with 35 unmeasured woodlots which could not be covered in the study. They were set to be visited and verified separately later through other exercises. Two seed orchard sites and some demo plots established through PFP support were not visited during the exercise.

A 100% sample was also achieved with the NFC-OSP woodlots of 2015/16. Concerning KVTC-OSP, the 129 visited woodlots accounted for an 83% sample of the 156 OSP woodlots which were located in Kilombero DC according to the company compartment register.

Table 6 Observations from NFC-OSP woodlots

Village	Number of beneficiaries	Number of woodlots	Total area (ha)
Kidabaga	12	12	5.0
Kiwalamo	25	27	18.2
Makungu	17	21	57.3
Ukwega	11	13	9.6
TOTAL	65	73	90.1

Table 7 Observations from KVTC-OSP woodlots

Number of beneficiaries	Number of woodlots	No. of woodlots established in 2014/15	No. of woodlots established in 2015/16
101	129	54	75

Note: The table only represents a sample of the KVTC-OSP woodlots.

Table 8 Woodlots destroyed by fire

Village	Scheme	No. of burned woodlots	Share of burned woodlots from the total no. of woodlots
Amani	TGIS in-kind	4	9.0%
Ikang'asi	TGIS in-kind	1	1.3%
Itambo	TGIS in-kind	9	16.7%
Kifanya	TGIS in-kind	5	3.8%
Lusala	TGIS in-kind	6	3.0%
Magunguli	TGIS in-kind	1	2.0%
Utilili	TGIS in-kind	19	17.8%
Makungu	NFC-OSP	1	4.5%
TOTAL		46	2.4%*

** The figure for the total share of burned woodlots is counted against the total of 1,956 woodlots.*

A total of 46 woodlots across the different PFP support schemes, with an estimated total area of 53 ha, were found to be destroyed by fire during the dry season. 45 of these woodlots had been established through TGIS in-kind and one woodlot through NFC-OSP (Table 8). Utilili suffered the most extensive losses both in terms of absolute number of burned woodlots and their percentage share from all PFP-supported woodlots. Itambo also had a notably high share of burned woodlots. In addition, partial fire damage was encountered in many woodlots across the study area.

3.2 Level of weeding

The observed levels for both circle weeding and slash weeding were generally low. In the four-tier scale 0–3, the mean scores by species and age breakdown remained largely under 1 and hence far from silviculturally approvable levels (Table 9). An exception was KVTC-OSP, which demonstrated significantly higher scores in both weeding types. The frequencies of assessed weeding scores are presented in Figure 3 and Figure 4. The TGIS cash pilot villages Lusala and Mgala showed average performance in relation to the level of weeding weeding (Table A1.1 of Annex 1).

Table 9 Mean circle weeding and slash weeding scores by support scheme, species group and year of stand establishment

Support scheme	Sp. group	Circle weeding			Slash weeding		
		14/15	15/16	Total	14/15	15/16	Total
TGIS in-kind	Pine	0.72	0.55	0.61	0.77	0.44	0.56
	Euca	0.27	0.49	0.39	0.21	0.42	0.33
	Total	0.63	0.54	0.57	0.66	0.44	0.52
Plantations for vulnerable groups	Pine	1.00	1.00	1.00	1.00	0.33	0.60
	Euca	1.50	0.25	0.88	1.00	0.75	0.88
	Total	1.25	0.70	0.94	1.00	0.50	0.72
KVTC-OSP	Teak	2.25	1.68	1.93	2.33	1.81	2.04
NFC-OSP	Pine	n/a	0.70	0.70	n/a	1.01	1.01

Figure 3 Frequencies of the assessed weeding scores of TGIS in-kind pine woodlots (left) and eucalyptus woodlots (right)

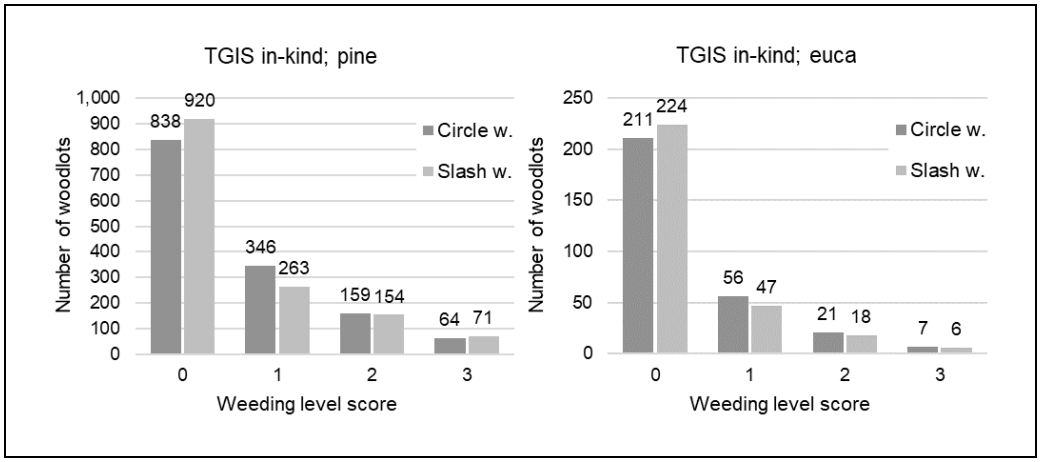
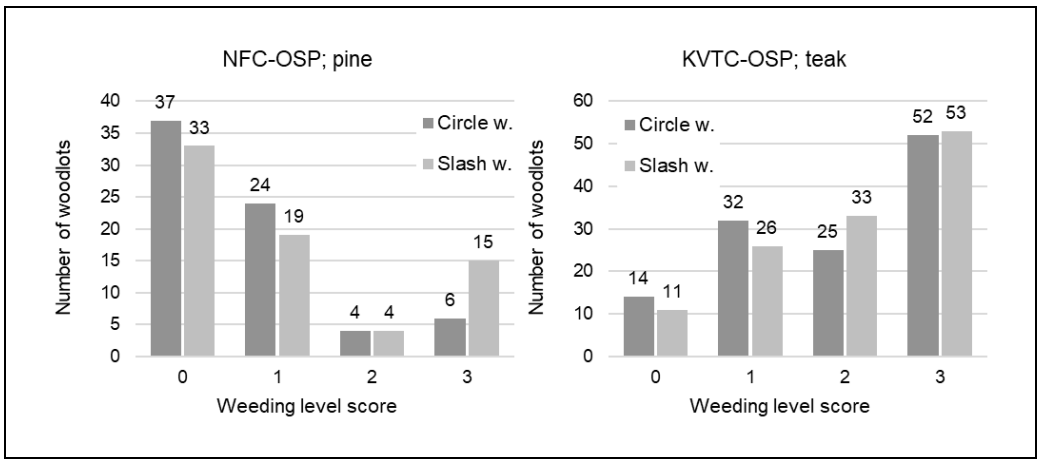


Figure 4 Frequencies of the assessed weeding scores of NFC-OSP pine woodlots (left) and KVTC-OSP teak woodlots (right)



3.3 Stand density

The reference figure for interpreting the stand density results is 1,111 stems per ha. This results from 3 x 3 m planting density, which is the standard promoted for appliance in all of the programme support models.

The interpretation of the stand density results should take into account that tree survival rate was assessed independent of the stand density, i.e. the density figures presented also include any standing dead trees within sample plots.

Table 10 compiles the observed general mean stand densities. The mean stand density within TGIS in-kind woodlots was 1,064 stems/ha. The mean figures for KVTC-OSP and NFC-OSP were 780 stems/ha and 1,198 stems/ha, respectively. The KVTC-OSP in fact had lower mean stand density than any individual village under the other assessed support schemes. On the contrary, all NFC-OSP villages demonstrated higher-than-average mean stand density figures, with Kidabaga having the highest observed mean of 1,537 stems/ha. The distribution of observed stand densities by village is included in Figure 5. The OSP areas are included in the right end of the x-axis, showing e.g. the divergent distributions of Kidabaga and Kilombero DC.

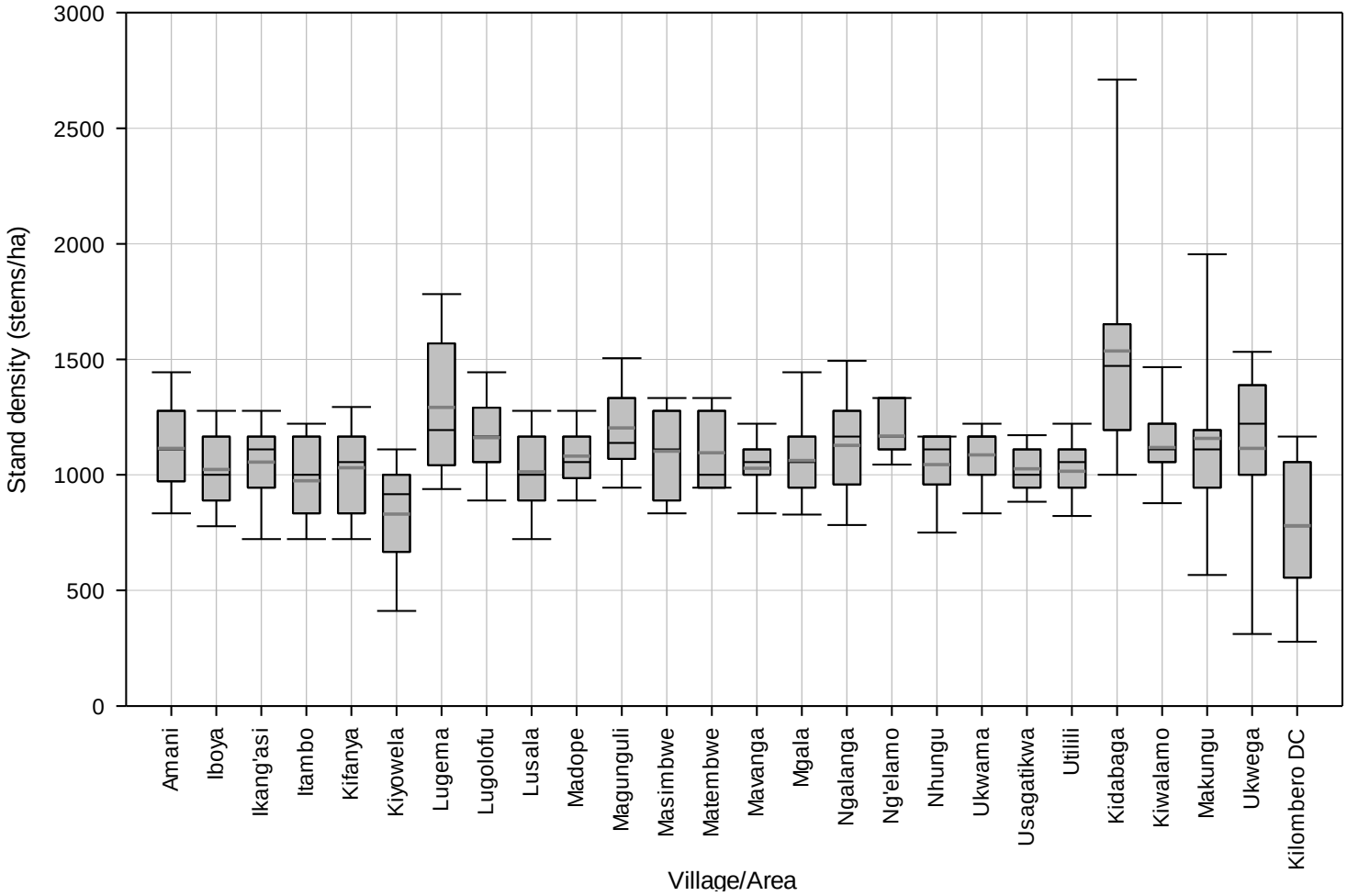
A major apparent reason for the lower stand densities observed at KVTC-OSP was an abnormally long dry season experienced in Kilombero after the 2015/16 planting season. The first rains only started briefly prior to the field survey. Some sprouts from the planted stumps had not emerged from underground and it was impossible to determine whether the tree was dead or yet to emerge. In the case of teak, this was subsequently reflected in lowered stocking figures rather that lowered survival rate.

Outside of KVTC-OSP, limited conclusions can be drawn from statistics behind the mean stand densities of individual villages. Kidabaga in NFC-OSP is a clear statistical deviation. Kiyowela (830 stems/ha), Lugema (1,293 stems/ha) and Maguguli (1,204 stems/ha) in TGIS in-kind also show significant differences in comparison to much of the rest of the data.

Table 10 Mean stand densities by support scheme, species group and year of stand establishment

Support scheme	Species group	Mean stand density (stems/ha)		
		2014/15	2015/16	Total
TGIS in-kind	Pine	1,050	1,072	1,064
	Euca	1,006	1,111	1,066
	Total	1,041	1,078	1,065
Plantations for vulnerable groups	Pine	944	917	928
	Euca	1,111	1,083	1,097
	Total	1,028	1,003	1,003
KVTC-OSP	Teak	813	747	780
NFC-OSP	Pine	n/a	1,198	1,198

Figure 5 Stand density distribution by village



Note: The boxes represent observations between 25th and 75th percentile, and the whiskers represent observations between 10th and 90th percentile. The box middle bars show medians (black bar) and arithmetic means (grey bar).

3.4 Tree survival

3.4.1 General survival figures

The overall mean survival percentage of the TGIS in-kind supported woodlots was 79% (Table 11). KVTC-OSP woodlots demonstrated higher overall mean survival of 86%. With NFC-OSP woodlots the correspondent figure was 70%. The lower figure resulted presumably from the late timing of planting in the NFC-OSP during 2015/16. The losses were addressed adequately in the company plan for blanking.

Eucalyptus generally demonstrated lower mean survival rates than pine. While the difference was rather marginal in the recently planted 2015/16 woodlots, in the two-year-old 2014/15 woodlots it was notably large 11 percent points. Comparison based on species was not applicable within the OSP schemes since they only applied a single species each.

Table 11 Mean survival rates by support scheme, species group and year of stand establishment

Support scheme	Species group	2014/15	2015/16	Grand Total
TGIS in-kind	Pine	90.0%	74.5%	80.0%
	Euca	78.6%	71.8%	74.8%
	Total	87.7%	74.1%	79.1%
Plantations for vulnerable groups	Pine	98.4%	65.6%	78.7%
	Euca	91.3%	89.0%	90.1%
	Total	94.9%	75.0%	83.8%
KVTC-OSP	Teak	91.5%	80.6%	86.1%
NFC-OSP	Pine	n/a	70.3%	70.3%

0% survival was discovered in total of 40 woodlots due to reasons other than fire damage. This included 15 woodlots in TGIS in-kind, 4 woodlots in NFC-OSP and 21 in KVTC-OSP. The estimated reasons for death included e.g. drought stress which was presumably related to late planting.

The observed survival rates were highly variable both between and within the villages (Figure 7). Comparison of mean survival rates between the villages generally showed statistically significant differences between a given village and a majority of the other villages. This suggests that plantation tree survival rate is a village-dependent phenomenon, which can hence be addressed through village-specific measures.

3.4.2 The relationship between tree survival and level of weeding

Tree survival rate was found to generally improve along with higher level of weeding. This was observed both with circle weeding and slash weeding. The correlations with tree survival were 12.6% and 21.5% regarding circle weeding and slash weeding score, respectively, with high statistical significance ($p<0.01$). Eucalyptus survival rate correlated stronger than survival of pine, especially in relation to the level of circle weeding. Table 12 and Table 13 show the observed mean effects on pine and eucalyptus stands of different age.

Table 12 Mean survival rate of pine and eucalyptus by observed level of circle weeding, species group and year of stand establishment

Circle weeding score	Mean survival rate (%)			
	2014/15		2015/16	
	Pine	Eucalyptus	Pine	Eucalyptus
0 (no weeding)	89.6%	77.6%	74.2%	68.5%
1 (inadequate)	91.8%	85.5%	69.9%	79.7%
2 (acceptable)	91.2%	85.1%	80.9%	89.4%
3 (good)	94.3%	n/a	85.0%	92.3%

Table 13 Mean survival rate of pine and eucalyptus by observed level of slash weeding, species group and year of stand establishment

Slash weeding score	Mean survival rate (%)			
	2014/15		2015/16	
	Pine	Eucalyptus	Pine	Eucalyptus
0 (no weeding)	87.6%	78.3%	72.2%	70.2%
1 (inadequate)	93.3%	86.3%	75.7%	76.5%
2 (acceptable)	93.7%	82.1%	76.8%	86.8%
3 (good)	98.1%	n/a	89.1%	93.7%

The effect of weeding on survival rate was especially clear with one-year-old eucalyptus stands, demonstrating about 24 percent point difference between no weeding and good weeding with both weeding types. The effect of slash weeding was more consistent on both species groups than the effect of circle weeding, with clear survival rate ascension from one score to the next (Figure 6).

Figure 6 The effect of the level of slash weeding to pine and eucalyptus survival rates

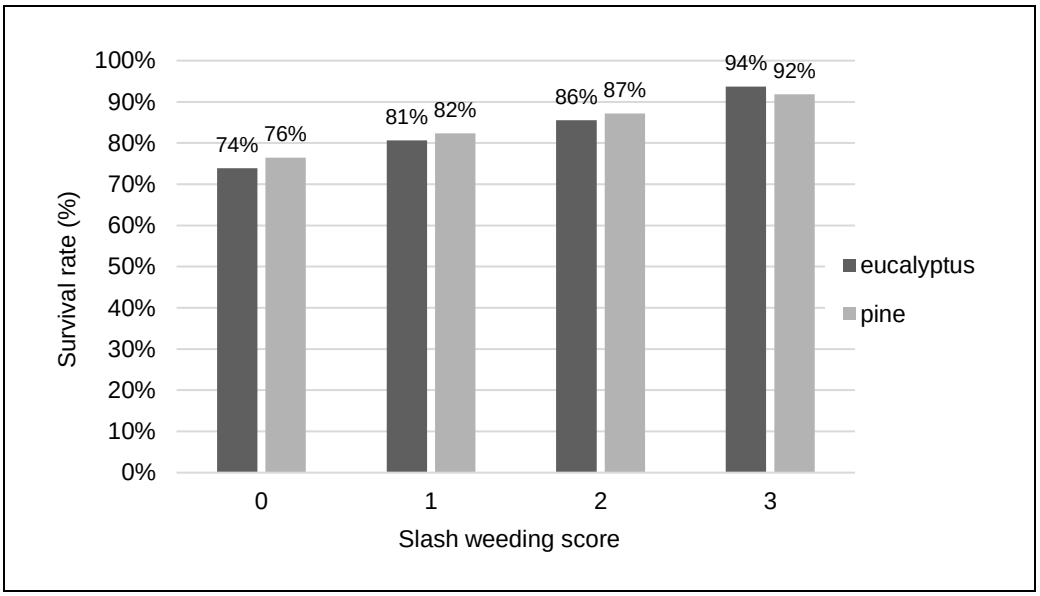
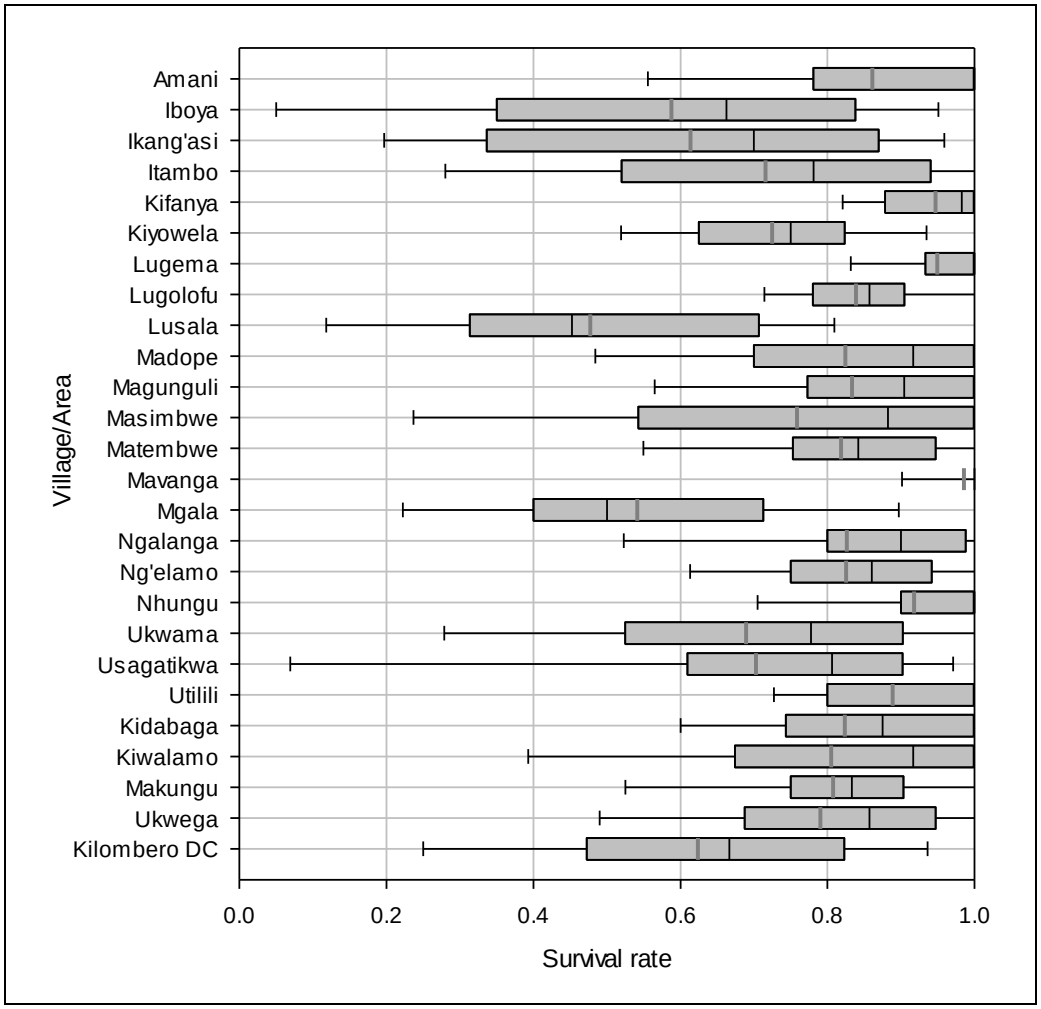


Figure 7 Survival rate distribution by village in TGIS in-kind and NFC-OSP villages, and in Kilombero DC



Note: The boxes represent observations between 25th and 75th percentile, and the whiskers represent observations between 10th and 90th percentile. The box middle bars show medians (black bar) and arithmetic means (grey bar).

3.5 Height growth

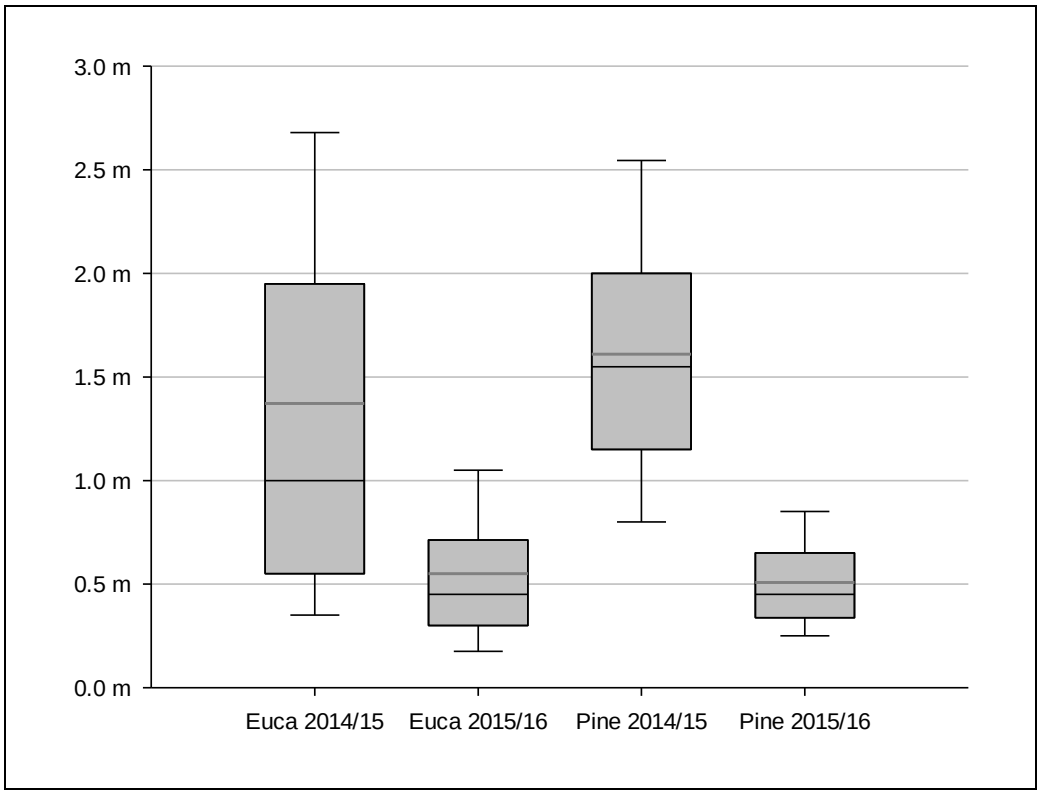
3.5.1 General height growth figures

Table 14 presents a compilation of the mean heights measured in the study. On average within the TGIS in-kind, the one-year-old plantations have reached a mean height of 0.51 m and two-year-old plantations have reached a mean height of 1.57 m. Figure 8 illustrates distribution of the recorded heights.

Table 14 Mean heights by support scheme, species group and year of stand establishment (m)

Support scheme	Species group	Mean height (m)	
		2014/15	2015/16
TGIS in-kind	Pine	1.62	0.50
	Euca	1.37	0.56
	Total	1.57	0.51
Plantations for vulnerable groups	Pine	1.00	0.54
	Euca	1.56	0.53
	Total	1.28	0.54
KVTC-OSP	Teak	2.01	0.43
NFC-OSP	Pine	n/a	0.55

Figure 8 TGIS in-kind tree height distribution by species and year of stand establishment



Note: The boxes represent observations between 25th and 75th percentile, and the whiskers represent observations between 10th and 90th percentile. The box middle bars show medians (black bar) and arithmetic means (grey bar).

3.5.2 The relationship between height growth and level of weeding

The average effect of weeding on height growth across all assessed pine and eucalyptus plantations is presented in Table 15 and Table 16. Positive stand height

trend experienced with higher weeding scores can be observed systematically throughout the series of the figures, and was also verified by the respective correlations between them (11.2% with circle weeding score and 22.3% with slash weeding score; $p<0.01$).

Table 15 Mean height of pine and eucalyptus by observed level of circle weeding, species group and year of stand establishment

Circle weeding score	Mean dominant height (m)			
	2014/15		2015/16	
	Pine	Eucalyptus	Pine	Eucalyptus
0 (no weeding)	1.56	1.31	0.49	0.51
1 (inadequate)	1.61	1.50	0.50	0.58
2 (acceptable)	1.73	1.70	0.58	0.71
3 (good)	1.76	n/a	0.59	0.98

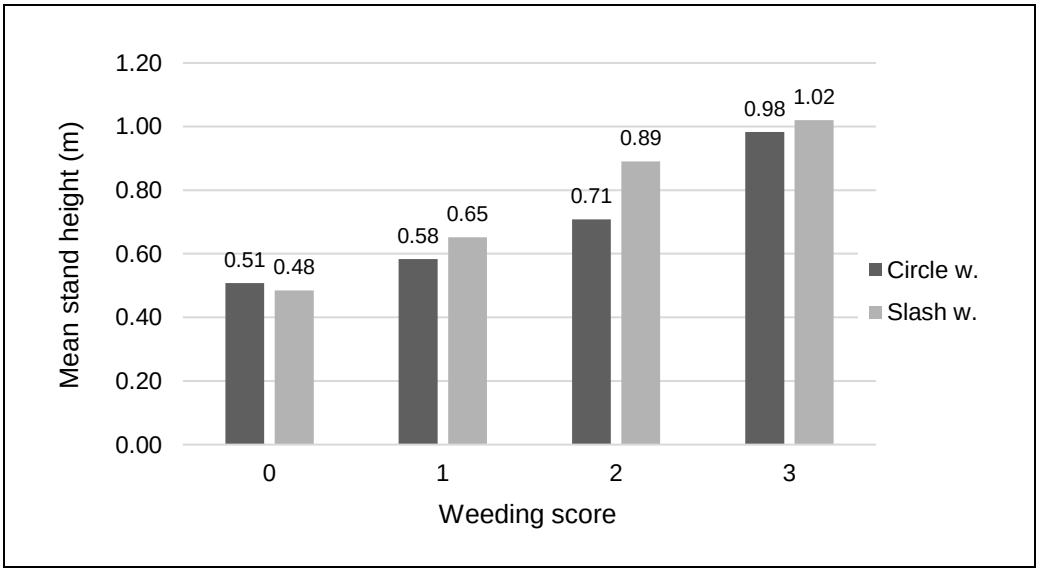
Table 16 Mean height of pine and eucalyptus by observed level of slash weeding, species group and year of stand establishment

Slash weeding score	Mean dominant height (m)			
	2014/15		2015/16	
	Pine	Eucalyptus	Pine	Eucalyptus
0 (no weeding)	1.37	1.25	0.50	0.48
1 (inadequate)	1.85	1.91	0.51	0.65
2 (acceptable)	1.86	1.83	0.53	0.89
3 (good)	2.14	n/a	0.49	1.02

A positive effect was also observed between the height growth of teak and the level of slash weeding. However, the height growth of teak seemed to appear somewhat independent from the assessed circle weeding scores.

According to the results, the strongest relative effect of weeding on the height growth has taken place with one-year-old eucalyptuses, the height growth of which doubles during the first year when no weeding is compared to good weeding with either of the weeding types (Figure 9).

Figure 9 Effect of circle and slash weeding on the height growth of eucalyptus stands during the first growing season



3.6 PPI scores

3.6.1 General description of the PPI data

PPI score results were obtained from a total of 563 people with existing PFP-supported woodlots (TGIS in-kind and NFC-OSP) assessed in this study (Table 17). This equals 46% of the beneficiaries within TGIS in-kind and NFC-OSP. The interviewed people possessed a total of 886 PFP-supported woodlots, which equals 50% of the TGIS in-kind and NFC-OSP woodlots assessed in this study.

Table 17 Mean PPI scores, and number and coverage of interviews by support scheme

Support scheme	No. of PFP beneficiaries	No. of PPI score interviews	%-covered of beneficiaries	Mean PPI score
TGIS in-kind	1,163	557	48%	40
NFC-OSP	65	6	9%	45
KVTC-OSP*	n/a	128	n/a	27

** The figures are based on a report from a separate survey by KVTC.*

The mean PPI score for the interviewed TGIS in-kind beneficiaries was 40 (Table 17). The respective figure for NFC-OSP was slightly higher (45), but meaningful comparison with TGIS in-kind is not possible due to the limited data behind the figure.

The PPI scores for KVTC-OSP beneficiaries were measured separately in an internal exercise carried out by the company, who submitted the results to PFP. According to the KVTC results, the mean PPI score for the OSP beneficiaries in Kilombero DC was 27. The mean score was substantially lower than the mean scores from the other two compared support models (Table 17), and in fact 10 points lower than any observed village-based mean score within TGIS in-kind and NFC-OSP. This indicates presence of notably different socioeconomic surroundings within the KVTC-OSP support model.

The breakdown of the PPI score results from TGIS in-kind and NFC-OSP by village is included in Table A1.4 of Annex 1. The share of interviewed TGIS in-kind beneficiaries per village ranged between 24% and 86%, while the mean was 48%. The share of interviewed NFC-OSP beneficiaries was significantly lower with 8–12% per village. The latter occurred due to a large number of interviews that had to be discarded from the sample since it was found out that a majority of the interviewed tree growers did not possess a standing NFC-OSP woodlot.

The differences between the means of individual villages (ranging from 34 to 56) were not statistically significant, with the exception of Ukwama (mean 34) in comparison with some villages with high-end mean scores. While Matembwe (TGIS in-kind) and Ukwega (NFC-OSP) stand out from others with significantly higher mean PPI scores, this seems to be related to the small number of respondents in both villages. Within the villages, there was considerable distribution in the data (Figure 11).

3.6.2 The relationship between PPI score and woodlot management

The PPI scores from TGIS in-kind and NFC-OSP were compared against the circle weeding scores and slash weeding scores observed at the owner's woodlot or woodlots. The observed correlations were practically negligible, with PPI score explaining merely 2.2% of the level of circle weeding and 2.4% of the level of slash weeding.

The result indicates that the socioeconomic status of a woodlot owner as reflected by the PPI score does not predict the level of early woodlot management. The observed differences in the level of management hence seem to occur due to other factors.

3.6.3 Interpretation of PPI scores as poverty likelihood

The PPI scores should be interpreted with the poverty likelihood table (Table 18). Distribution of the PPI score results into the categories corresponding to the poverty

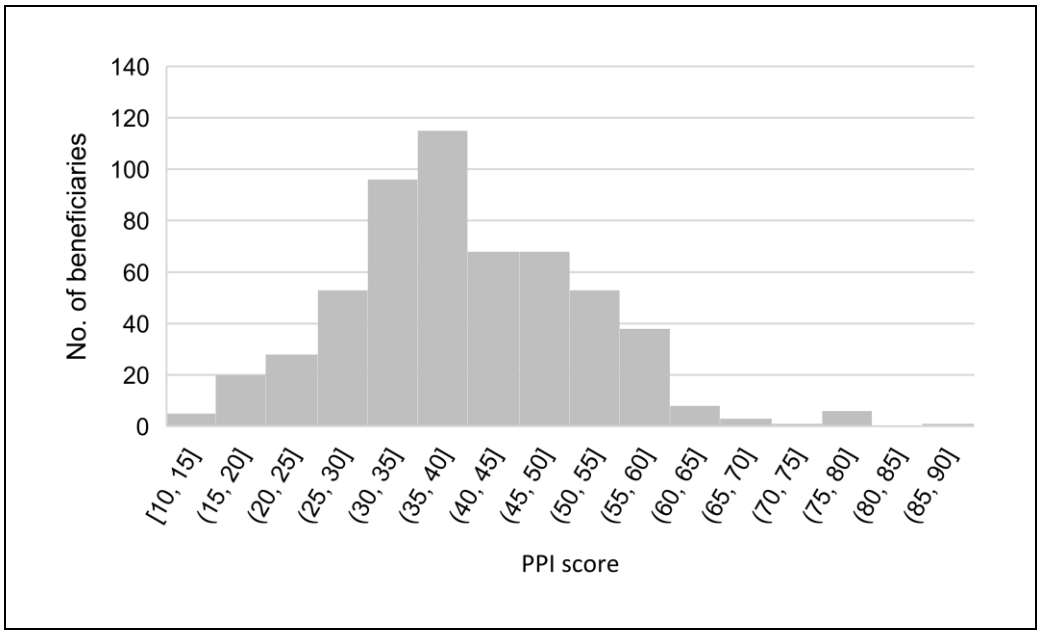
likelihood table is shown in Figure 10. The outcome is that an average PFP beneficiary with a PPI score of 40 has a 14.0% likelihood of being under the national poverty line, and 2.8% likelihood of being under the food poverty line. For comparison, the correspondent figures for rural Tanzania in general are 33.3% and 11.3%, respectively[3].

Table 18 Look-up table for converting PPI scores into poverty likelihoods

PPI score	Likelihood of being under the given poverty line (%)			
	Food poverty line	National poverty line	1.5 x National poverty line	2 x National poverty line
0 – 4	100.0	100.0	100.0	100.0
5 – 9	39.5	100.0	100.0	100.0
10 – 14	36.6	82.3	93.1	100.0
15 – 19	29.9	62.1	89.2	98.6
20 – 24	21.0	51.2	84.5	93.8
25 – 29	13.3	40.3	77.4	93.8
30 – 34	10.4	32.9	68.0	87.4
35 – 39	4.4	20.2	58.1	79.4
40 – 44	2.8	14.0	42.5	67.9
45 – 49	1.5	10.9	40.2	63.7
50 – 54	1.3	6.6	29.2	51.2
55 – 59	0.6	4.1	24.2	43.8
60 – 64	0.6	2.2	13.5	31.8
65 – 69	0.4	1.3	8.6	28.1
70 – 74	0.0	1.0	5.9	19.5
75 – 79	0.0	1.0	5.9	16.8
80 – 84	0.0	1.0	2.6	7.3
85 – 89	0.0	0.0	2.2	7.3
90 – 94	0.0	0.0	0.0	7.3
95 – 100	0.0	0.0	0.0	0.0

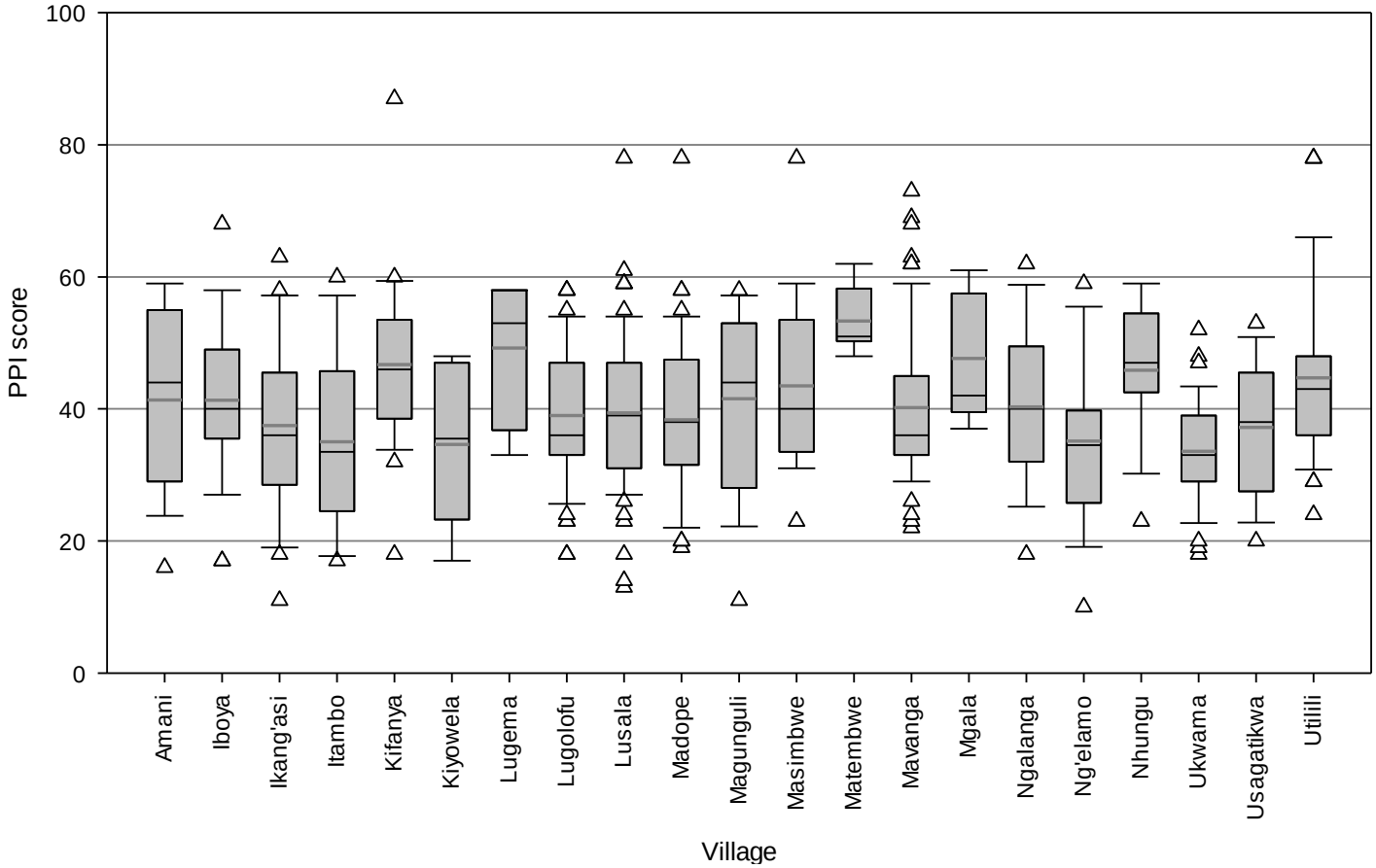
Note: Table drafted according to Schreiner, M (2016). Reproduced with the permission of Innovations for Poverty Action (IPA); www.progressoutofpoverty.org

Figure 10 Distribution of recorded PPI scores (TGIS in-kind and NFC-OSP) within ranges corresponding the poverty likelihood classes



[3] http://www.simplepovertyscorecard.com/TZA_2011_ENG.pdf

Figure 11 PPI score distribution by village (TGIS in-kind)



Note: The boxes represent observations between 25th and 75th percentile, and the whiskers represent observations between 10th and 90th percentile. The box middle bars show medians (black bar) and arithmetic means (grey bar). White triangles show outlier observations.

4. CONCLUSIONS

4.1 Growth and survival of the PFP-supported woodlots

With an overall mean survival of 79%, and 0.5 m mean height for one-year-old plantations and 1.6 m mean height for two-year-old plantations, the programme falls a little bit short from its own target-setting as per the Results Based Management framework (80%, 1 m and 2 m, respectively). However, the differences between individual woodlots are large.

4.2 Weeding within the PFP support schemes

The results of the survey showed that the level of weeding within the pine and eucalyptus plantations established through the programme support was generally low. The mean figures remained notably below the acceptable technical standards (minimum weeding score of 2). The subsequent negative effects on plantation survival rate and height growth were also evident through the data.

Eucalyptus was found to suffer more from the lack of weeding than pine in relation to both tree survival and height growth. While the survival rate drop on eucalyptus did not reach disastrous levels on average even under complete lack of weeding (i.e. no stand density reduction into silviculturally unsustainable figures), the observed 10–20% losses should be seen as considerable from the tree grower point of view. Moreover, the resulting reduction in eucalyptus height growth indicates that at least 1–2 additional years are needed in the rotation period in order to achieve a given stand volume. With the relatively short rotation periods of eucalyptus, a major effect should be presumed on the calculated net present values of the plantation investment.

While pine was found to be somewhat less affected from the lack of weeding, in the light of the results the negative implications to survival and growth should not be neglected in the case of the pine either.

A positive exception to the low weeding figures was KVTC-OSP, which demonstrated significantly higher weeding scores than any other scheme. The support model is known to incorporate a very intensive weeding regime with a high level of follow-up.

4.3 Socioeconomic assessment of the PFP beneficiaries

The PFP beneficiaries were found to be somewhat more well-to-do than the Tanzanian rural population on average. However, comprehensive national statistics were unavailable for this report so only limited comparison can be drawn with the survey data.

The survey data showed that beneficiaries came across a wide range of poverty likelihood classes rather than a narrow one, which indicates that the programme is relatively inclusive in its realised beneficiary uptake. However, the poorest of the people (PPI score below 10 and the respective food poverty likelihood above 40%) were absent in the data. From development policy point of view, this brings certain justification for tailoring specific support measures within the programme for the poorest of the people, even though their level of presence in the supported communities is unknown due to the lack of statistics.

The beneficiaries of KVTC-OSP, according to the results from a separate PPI score survey by KVTC, were found to be significantly poorer on average than the ones under the other support schemes interviewed within this exercise.

Annex 1 Breakdown of results by village

Note: data for the TGIS in-kind includes the plantations established for vulnerable groups and the demo plots.

Table A1.1 Mean circle weeding scores by village

Scheme	Village	District	Mean score for circle weeding			Rank
			2014/15	2015/16	Total	
TGIS in-kind	Usagatikwa	Makete	1.91	1.81	1.84	1
	Matembwe	Njombe DC	1.45	-	1.45	2
	Lugema	Mufindi	-	1.39	1.39	3
	Lugolofu	Mufindi	-	1.20	1.20	4
	Kiyowela	Mufindi	-	1.10	1.10	5
	Magunguli	Mufindi	-	1.04	1.04	6
	Iboya	Njombe TC	1.01	0.58	0.83	7
	Mgala	Njombe TC	1.35	0.22	0.82	8
	Nhungu	Makete	-	0.76	0.76	9
	Mavanga	Ludewa	0.94	0.54	0.76	10
	Ukwama	Makete	-	0.63	0.63	11
	Lusala	Ludewa	0.65	0.40	0.61	12
	Kifanya	Njombe TC	0.40	0.55	0.44	13
	Itambo	Njombe DC	0.23	0.47	0.33	14
	Ikang'asi	Njombe DC	0.20	0.50	0.27	15
	Ng'elamo	Njombe TC	0.22	0.19	0.21	16
	Amani	Ludewa	-	0.15	0.15	17
	Utilili	Ludewa	-	0.15	0.15	18
	Ngalanga	Njombe TC	0.03	0.09	0.06	19
	Madope	Ludewa	-	0.01	0.01	20
	Masimbwe	Ludewa	-	0.00	0.00	21
	TGIS in-kind Subtotal		0.64	0.54	0.58	n/a
NFC-OSP	Kiwalamo	Kilolo	-	0.96	0.96	1
	Ukwega	Kilolo	-	0.83	0.83	2
	Makungu	Kilolo	-	0.52	0.52	3
	Kidabaga	Kilolo	-	0.33	0.33	4
	NFC-OSP Subtotal		-	0.70	0.70	n/a
KVTC-OSP	n/a	Kilombero	2.24	1.70	1.93	n/a
TOTAL						n/a

Table A1.2 Mean slash weeding scores by village

Scheme	Village	District	Mean score for slash weeding			Rank
			2014/15	2015/16	Total	
TGIS in-kind	Matembwe	Njombe DC	1.73	-	1.73	1
	Kiyowela	Mufindi	-	1.15	1.15	2
	Mavanga	Ludewa	1.46	0.74	1.14	3
	Lugema	Mufindi	-	1.11	1.11	4
	Lusala	Ludewa	0.99	0.57	0.93	5
	Maguguli	Mufindi	-	0.88	0.88	6
	Madope	Ludewa	-	0.66	0.66	7
	Mgala	Njombe TC	0.90	0.22	0.58	8
	Usagatikwa	Makete	0.45	0.48	0.47	9
	Kifanya	Njombe TC	0.33	0.42	0.35	10
	Lugolofu	Mufindi	-	0.35	0.35	11
	Ukwama	Makete	-	0.34	0.34	12
	Utilili	Ludewa	-	0.33	0.33	13
	Ikang'asi	Njombe DC	0.25	0.50	0.31	14
	Itambo	Njombe DC	0.22	0.40	0.30	15
	Nhungu	Makete	-	0.27	0.27	16
	Amani	Ludewa	-	0.26	0.26	17
	Iboya	Njombe TC	0.18	0.27	0.22	18
	Ngalanga	Njombe TC	0.09	0.13	0.11	19
	Masimbwe	Ludewa		0.03	0.03	20
	Ng'elamo	Njombe TC	0.00	0.00	0.00	21
	TGIS in-kind Subtotal		0.66	0.44	0.52	n/a
NFC-OSP	Kidabaga	Kilolo	-	2.00	2.00	1
	Kiwalamo	Kilolo	-	0.85	0.85	2
	Ukwega	Kilolo	-	0.83	0.83	3
	Makungu	Kilolo	-	0.76	0.76	4
	NFC-OSP Subtotal		-	1.01	1.01	n/a
KVTC-OSP	n/a	Kilombero	2.31	1.83	2.04	n/a
TOTAL						n/a

Table A1.3 Mean tree survival rate and stand density by village

Scheme	Village	District	Mean survival-%	Mean stand density (stems/ha)	Rank (survival)
TGIS in-kind	Matembwe	Njombe DC	99%	1,096	1
	Usagatikwa	Makete	95%	1,026	2
	Lusala	Ludewa	90%	1,015	3
	Kiyowela	Mufindi	89%	830	4
	Ukwama	Makete	84%	1,087	5
	Ngalanga	Njombe TC	83%	1,128	6
	Maguguli	Mufindi	83%	1,204	7
	Madope	Ludewa	83%	1,082	8
	Ng'elamo	Njombe TC	82%	1,168	9
	Kifanya	Njombe TC	82%	1,031	10
	Mavanga	Ludewa	82%	1,028	11
	Ikang'asi	Njombe DC	81%	1,055	12
	Iboya	Njombe TC	79%	1,023	13
	Itambo	Njombe DC	77%	984	14
	Mgala	Njombe TC	76%	1,063	15
	Utilili	Ludewa	72%	1,016	16
	Lugema	Mufindi	70%	1,293	17
	Lugolofu	Mufindi	69%	1,162	18
	Amani	Ludewa	62%	1,115	19
	Masimbwe	Ludewa	54%	1,103	20
	Nhungu	Makete	48%	1,044	21
	TGIS in-kind Subtotal		79%	1,064	n/a
NFC-OSP	Kidabaga	Kilolo	95%	1,537	1
	Kiwalamo	Kilolo	72%	1,119	2
	Makungu	Kilolo	61%	1,159	3
	Ukwega	Kilolo	59%	1,115	4
	NFC-OSP Subtotal		70%	1,198	n/a
KVTC-OSP	n/a	Kilombero	86%	780	n/a
TOTAL					n/a

Table A1.4 Percentage of beneficiaries covered by PPI score interviews and mean PPI scores by village

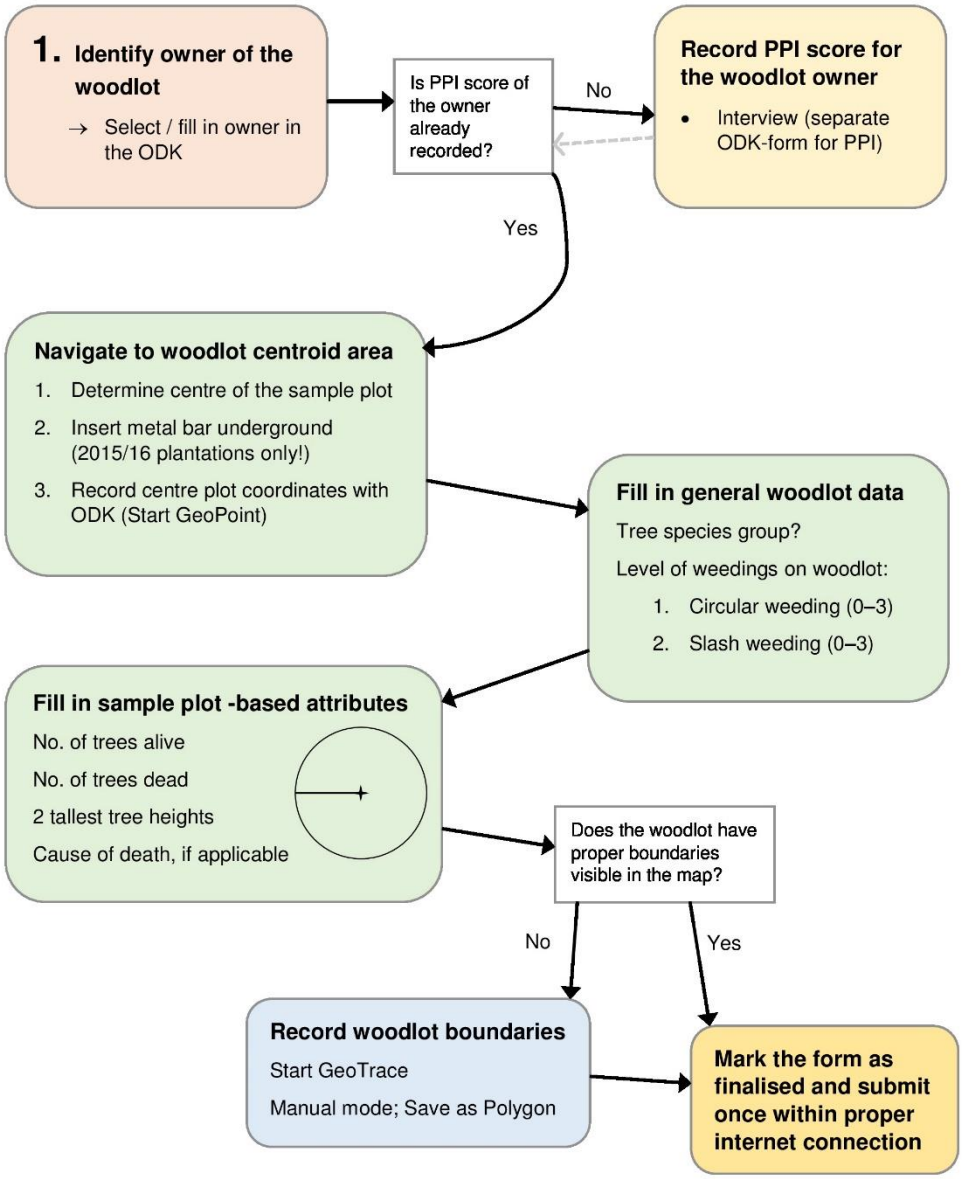
Scheme	Village	No. of PFP benef.	No. of PPI score interviews	%-covered of benef.	Mean PPI score
TGIS in-kind	Amani	39	15	38%	41
	Iboya	47	29	62%	41
	Ikang'asi	49	21	43%	37
	Itambo	31	16	52%	35
	Kifanya	68	25	37%	47
	Kiyowela	18	8	44%	35
	Lugema	14	4	29%	49
	Lugolofu	88	57	65%	39
	Lusala	99	71	72%	39
	Madope	122	44	36%	38
	Magunguli	32	17	53%	42
	Masimbwe	29	25	86%	43
	Matembwe	11	6	55%	53
	Mavanga	101	71	70%	40
	Mgala	21	9	43%	48
	Ngalanga	55	17	31%	40
	Ng'elamo	37	16	43%	35
	Nhungu	70	17	24%	46
	Ukwama	159	38	24%	34
	Usagatikwa	28	16	57%	37
	Utilili	60	35	58%	45
	TGIS in-kind Subtotal	1,163	557	48%	40
NFC-OSP	Kidabaga	12	1	8%	45
	Kiwalamo	25	2	8%	43
	Makungu	17	2	12%	42
	Ukwega	11	1	9%	56
	NFC-OSP Subtotal	65	6	9%	45
TOTAL		1,228	563	46%	40

Annex 2 Flowchart of the field procedure

EODS woodlot assessment 2016/17

PANDA MITI KIBIASHARA
PRIVATE FORESTRY PROGRAMME

Flowchart sheet for the field procedures per woodlot



Indufor ...forest intelligence

NIRAS