

An analysis of socio-economic and farm forestry enterprises in selected arid and semi-arid areas (ASALs) of forest zones of Kenya

Abstract

This paper presents the results of the study carried out in the three forest zones namely: Tharaka, Mbeere and Kitui. The objective of the study was to establish socio-economic status of selected farm forestry groups and networks currently undertaking farm forestry enterprises. The study involved: A desktop review of pertinent documents analysis. The desktop review was followed by a consultative meeting and Focused Group Discussions (FGD) with zonal and divisional forest officers with the aim of identifying the proposed farm forestry enterprises, products and their market value chain analysis. The population under investigation consisted of individual farmers, farm forestry groups, farm forestry networks, input suppliers, traders, transporters and consumers in the predetermined three Forest Zones of Kitui, Tharaka and Mbeere. In each of the three zones the population was stratified according to types of people participating in Farm forestry and agro-forestry activities. Both qualitative and quantitative data and information obtained from desktop reviews and field visits were analyzed. The quantitative data was analyzed using relevant computer based software mainly excel. The qualitative data/information was analyzed using SPSS Package as well as content analysis, deductions and field observations.

On the basis of the desktop review, several farm forestry enterprises were identified as viable enterprises in the three forest zones. These included: Tree nurseries, mango orchards, and woodlot for timber and firewood and charcoal, wild fruits (i.e. Tamarind, Baobab, and Vitex spp) and bee keeping. From the analysis in the table above the main product in the bee keeping enterprise in the three zones was honey. In the fruit orchard enterprise the major product was mango (95percent). In the tree nursery enterprise the main product mentioned by the respondents was seedling. In woodlot enterprise the major products mentioned were timber (74percent) and charcoal (14 percent).

The results indicate that apart from Kitui zone, primary level of education was prevalent in the other two (2) zones. However, in Kitui zone close to 50% of respondents had attained secondary level of education. The interpretation is that interventions involving high level of information analysis would be difficult to sell in the area of study. The analysis revealed that majority of the farm forestry farmers own an average farm size between 2 and 20 acres

Background

According to Scott Geller et.al (2007), declining economic growth in Kenya during the 1980s and 1990s, coupled with rising inequality and unemployment, led to an increase in the number of poor people from 11 million in 1990 to 17 million in 2001. It was further observed that, the annual growth rate rose from 1.2% in 2001 to 6.1% in 2006 due to the improved performance of agriculture, manufacturing, trade, transport and communications. To achieve poverty reduction based on forest products, there is a need to increase the creation of wealth through forest product production, processing and marketing, and for mechanisms to ensure that some of that wealth is captured by the intended beneficiaries (Belcher, B.M. 2005).

Kenya Forest Services (KFS) uses the Farm Forestry Field School (FFFS) methodology as one of the ways of increasing Kenya's forest cover to the prerequisite 10%.The new

47 Constitution requires Kenyans to attain and maintain a 10% forest cover and the FFFS is
48 seen as one of the best ways through which this can be achieved.

49 A study by J. K. Mariara (2009) found that in Kenya, forests play an important role as an
50 economic ‘safety net’ that can cushion rural households during periods of economic
51 hardship. It also finds that forests provide resources and a source of income for both rich
52 and poor people, although they provide the most benefit to the poor.

53 Kenya Forest Service (KFS) lays emphasis on protection and conservation of national
54 forests as well as the establishment and management of individual forest plantations in
55 order to streamline forest management Kenya Forest Service (KFS) continues to establish
56 and maintain industrial forest plantations for the purposes of revenue generation,
57 production of timber, pulpwood and fuel wood as well as other minor forest produce.

58 The Forest Act 2005 provides for stakeholder participation in forest conservation and
59 management. Kenya Forest Service (KFS) thus continues to foster partnership with
60 stakeholders which include corporate organizations, civil society members, education and
61 research institutions and governmental and donor agencies. The Intensified Social Forestry
62 Project in semi and arid areas of Kenya (ISFP) was such partnership arrangement whose
63 focus was dry land forestry development through farm forestry. Currently the “Support to
64 Community Based Farm Forestry Enterprises project (SCBFFE) is a deepening of the
65 focus.

66 Kenya Forest Service (KFS) continues to support various forest based micro-projects in
67 order to improve the livelihoods of the local communities and to create awareness on the
68 value of forests and conservation enhancement.

69 The woody resources in Kenya are important national assets due to their economic,
70 environmental, social and cultural values. They provide important goods and services to
71 the nation as a whole including the maintenance of the water catchment areas, and the
72 conservation of biodiversity. However, the importance of forest resources is not reflected
73 in current official statistics, which indicate that forest products and services contribute
74 only about Ksh 16.4 billion, equivalent to 1% of national GDP (RoK, 2009).

75 Kenya’s forest cover stands at 6.99% a figure below the required 10%. The demand for
76 forest related goods and services has continued to grow with increasing population and
77 diversified needs. Since the area under state forest is unlikely to expand significantly, the
78 most viable alternative for increasing tree cover is through tree planting and conservation
79 in the farm lands and Dry lands. The extensions services of Kenya Forest Service exists to
80 promote farm and dry land forestry to increase tree cover for sustained timber, wood fuel,
81 non-wood forest products and environmental conservation. The cultivated semi-arid areas
82 are sometimes referred to as tension zone because conflicts are occasioned by expansion of
83 farming activities and use for dry season farming.

84 The focus of the study was to identify socio-economic background of the study region and
85 farm forestry enterprises with view on improving the livelihood security of households using
86 the farm forestry enterprises in the arid and semi-arid areas (ASALs) of Tharaka, Mbeere
87 and Kitui forest zones.

88

89 **Methodology**

90 In the three divisions of Tharaka, Mbeere and Kitui, pertinent data and information was
91 collected through focused group discussions (FGDs) with farm forestry groups and farm

92 forestry networks. Face to face interviews with individual farm forestry farmers, farm
93 forestry input suppliers, farm forestry product traders, farm forestry product transporters
94 and consumers as well as processors.

95 In order to have an overall synthesized perception and views of the larger community
96 living within the project area as well as authenticating the data from the sampled
97 individual farmers from farm forestry groups, focused groups discussions were held with
98 sampled farm forestry groups. Appropriate introductions were done at the start of the
99 meetings about the aim of the study to build the confidence among the group members by
100 the division foresters in order to dispel misplaced expectations.

101 The population under investigation consisted of individual farmers, farm forestry groups,
102 farm forestry networks, input suppliers, traders, transporters and consumers in the
103 predetermined three Forest Zones of Kitui, Tharaka and Mbeere. In each of the three zones
104 the population was stratified according to the category of people participating in Farm
105 forestry and agro forestry activities.

106 In this study purposeful sampling was used. This is a survey method which employs sub-
107 sets of study individuals who have the information sought for further investigation. In this
108 particular assignment a combination i.e. mixed purposeful sampling was used as follows:

- 109 i. **Stratified purposive sampling** was initially used to group major study areas
110 (Forest zones) into smaller units i.e. Administrative Divisions and locations. This
111 would later enable comparisons between zones.
- 112 ii. **Criterion sampling** was then used where only groups that had graduated in FFS
113 were favored for interviewing. This was necessary to ensure quality as all groups
114 considered had graduated from FFS and were thus assumed to be actively involved
115 in Farm forestry activities, but also other individuals and persons involved in Farm
116 forestry activities were included e.g. service providers, traders, transporters and
117 input suppliers.
- 118 iii. **Random purposive sampling** was finally used so as to choose a small sample
119 from the large number of qualifiers (all the FFS graduated groups in a zone or
120 Division). The number of respondents who were later interviewed was therefore
121 determined using this method. This was necessary to avoid obvious bias in
122 choosing groups to interview.

123 The sampling frame consisted of the units of all the farmers, enterprise operators and other
124 practitioners scattered all over the project areas that are involved in the activities of the
125 Support to Community Based Farm Forestry Enterprises (SCBFFE) project. These
126 included a pool of: Individual Forestry Farmers, Forestry Farmer groups, Farm forestry
127 Networks, project implementing staff, key informants (village leaders and community
128 owner resource persons). Chiefs, Village elders and other service providers like
129 collaborating Faith Based Organizations (FBOs) and Community Based Organization
130 (CBOs) participating in forestry service delivery constituted a frame list from where
131 respondents were drawn. From the sample frame, the total number of respondents
132 interviewed is illustrated in the **Table1** below.

133 **Table 1: Total Number of Respondents Interviewed**

Zones	Respondents interviewed								Total
	Individual farmers	FFG	FFN	Farm forestry input suppliers	FFP traders	Private companies	Key informant	Collaborating institutions	
Tharaka	52	4	3	5	20	3	3	2	92
Mbeere	80	4	4	7	20	4	3	2	124
Kitui	155	10	5	27	43	5	3	2	250
TOTAL	287	18	12	39	83	12	9	6	466

134

135 Both qualitative and quantitative data and information obtained from desktop reviews and
 136 field visits were analyzed. The quantitative data was analyzed using relevant computer
 137 based software mainly excel. The qualitative data/information was analyzed using SPSS
 138 Package as well as content analysis, deductions and field observations.

139

140 Results and Discussions

141 Socio-economic profile

142 This subsection presents the Socio-Economic profile of the respondents in the project area
 143 of study and other important household characteristics for 466 sampled respondents in the
 144 Tharaka, Mbeere and Kitui forest zones. As important, the socio-economic variables
 145 provide both social and economic background of individual respondents likely to be used
 146 in assessing intervention measures.

147 Age Distribution

148

149 As a social variable the age distribution is considered important since it is believed to have
 150 an influence on adoption of new technologies. Thus, the older the person is less responsive
 151 towards change, and vice versa. Table 2 below displays age strata for the survey
 152 population in the three forest zones. Over 90 percent of the populations surveyed were 31
 153 years of age and above. The majority of population was over 51 years in Kitui and Mbeere
 154 as well as between 31-50 years of age in Tharaka forest zones.

155

156

157 **Table 2: Age Distribution of the Sample Respondent**

Forest Zone	Age			Total
	20-30years	31-50 Years	More than 51 Years	
Kitui	10(5.3%)	85(45.2%)	93(49.5%)	188 (100%)
Mbeere	6(8.7%)	24(34.8%)	39(56.5%)	69 (100%)
Tharaka	2(3.3%)	33(54.1%)	26(42.6%)	61 (100%)
Total	18(5.7%)	142(44.7%)	158(49.7%)	318 (100%)

158 With regards to the above findings, it can be concluded that majority of the respondents in
159 the three forest zones were less likely to be responsive towards new technology. It is
160 advisable that the project encourage younger people to embrace farm forestry farming.

161 **Education Level**

162
163 Studies have consistently shown that educational attainment has a strong effect on socio –
164 economic status of households. Table 3below presents analysis results on educational
165 attainment of the population surveyed.

166 The results show that majority had attained primary education in all the three forest zones.
167 the proportion of level of education attainment by the three forest zones were as follows:
168 primary education (Tharaka(70 percent), Kitui (49.5 percent) and Mbeere (39 percent):
169 secondary education(Mbeere (34.8percent) ,Kitui (23.9 percent) and Tharaka (13.percent):
170 post-secondary Kitui (14.4 percent); Tharaka (8.2 percent) and Mbeere (7.2 percent)and
171 none (Mbeere (18percent) , Kitui(12.2percent) and Tharaka (8.2 percent).

172 **Table 3: Education Level of the Sampled Respondents**

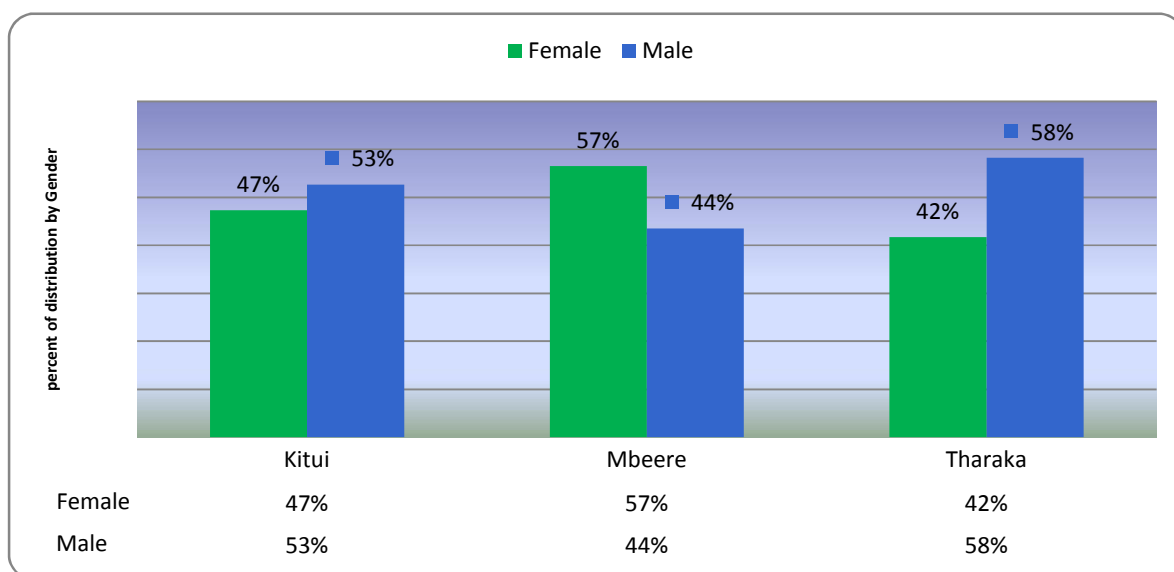
Forest zones	Level of education				Total
	None	Primary	Secondary	Post-secondary	
Kitui	23(12.2%)	93(49.5%)	45(23.9%)	27(14.4%)	188 (100%)
Mbeere	13(18.8%)	27(39.1%)	24(34.8%)	5(7.2%)	69 (100%)
Tharak a	5(8.2%)	43(70.5%)	8(13.1%)	5(8.2%)	61 (100%)
Total	41(12.9%)	163(51.3%)	77(24.2%)	37(11.6%)	318 (100%)

173 The results indicate that apart from Kitui zone, primary level of education was prevalent in
174 the other two (2) zones. However, in Kitui zone close to 50% of respondents had attained
175 secondary level of education. The interpretation is that interventions involving high level
176 of information analysis would be difficult to sell in the project area.

177 **Gender Distribution**

178 Gender differentiation is often associated with division of labour and socio-economic roles
179 played in livelihood acquisition. The analysis of the population surveyed shows the
180 distribution of gender by zones as illustrated in the Figure 1below. The majority of the
181 respondents in both Kitui and Tharaka were men while those in Mbeere were women.

182 **Figure 1: Gender Distribution**



183

184

185

186

187

188

189

190

191

These results indicate that except for Mbeere zone, the other two (2) zones, i.e. Kitui and Tharaka, men dominated the sampled respondents. It is likely that most of the Enumerators interviewed Male headed households. However, field observations showed that membership in most farm forestry groups were predominantly female. Thus interventions targeting farm forestry groups should mostly be prepared to deal with women farmers in the project area

Civil Status

192

193

194

195

196

197

198

199

200

201

202

203

In situations where couples work together, better social and financial capital would be achieved. Therefore civil status is an important determinant of resource mobilization and enterprise viability. The analysis of the marital status of the surveyed population was as shown in Table4 below. Majority: Kitui (91.5 percent), Tharaka (88.5 percent) and Mbeere (85.5 percent) were married. The proportion of single surveyed population by zones was as follows: Tharaka (6.6 percent), Kitui (4.8 percent) and Mbeere (4.3 percent). Widowed surveyed population by zones: Mbeere (10.1 percent) Kitui 2.7 percent) and Tharaka (1.6 percent) and divorced surveyed population: Mbeere (zero percent), Kitui (1.1 percent) and Tharaka (2 percent).

Table 4: Civil Status of the Surveyed Population

Forest zones	Civil Status				Total
	Married	Single	Widowed	Divorced	
Kitui	172(91.5%)	9(4.8%)	5(2.7%)	2(1.1%)	188 (100%)
Mbeere	59(85.5%)	3(4.3%)	7(10.1%)	0(0.0%)	69 (100%)
Tharaka	54(88.5%)	4(6.6%)	1(1.6%)	2(3.3%)	61 (100%)
Total	285(89.6%)	16(5.0%)	13(4.1%)	4(1.3%)	318 (100%)

204

205 The results indicated that in the entire study area, the majority were married meaning
206 better social and financial capital and likely efficient resource mobilization. This does not
207 preclude the fact that single headed households would also have comparative advantage in
208 adoption decision making over married couples.

209

210 **Family Size**

211 It is often postulated that the larger the family size, the less likely the person would spend
212 on modern farm inputs. Thus households with relatively smaller number of members are
213 more likely to spend and therefore adopt modern farm inputs. The most prevalent family
214 size among the population households surveyed had less than 6 persons per household in
215 Tharaka and Mbeere while Kitui zone had between 6 to 10 persons in the household. This
216 indicated that the family size in Kitui zone was considered as relatively large in
217 comparison to the other zones. This could be considered as the social factor festering the
218 prevalence of poverty at large in the Kitui sub-zone. In addition, it was established that
219 close to 51% of the population was not economically active in the Kitui sub-zone leading
220 to higher dependency syndrome in the area.

221

Table 5: Family Size of Respondents by Forest Zones

Forest zones	Family Size			Total
	Less than 6 Persons	6 to 10 Persons	More than 10 Persons	
Kitui	83(44.4%)	97(51.9%)	7(3.7%)	188 (100%)
Mbeere	49(71.0%)	18(26.1%)	2(2.9%)	69 (100%)
Tharaka	31(53.4%)	23(39.7%)	4(6.9%)	61 (100%)
Total	163(51.9%)	138(43.9%)	13(4.1%)	318 (100%)

These results show that interventions requiring relatively huge resource mobilization from individual households would not be viable in the Kitui zone. However, given that the other two (2) zones had relatively smaller family size there is a likelihood of higher adoption rate of new technologies in the two zones.

Average Farm Size

Economic perspectives have shown that farm or enterprise operational size is often an important consideration for purposes of business break-even and profit maximization. This is explained by the concept of economies of scale such that as the size of operation increases so does the profit margin but up to a point beyond which diseconomies of scale set in. When the respondents were asked to state the range of acres they owned in the three forest zones, the results were as demonstrated in the Table 6 Below. The analysis revealed that majority of the farm forestry farmers own an average farm size of between 2 and 20 acres.

Table 6: Average Farm Size owned by Respondents

Forest zones	FARMSIZE			Total
	Less Than 1 Acre	2 to 20 Acres	More than three 20 Acres	
Kitui	53(29.1%)	127(69.8%)	2(1.1%)	188 (100%)
Mbeere	14(23.0%)	45(73.8%)	2(3.3%)	69 (100%)
Tharaka	10(17.5%)	45(78.9%)	2(3.5%)	61 (100%)
Total	77(25.7%)	217(72.3%)	6(2.0%)	318 (100%)

These results indicate that farm forestry enterprise in the area of study were viable particularly in relation to operational sizes. What remained to doubt was the profit maximization objective.

245 Farm Forestry Enterprises, Products and their Market Value Chain

246

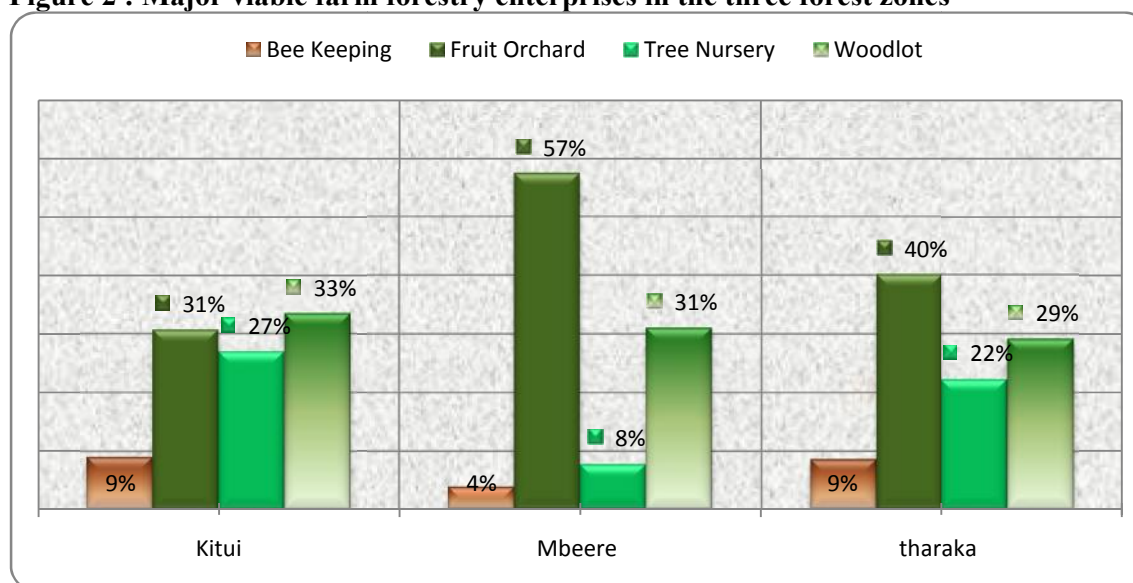
247 Farm Forestry Enterprises

248 Forests play a vital role in improving the livelihoods and alleviating poverty in the
 249 developing world. According to the World Bank (2002), forests directly contribute to
 250 supporting the livelihoods of approximately 90% of the world's poorest people – either in
 251 the form of subsistence, conversion of forests to agricultural uses, or income derived from
 252 a diverse range of timber products, non-timber products, or ecosystem services (Arnold,
 253 2001; Sunderlin *et al.*, 2005). There are many ways in which farmers can make income or
 254 save money by growing trees: They can get tree products such as timber, fuel wood, seed,
 255 flowers or oils for sale or on-farm use. They could lease land to someone else to grow
 256 trees or even enter into a joint venture arrangement where the costs and returns are shared.
 257 They could explore opportunities for growing trees and then selling environmental values
 258 such as carbon sequestration, biodiversity values or improved water quality. A broad
 259 definition of farm forestry includes any trees on farm land which are managed to produce
 260 saleable products such as timber, oil, tannin, charcoal or carbon credits.

261

262 Observations and discussions with FFGs and Non FFGs established that the major viable
 263 farm forestry enterprises in the three forest zones were: tree nurseries, wood lot (timber,
 264 fuel and charcoal) and Mangoes/Fruit orchard, bee keeping and charcoal production. The
 265 results of the analysis In Figure 2 below further revealed that, the proportion of
 266 concentration of enterprise by forest zone were as follows: Kitui; Woodlot
 267 (33percent),fruit orchard (31percent), tree nursery(27percent) and beekeeping (9percent):
 268 Mbeere; fruit orchard(57 percent),woodlot(31 percent), tree nursery (8percent) and
 269 beekeeping(4percent) and Tharaka ; fruit orchard (40 percent) ,woodlot(29percent),
 270 nursery (22percent and beekeeping(9percent).

271 **Figure 2 : Major viable farm forestry enterprises in the three forest zones**



272

273

274 Additionally, field observations also revealed a huge potential in Tharaka and Kitui for an
 275 enterprise on wild fruits especially Tamarind (*Tamarindus indica*), Baobab (*Adansonia*
 276 *digitata*), and indigenous *Vitex* species for juice, cools, jam and sisal particularly in Kitui.
 277 The enterprise on wild fruits deserves special mention because these fruits are diverse and
 278 widely distributed in most ASALs of Kenya. They provide not only food for humans and
 279 their livestock but are a very good source of essential nutrients. Emphasis on the
 280 development of this enterprise will result in spill-over benefits as communities will
 281 conserve these tree species and hence the indigenous vegetation associated with these
 282 species, and which is under threat from charcoaling and farming activities. KEFRI has
 283 undertaken a lot of research on the domestication of some of these species and it will be
 284 easy to get pertinent information from Kitui and other KEFRI centers. Alternative
 285 enterprises included *Fodder banks, poultry keeping, dairy goats*.

286 Major Enterprise Products

287 The data analysis of the products from each enterprise was as tabulated in **Table 7** below.
 288 Data analysis revealed that the main product in the beekeeping enterprise in three zones
 289 was honey (100percent). In the fruit orchard enterprise, the major product was mango
 290 (95percent). Other products mentioned within the same enterprise though not substantial
 291 include: pawpaw (2percent) avocado (1percent), oranges (1percent) and tamarind
 292 (1percent).

293
 294 **Table 7: Major viable farm forestry enterprise products in the three forests**

Enterprise	Avocado	Charcoal	Firewood	Honey	Mango	Medicine	Oranges	Pawpaw	Poles	Seedlings	Tamarind	Timber
Bee Keeping				26(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Fruit Orchard	1(10%)	0(0%)	0(0%)	0(0%)	123(95%)	0(0%)	1(1%)	3(2%)	0(0%)	0(0%)	1(1%)	0(0%)
Tree Nursery	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	73(100%)	0(0%)	0(0%)
Woodlot	0(0%)	15(14%)	4(3%)	0(0%)	0(0%)	1(1%)	0(0%)	0(0%)	8(7%)	0(0%)	0(0%)	80(74%)

295 In the tree nursery enterprise, the main product mentioned by the respondents was seedling
296 (100percent). In woodlot enterprise the major products mentioned were timber (74percent)
297 and charcoal (14 percent). Other products mentioned in the woodlot enterprises though
298 not significant were: poles (7percent), firewood (3percent) and medicine (1percent).

299 **Tree Nursery Seedling Market Value Chain**

300 **Tree Seedling Market Value Chain Map**

301 The tree nursery seedling value chain map provides a graphical representation of the
302 structure of the tree nursery seedling showing how the commodity flows from the
303 fundamental chain segment represented by the production process, to the intermediary
304 chain delineated by the market segment, through to the end-users represented by the
305 consumer segment of the chain. In the tree nursery enterprises map, the core processes are;
306 Input supply, seed bed preparation, sowing, potting and pricking out, management,
307 transportation, marketing and consumption (See Figure 3). The main actors in the tree
308 nursery enterprises subsector in Tharaka, Mbeere and Kitui forest zones are input
309 suppliers, producers, transporters, traders and consumers. . In terms of volume of
310 movement in the value chain, focus group discussions with farmers and analysis of
311 collected data established that, 46.13% of the seedling was sold at the farm gate,
312 20.5percent used for by the members of the group, 20.9percent was sold to the market
313 directly and 18.4percent was wastage.

314 **Input supply:** In this Segment; the Actors mentioned by the respondent include: KFS,
315 agro vets, KEFRI, individual farmers across the three forest zones.

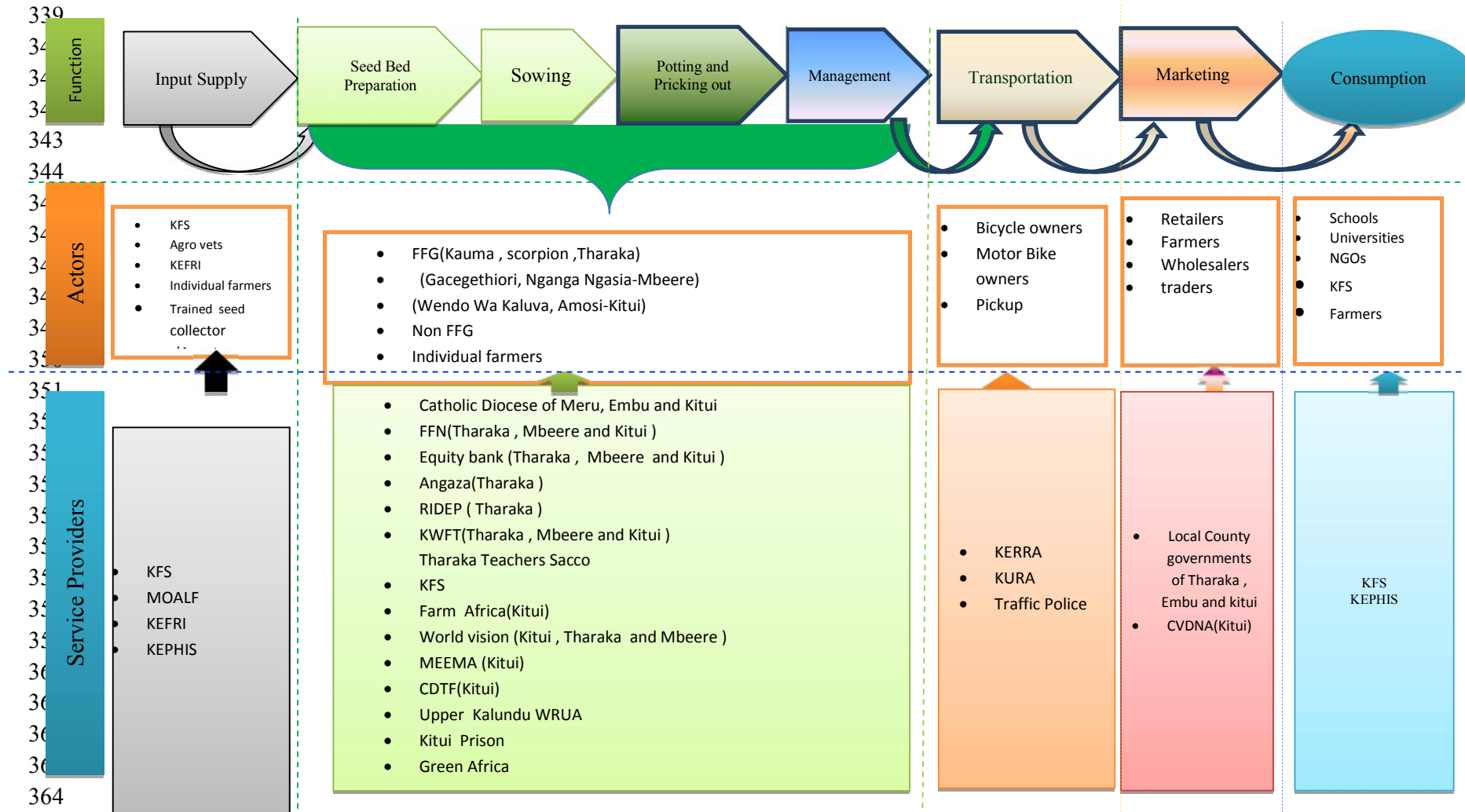
316 **Production:** In this segment the main actors include: family members, casual laborers,
317 individual farm forestry farmers, farm forestry groups and non-farm forestry groups who
318 engage in production of seedlings. They are mainly small in size. The gender
319 differentiation of this category of actors indicated a dominance of females in some cases
320 operating as individuals, groups or in association. Under production function the actors are
321 mainly involved in seed bed preparation, sowing, watering, potting and prinking out and
322 management.

323 **Transporters:** The main means of transporting seedling in the three forest zones were:
324 motor cycle, pickup, wheel-barrows bicycle, donkeys, donkey and ox carts and in some
325 cases back loads .They transport from individuals, FFGs, and Non FFGs to buyers' farms
326 or premises. The gender differentiation of this category of actors indicated a dominance of
327 male in some cases operating as a group or in associations owning means of transport such
328 as pickups or canters.

329 **Marketing:** This segment of chain actors show diversity in operation and form such that
330 four distinct classes emerge. These include traders, farmers, brokers and traders. They
331 mainly obtain seedlings from their own tree nursery, individual farmers and farm forestry
332 groups. These traders sell their products as far as Embu town, Siakago, Meru and Kitui.

333 **Consumers:** the main buyers in the three forest zones include: private and public schools,
334 universities, institutions such as hospitals, non-governmental organizations such as RIDEP
335 and Manyirani in Tharaka and Kenya forest service as well as farmers.
336
337

Figure 3: Tree Nursery seedling market Value Chain Map



Tree Nursery Input Supply

Discussions with farm forestry groups, non-farm forestry groups and farm forestry networks and face to face interview with farm input stockists established that the main inputs in tree nursery enterprises included: seeds, manure, agrochemicals, polythene tubes, water storage tanks, fencing materials and farm forestry implements. However, during the discussions, the participants indicated that availability of agro chemicals, fertilizer and seeds of trees such as Tamarind (*Tamarindus indica*), Mukau, Baobab (*Adansonia digitata*), and indigenous *Vitex* species for juice, cools, jam was substantially difficult in the three forest zones.



Input Distribution: The inputs were distributed from wholesalers to input traders through agents and courier service providers. However, discussions with farm forestry groups and non-farm forestry groups and interview of input traders by enumerators indicated that farmers mainly buy inputs from input traders and transport to their farm themselves using their own or hired bicycles or motorcycles.

Price of the Inputs: The price of the inputs varies according to source, quality and effectiveness. Manure price varies from KES80 to KES 100 per 90 kg bag, the improved seed prices varied from KES100 to KES3000 depending on the volume purchased. Similarly fertilizer price range was from KES 130 to KES 2800 depending on the volume mostly in the range of 1 kg to 50kg while agrochemical prices varied from KES250 to KES5000 depending on the amount.

Transportation: Inputs traders and farmers expressed their dissatisfaction regarding the high cost of transportation services particularly in the rural areas where roads were poor. The main means of transport were bicycles, wheel-barrows and in some cases head loads. The price of transportation varied from KES100 to KES200 depending on the mode of transport and distance covered.

Tree Nursery Input Suppliers Constraints

The role played by input suppliers in order for producers to achieve set production goals, cannot be overstated. An adequate and rewarding production level heavily depends on the quality and availability of farm inputs at the right time and quantity required. In the absence of quality farm inputs and at the opportune moments often leads to unfulfilled goals by producers. Field data analysis and discussions with farm forestry groups and non-farm forestry groups as well as input suppliers across the three forest zones identified several constraints that plague the tree nursery enterprises.

The analysis of constraints facing tree nursery input suppliers found that poorly managed nurseries, credit delinquency, high cost of inputs, neglecting of farm forestry enterprises in favour of other competitive enterprises and inadequate knowledge and skills on agrochemical use and application. Their causes, effect, suggested solution and opportunities are illustrated in the Table 8 below

Table 8 Tree Nursery Input Suppliers Constraints

Constraints	Cause	Effect	Solution	Opportunities
Credit delinquency	- Poverty - Unbearable conditions put in place by banks - Mismanagement of the credit facility	Low sales leading to low market margins	- Assist to farmer to access credit - Training and capacity building on credit facility management - Lobby for favorable conditions for credit facility	Improved repayment capacity leading to improved business by Input suppliers
High cost of inputs	- Poor rural access roads - High fuel price	Low sales volume leading Low market margins	Construction/ rehabilitation of rural access	Lower operation costs and increased sales
Inadequate knowledge and skills on agrochemical use and application by farmers	Inadequate training and capacity building on agrochemical used and application	- Frequent complaint of fake agrochemicals - Low sales volume	Training and capacity building on use and agrochemical application	- Improved income - Increased adoption of farm forestry inputs
Neglecting of farm forestry enterprises in favour of other competitive enterprises	- Inadequate knowledge of the alternative potentials associated with FF enterprises - Farmers involve in other commitments	Low business activities low sales and income	Sensitization of the farmers on the importance and potential of farm forestry farming	Change of attitude towards farm forestry farming leading to increased engagement in FF enterprises
Poorly Managed nurseries	Inadequate Training on nursery management	Wilting of Seedlings	Training and Capacity Building On Seedling	- Improved quality seedling - Increased

			Management	markets for FF inputs
Poor nursery soil (Mwea division in Mbeere)	• Change of climate	• Poor seedling production	• Facilitate the farm forestry groups to access good forest soils from the neighbouring divisions	• Good quality seedling production
Fake inputs supply	• Prevalence of unregistered stockists • Inadequate knowledge among stockists and farmers on the genuine inputs identification	• Poor quality inputs leading to Low input viability	• provide training and capacity building on genuine input identification	• Availability of genuine inputs

412

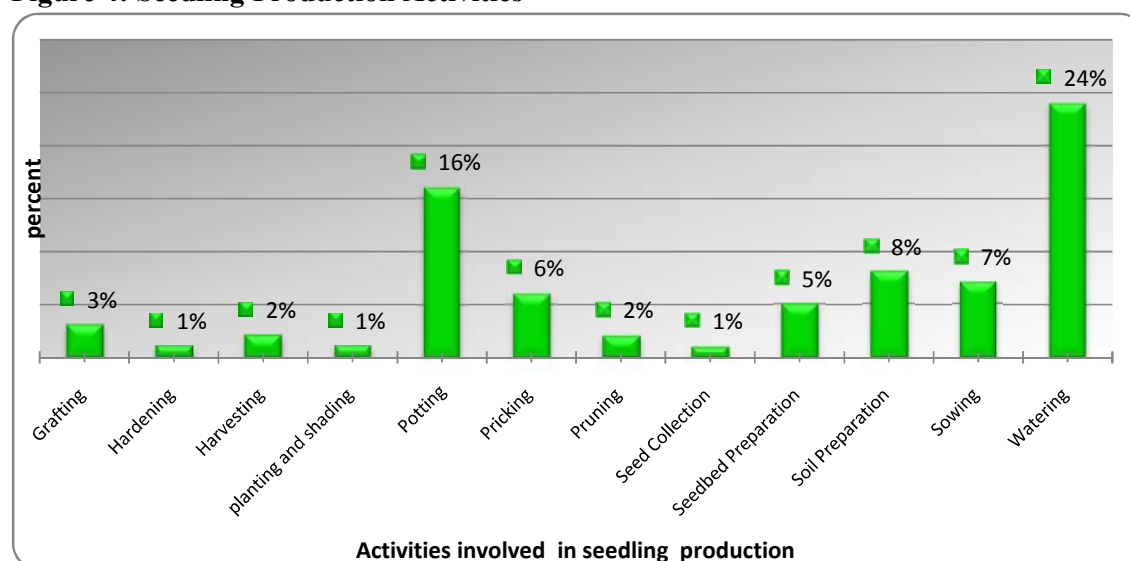
Seedling Production

A seedling is a young plant saprophyte developing out of plant embryo from a seed up to one meter of height and the term seedling production is a process of producing plantlets for a certain purpose, especially plantation. The scope of seedling production has been brought by various issues on environmental protection, forest production, tree improvement, ecosystem balance, forest regeneration and many other programs. To fulfill the demand and objective of plantation, there are several techniques and procedures of seedling production.



Across the forest zones, the average Farm sizes under seedling were: (0.23 acres), (0.17acre) and (0.6acre) with an average yield of 18328 seedlings per acre, 15204 seedlings per acre and 2967 seedlings per acre in Kitui, Mbeere and Tharaka zones respectively. The maturity period varied according to seedling and varied between 3 months to 9 months. Analysis of the data collected revealed that seedling production activities carried out by individual farmers, farm forestry groups and non-farm forestry groups are illustrated in the **Figure 4**below

Figure 4: Seedling Production Activities



They included; soil preparation; seed bed preparation, quality seed collection, seed sowing, watering, pricking, potting, planting and shading, pruning, hardening off, Appropriate site selection, site preparation, quality seed collection, seedlings establishment, storage, protection, management and supply are the components of high seedling yields .Mostly seedlings are produced in a nursery either from seed or from vegetative parts. There are various actors in the tree nursery enterprises, their characteristics, roles limitations and opportunities are shown in Table 9 below

441

442 **Table 9: seedling production Actors**

Actors	Characteristics	Role	Limitation	Opportunity
Agro vet	They are either individually owned, private businesses, Majority of them are small in size	Sourcing, Supply, and Distribution of farm inputs	High transport costs, low demand for farm inputs, credit delinquency	Effective Demand for fertilizer and agrochemicals and Business growth
Hired labor	Individual with flexible terms of providing labour Provide seasonal labour when required	Nursery preparation, Planting spraying, weeding and harvesting	Small size of nursery operations (Economies of scale)	Increased market opportunities for seedlings
Farmers/farmers group /family members	Most are small scale, a few had operated as farmer groups, resource poor	Establishment of tree nurseries and seedling sales Planting, seed collection, pruning and sowing,	Inadequate availability of water Unfavorable weather conditions, pest and disease infestation (termites)	Increased production levels Effective demand for seedling
Transporter	Are individual/group enterprises and farmers	Transporting seedlings and inputs to the farms Transport of produce to markets	High transport cost, inadequate supply and demand	Effective demand, Construction and rehabilitation of access roads, and expansion of markets

443

444

445

Seedling Production Constraints

Discussions and observations with tree seedling producers established that various constraints affect seedlings in the three forest zones, they include inadequate improved seeds, inadequate means of transport to ferry in bulk, inadequate capital to buy manure, high cost of transport, high cost of polytubes, unavailability of improved seeds, inadequate water, and low viability of seeds. The causes, effects and possible interventions of each constraint are as presented in the Table 10 below:

Table 10: Analysis of the Constraints facing the Seedling Producers in the three Forests Zones

Constraints During Establishment					
Constraint	Cause	Effect	Suggested Solution	Opportunities	
Inadequate water supply	Climate change I nadequate permanent water source	Wilting of seedlings Low seedling production	Support water harvesting by providing storage Tanks and sinking boreholes	Increase in production levels Production of quality seedlings Expansion of market reach	
Inadequate water storage tanks, watering cans and wheelbarrows	I nadequate capital	Low production	Facilitate group member to access credit	Increased seedling production Expanded market reach	
Inadequate top soil for potting	Poor soils	Low quality seedlings	Facilitate group member to access soil tests	Increased levels of production Good quality seedlings	
Low viability of seeds	Lack training on seed propagation	Low production	Work in close collaboration with seed companies and research institutions Awareness creation on the use of improved seeds	Increased levels of production Good quality seedlings	
Pests and Diseases	Poor agronomic practices High cost of pesticide	Poor quality seedling production Low use of agrochemicals	Provide training and capacity on use of pesticides to curb pests and diseases	Increased production levels Good quality seedlings	
High cost of seeds and polytubes	Inadequate capital for buying seeds polytubes	Low production Low quality of seedlings	Facilitate the farmers to get loans to purchase seeds and polytubes	Increased production Increased quality of seedlings Expanded market reach	
Constraints During Management					
Pests and diseases	• High cost of pesticides	• Poor quality seedling production	• Pesticides to be packaged in affordable packs	• Increased production	
Inadequate water	• Inadequate water storage tanks	• Low production	• Buying of water storage tank	• Increase in seedling production	
Destruction of seedlings by browsing animals	• Inadequate fence around the nursery	• Poor seedling growth	• Fencing of tree nursery	• Increased production	
Wilting	• Pests and diseases • Salty water	• Poor quality seedlings • Low production	• Support Use of pesticides • Support Water harvesting and storage	• Good quality seedlings	
High seedling death rate	• Over watering	• Low production of seedlings	• Training on watering and management of seedling	• Increased production • Increase in seedling production	

			gs	
Inadequate water	• Inadequate permanent water source	• Low production	• Buildin g of dams	• Increase in seedling production

References

Belcher, B.M. (2005). Forest product markets, forest and poverty reduction. Summary Introduction Papers, International Forestry Review Vol. 7 (2), 2005 Jakarata, Indonesia.

Kabubo-Mariara, J. (2009). 'Forest Dependence And Household Welfare: Empirical Evidence From Kenya. A summary of CEEPA Discussion Paper No. 41. Nairobi, Kenya.

Republic of Kenya (2009) .Miti Mingi Maisha Bora –Support to Forest Sector Reform in Kenya, Implementation Phase (2009 – 2014) Programme Document. Ministry of Forestry and Wildlife of Kenya. Nairobi.

Scott Geller, R. McConnell, and J. Wanyiri .(2007). Linking National Forest Programmes and Poverty Reduction Strategies, Kenya. Food and Agriculture Organization, Forestry Department, Forestry Policy and nstitutions Service