Assessment of the Youth in Plantation Establishment as an Occupation Project of the Forest Plantation Development Fund: Concept, Implementation and Lessons

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Consultancy Report

Submitted to:
Forest Plantation Development Fund Board

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List of Acronyms

CSIR	Council for Scientific and Industrial Research
DBH	Diameter at Breast Height
DCE	District Chief Executive
FC	Forestry Commission
FGD	Focus Group Discussion
FORIG	Forestry Research Institute of Ghana
FPDF	Forest Plantation Development Fund
FPDFB	Forest Plantation Development Fund Board
FSD	Forest Services Division
GFPS	Ghana Forest Plantation Strategy
MAI	Mean Annual Increment
SD	Standard Deviation
TEL	Timber Export Levy
TOR	Terms of Reference
UENR	University of Energy and Natural Resources

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Executive summary

The Forest Plantation Development Fund Board (FPDFB) in 2018 designed a plantation development scheme under three different implementation models to encourage interested young entrepreneurs to develop private commercial forest plantations within selected degraded forest reserves. Model 1 targeted unemployed graduate foresters or unemployed graduates of similar backgrounds and was piloted in three (3) forest reserves (Essen Epam, Tinte Bepo and Tain II) located in three (3) administrative regions (Eastern, Ashanti and Bono) respectively. Model 2 targeted youth of any background, educated or uneducated and was piloted in off-reserves in the Volta region. Model 3 was to focus on offering financial support to prisons close to forest reserves to undertake plantation establishment while at the same time meeting their food needs from the foodstuffs produced from the farms.

This study was commissioned by the Forest Plantation Development Fund Board (FPDFB) to assess the impacts, lessons and future implications of the project after four years of its inception. The study assessed the extent to which the project goals were being met, the challenges associated with implementation and the lessons learnt to inform policy decisions and way forward. Ecological assessment of the established plantations and qualitative approach, including field-level consultations, focus group discussions, workshops, key informant interviews, and literature review, were employed in gathering data for the study.

The ecological assessment of the established plantations showed that survival rates were reasonably good under both Model 1 (77%) and Model 2 (83%). However, the survival rates at Tain II Forest Reserve and Tinte Bepo Forest Reserve are low in comparison with studies from plantations in similar locations under similar ecological conditions. The recorded growth rate for teak in this study is comparatively lower than what has been reported from similar sites of the dry semi-deciduous ecological zones. The observed variation trends in survival rates, growth rates, plant vigour and stand forms between plots and compartments might be attributable to more local (site-specific) variations such as soil, topography, grazing, and weed control. Variations between the planting sites (forest reserves and farms in off-reserve areas under Model 2) might be reflective of variations in ecological factors that characterize the three sites as well as genetic causes related to the species and the type and source of planting materials used in the plantation establishment. The source of planting materials used for plantations has a huge impact on the success of such projects. The ecological assessment also revealed very high fire events at Tain II, unlike Tinte Bepo (low likelihood of fire) and Essen Epam (no fire event). Other factors accounting for the variation trends in survival rates, growth rates, plant vigour and stand forms include encroachment, farming activities, livestock grazing and the silvicultural management interventions implemented in the planted

areas. In this regard, it is recommended to include training for the farmers and beneficiaries in different silvicultural management practices.

Good quality seeds are needed to produce quality seedlings for plantation establishment. All project beneficiaries identified challenges with seedling supply, including the late supply of seedlings and immature seedlings of poor quality. The relevant institutions, such as the National Tree Seed Center at CSIR-FORIG could be relied on for regular technical support and training services for all seedling contractors used under the project. Community nurseries are further recommended to ensure readily available seasonal supply of seedlings. The fringe community nurseries will further create employment opportunities for the youth, particularly women and young adults, securing the good will and participation of the communities in close proximity to the established plantations.

The implementation framework of the current models are good, with reasonable impacts in its current form. FPDFB adhered to ensuring transparency and inclusiveness in the recruitment processes. However, several weaknesses need to be addressed. Overall, a general trend of low commitment and inactive involvement of participants was noted. Field activities were reportedly mainly undertaken by the farmhands. Underlying drivers for this trend include the lack of a clear road map and documentation of a benefit-sharing agreement, proximity and access to the forest reserves, inadequate financial support, limited access to credit facilities to maintain the plantations beyond the project duration and the lack of prior training on green business models and entrepreneurship skills in plantation development. Furthermore, the farmhands were not included in the benefit-sharing arrangement despite being fully responsible for all field activities. Recommendations for modifications of the models to ensure effectiveness include the following:

Model 1, in its current form, needs revision along the following dimensions:

i) **The benefit-sharing arrangement should be documented and should include the farmhands who live in close proximity to the sites of implementation and have been responsible for the active silvicultural management of the plantations:** With most of the unemployed graduate participants living outside the districts of the degraded reserves, their shared responsibility on the project will still remain as supervisors and project managers (e.g. exploring funding opportunities) beyond the active funding period of the FPDFB. The shared responsibility for the farmhands beyond the FPDFB project period will be to continue providing labour support and the silviculture management required to maintain the established plantation.

ii) **Develop entrepreneurship training on green economy and the business of plantation development for all beneficiaries:** All beneficiaries of the scheme should be well sensitized on the project concept and provided with entrepreneurship training on green economy and the business of plantation

development right from the onset. The training should include building the capacity of trainees on silvicultural management practices, including fire management. This will ensure that the capacities of beneficiaries are built on the entire value chain of plantation development with associated cost and profit implications.

iii) **Provide a clear roadmap on ownership of the established plantations:** Expedite actions on negotiating and signing the benefit-sharing agreement for the existing plantations. Moving forward, negotiating and signing the benefit-sharing agreement should be promptly done in the first year of field activities to provide a clear roadmap on ownership to boost the confidence of beneficiaries as well as motivate them for their active participation.

iv) **Inclusion/ introduction of fast-growing species with ecological resilience to harsh environmental conditions**: Considering that many people are discouraged from investing in tree growing (as a business) due to the long duration to maturity, it is recommended that the project considers the inclusion of relatively fast-growing species such as *Gmelina arborea*. In particular, the inclusion of *G. arborea* would be useful in plantation sites with harsh environmental conditions, as in the Tain II Forest Reserve, considering the species' well-known tolerance/ resilience to harsh growing conditions.

v) **Undertake fire education and management with beneficiaries and fringe communities**: Beneficiaries and farmhands should be regularly educated on bushfire issues. They should further be given training on bushfire management and provided with basic fire-fighting tools. This should be done in conjunction with community fire volunteer groups (if they already exist). If such groups do not exist, it is recommended to establish them in the project fringe communities, particularly in the Tain II Forest Reserve area, where fire was noted to be a major challenge.

The governance process of Model 2 was found to be very useful and achieved great results. This model can be expanded to include more local committed farmers willing to enroll in the project. Issues of diversity in site-specific species in a mixed plantation are highly recommended besides monoculture systems where only teak is encouraged and supplied for planting. Issues of ownership rights and benefit-sharing under model 2 should be promptly addressed.

The intentions envisioned under Model 3 are commendable: It allows the Prison Service to own the established plantations as an institution while granting part-ownership to the individual/group of prisoners who are involved in the establishment of the plantations. With this proposed model, we envisage greater sustainability of the project with the added advantage that the Prison Service would be able to use the proceeds from the plantations to improve their services. Generally, prisoners are typically rotated and are mostly not from the areas of the specific prison of

incarceration. The involvement of prisoners in plantation establishment can be a fulfillment of the hard labour conditions often associated with their sentence. Alternative arrangements that can maintain the original intent of Model 3 could perhaps be seed money or incentives provided from funds accruing from benefit-sharing remuneration from the involvement of any plantation establishment upon release from prison.

1. Introduction and Background

The Forest Plantation Development Fund (FPDF) was established in the year 2000 by the Forest Plantation Development Fund Act, 2000 (Act 583) and an Amendment Act, 2002 (Act 623) to accelerate the rate of establishment of forest plantations. This would be achieved by providing financial assistance for developing private forest plantations on lands suitable for commercial timber production and by providing funds for research and technical advice to persons involved in commercial plantation forestry on specified conditions. The FPDF seeks to support the development of a sustainable forest resource base that will meet future demand for industrial timber while providing ecosystem services to promote environmental quality, produce more food and create employment opportunities. Act 583 further prescribed that monies of the Fund may be used for the payment for the establishment of a specified size plantation, including payment for the relevant management costs, training and incentives as determined by the fund governing board. The Fund may also be used for the provision of incentives to forest plantation growers and forestry firms (FPDF Act, 2000). According to the Ghana Forest Plantation Strategy (GFPS, 2016), the FPDF is the main source of public funding for both private and public forest plantation development in Ghana. Sources of the FPDF include proceeds of the Timber Export Levy (TEL) imposed under the Trees and Timber Act, 1974 (N.R.C.D 273), grants and loans for encouraging investment in plantation forestry, grants provided by international environmental and other institutions to support forest plantation development projects for social and environmental benefits and money provided by Parliament for private forest plantation purposes (FPDF Act, 2000[1]).

In line with the functions and objectives of the Forest Plantation Development Fund Board (FPDFB), a plantation development scheme designed to attract the youth into plantation as an occupation was rolled out in 2018 to encourage interested young entrepreneurs to develop private commercial forest plantations within selected degraded forest reserves. The project dubbed 'youth in plantation establishment' has two major objectives: (i) to attract youth into plantation establishment as a business venture, and (ii) to create a scheme that will serve as a road map in attracting investors and donors into the business of plantation establishment. In addition, the project is expected to increase forest cover and create jobs for the youth, especially graduate youth. The implementation adopted three (3) models. Model one (1) targeted unemployed graduate foresters or unemployed graduates of similar backgrounds and was piloted in three (3) regions - Eastern, Ashanti and Bono. Model two (2)

1 Forest Plantation Development Fund (FPDF) Act, 2000 (Act 583). (Provides financial assistance for the development of forest plantations; provides funds for research and technical advice).; Forest Plantation Development Fund (Amendment) Act, 2002 (Act 623). (Sections (iii), (iv) and (v) support public and private investment in forest plantation development).

targeted youth of any background, educated or uneducated and was piloted in the Volta region. Model three (3) was to focus on offering financial support to prisons close to forest reserves to undertake plantation establishment while at the same time meeting their food needs from the foodstuffs produced from the farms.

Overall, the following implementation strategies were to be adopted by the project: (i) Distribution of free seedlings sourced from selected seedling contractors to ensure high seedling viability and overall success of the plantations, (ii) collaboration with the Forestry Commission (FC) for release of suitable sites in some degraded forest reserves to participants who are interested but do not have lands of their own to establish the plantations, iii) monitoring of participants' sites to ensure that work is carried out as planned, and iv) seek support from relevant institutions (UENR, CSIR-FORIG, FC and Prisons) to provide directional support to the project.

The project has since been implemented for three years as a pilot project necessitating the need for a comprehensive assessment of the implementation process, impacts, lessons and future implications for the youth in plantation establishment as an occupation project of the forest plantation development fund. Therefore, this study seeks to evaluate the project, from conceptual design process through implementation, to draw key lessons for revision or the adoption and upscale of the piloted models.

1.1 Organization of the Report

The remaining sections of the report are structured as follows: the next section covers the objectives, scope of work and expected outputs/deliverables. This is followed by the methodological approach for data collection and analysis. The main findings cover the following sections: (i) ecological growth assessment of the established plantation, (ii) implementation of models/concepts (projections vs. reality), (iii) management of the established plantation and (iv) constraints and challenges. The final section covers the lessons learnt from the study and provides key recommendations and the way forward for future management implications.

1.2 Objectives, Scope of Work and Expected Outputs/ Deliverables

This section reiterates the objectives, scope of work and expected outputs/deliverables as stated in the terms of reference (TOR) of this assignment.

1.3 Objectives

The main objective of this study is to identify the extent to which the project goals are being met, the challenges faced in implementation and lessons that can be learned in order to revise and or scale up the implementation of the models in other landscapes. The specific objectives and research questions guiding the study are as follows:

Specific objectives

i. Assess the success of the established plantations with reference to planting targets and participation of participants in the respective models

ii. Evaluate the extent to which the models used in the implementation process have achieved their intended objectives based on the initial assumptions made

iii. Review the governance and implementation arrangements with respect to the major stakeholders and processes and make necessary recommendations for future engagement in community participation in plantation establishment

iv. Identify key challenges militating against the effective implementation of the project and draw lessons for upscaling and future projects

1.4 Expected Outcome/Deliverables

The expected outcome of this study is to provide a comprehensive evaluation of the implementation of the youth in plantation establishment models to inform policy decisions and planning for future expansion of the project activities.

2. Approach and Methods

2.1 Overview of Study Area

The study was conducted in all four regions where the project models were being piloted – Eastern, Ashanti, Bono and Volta regions. Data collection with beneficiaries of the different models were conducted in 5 communities, namely, Odumase in the Bono region, where project beneficiaries work in the Tain II Forest Reserve, Mehame in the Ahafo region, with members working in the Tinte Bepo Forest Reserve, Akuamaase and Akim Asantemang in the Eastern region where members work in the Essen Epam Forest Reserve and Hohoe in the Volta region where the model focuses on individual farms outside forest reserves (Figure 1). The ecological field level assessment data was also collected in all the established plots within the three forest reserves (Tain II, Tinte Bepo and Essen Epam) and on farmers' fields outside forest reserves in the Volta region.

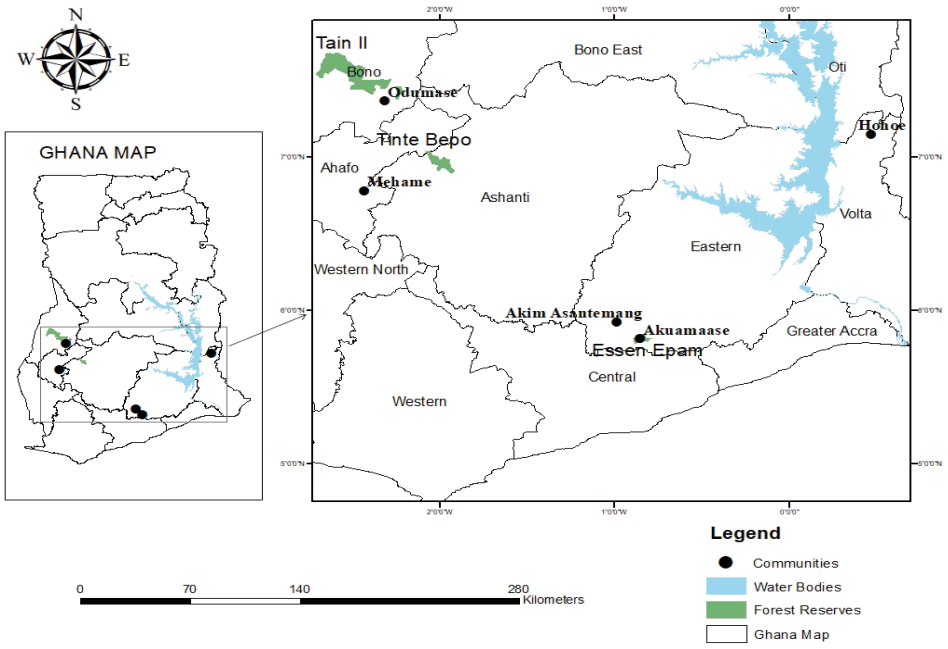


Figure 1. Map of the study area

2.2 Study Design and Data Collection Approach

The study was conducted following a three-step approach:

i. Desk review of relevant background documents

ii. Field-level ecological assessment of the established plantation plots within the allocated forest reserves and farmers fields in the case of Model 3 in the Volta region.

iii. Key stakeholder consultations and data collection using participatory approach (key informant interviews, focus group discussions and workshops)

2.2.1 Scoping and Desk Review

The desk review was conducted to understand the project background, model design and framework for implementation. The review also covered literature on best practices for plantation establishment and management in degraded forest reserves and benefit-sharing arrangements in Ghana's forest sector. The information gathered was used to formulate the study design, data collection instruments for field-level assessment, consultation and analysis.

2.2.2 Ecological Assessment of Established Plantations

2.2.2.1 Sampling Approach and Data Collection

Sample plots were established at each site for the monitoring of tree growth. The sampling design was based on the plantation model being implemented. For Model 1, dealing with unemployed graduates allocated to three Forest Reserves (Tain II, Tinte Bepo, and Essen Epam), sample plots were located in each of the Forest Reserves. The sample plots were also laid to ensure that a minimum of three replicates were located in each compartment per Forest Reserve. In laying sample plots per compartment, the number of individual plots and beneficiaries allocated in the compartment was also taken into consideration for deciding the number of sample plots (see Table 1).

Table 1. Plot distribution in Forest Reserves and Compartments under Model 1

Forest Reserve	Compartment	Number of plots	Species planted	Year of establishment	Spacing
Tain II Forest Reserve	381	3	*Tectona grandis*	2019	3 m x 3m
	324	3	*Tectona grandis*	2019	3 m x 3m
	325	3	*Tectona grandis*	2019	3 m x 3m
	333	3	*Tectona grandis*	2020	3 m x 3m
	334	3	*Tectona grandis*	2020	3 m x 3m

Forest Reserve	Compartment	Number of plots	Species planted	Year of establishment	Spacing
Tinte Bepo Forest Reserve	92	12	*Cedrela odorata, Khaya ivorensis, Terminalia superba*	2019, 2020	3 m x 3 m
	93	12	*Cedrela odorata, Khaya ivorensis, Terminalia superba*	2020	4 m x 4 m
Essen Epam Forest Reserve	12	5	*Cedrela odorata, Terminalia superba*	2020, 2021	3 m x 3 m
	14	5	*Cedrela odorata, Terminalia superba*		3 m x 3m
Total	**9**	**49**			

(Source: Ecological Assessment, December 2022)

For Model 2, targeting youth of any background engaged in tree planting on their own lands, thirteen (13) farms out of 22 were included in the study with a minimum of two sample plots per farm. All the farms under this model were planted with *Tectona grandis* (Teak) in 2019 (Plate 1).

Plate 1. Laying of sample plot on a farmer's farm in the Volta region

Regardless of the plantation model, sample plot sizes of 20 m x 20 m were used for the study except in Tain II Forest Reserve, where the plot size was 30 m x 30 m. A total of 75 sample plots were established and assessed for the entire study sites.

2.2.1.2. Data Collection

Tree inventory: For each plot, the diameter at breast height (1.3 m above the ground) and the total height of trees were measured and recorded. The diameters at breast height for all trees in each plot were measured using a diameter tape (Plate 2), and the total height was measured with the aid of a graduated pole.

Plate 2. Measurement of tree diameter at breast height at Volta region (left) and Tain II Forest Reserve (right)

2.2.1.3. Description of Site Indicators

At each site, silvicultural indicators such as weed control, stem form, plant vigor, singling, and fire rides were assessed. The indicators were scored based on Likert scale ranging from 1 to 5: 1 (very good), 2 (good), 3 (fair), 4 (poor), and 5 (very poor). Also, disturbance indicators such as encroachment, grazing, and fire were scored on a Likert scale ranging from 0 to 3: 0 (none), 1 (low), 2 (high) and 3 (very high).

2.2.1.4. Data Analyses

To address the objective of assessing the success of the established plantations, the mean values of seedling percentage survival were calculated at the plot level, using Equation 1, regardless of species planted.

$$\% \ Survival = \frac{Number\ of\ surviving\ trees}{Total\ number\ of\ trees\ planted} \times 100 \quad (1)$$

For assessing the growth rates of the plantations, the mean annual increment in diameter at breast height (MAI_{dbh}) (Equation 2), and mean annual increment of total height (MAI_{ht}) (Equation 3) were calculated at the plot level for each species. Species-specific analyses were done to reflect the ecological likelihood of different growth rates exhibited by different species of the same age and growth conditions.

$$MAI_{dbh} = \frac{Average\ diameter\ at\ breast\ height}{Age} \times 100 \quad (2)$$

where, MAI_{dbh} is the mean annual increment in average diameter at breast height (cm/yr)

$$MAI_{ht} = \frac{Average\ total\ height}{Age} \times 100 \quad (3)$$

where, MAI_{ht} is the mean annual increment in average total height (m/yr)

Silvicultural interventions and the level of disturbance were estimated by summing the number of occurrences of each Likert scale score and dividing by the number of plots assessed. The resultant values were multiplied by 100 to obtain the percentage score (Equation 4).

$$\% \ Score = \frac{Number\ of\ occurrence\ of\ score}{Number\ of\ plots\ assessed} \times 100 \quad (4)$$

Additionally, the standard deviation, as well as the standard error, was calculated. All calculations were done at plot level and averaged for compartments and Forest Reserves. To put the results into perspective, comparisons of the various growth parameters were made across compartments within Forest Reserves.

2.2.3 Key Stakeholder Engagement Approach

2.2.3.1 Focus Group Discussions and Key Informant Interviews

Stakeholder consultations and field-level engagements began at the community level with a participatory approach to better understand the project implementation process from beneficiaries and other relevant stakeholders' perspectives. Focus group discussions using checklists were held to elicit information from the farmhands and participants (unemployed graduate foresters/unemployed graduates of similar backgrounds) involved in the programme. The checklist covered questions relating to how the beneficiaries were selected, the type of prior training provided, livelihood support provided under the project, implementation lessons and challenges, and

participants knowledge of the benefit-sharing arrangements proposed for the established plantations (Appendix 1). The consultations also included key informant interviews with project coordinators of the FC for all the implementation sites and selected members of the FPDFB. Specifically, the key informant interviews solicited opinions and perspectives on the entire project implementation process and their suggestions for future implementation. Overall, a total of 249 stakeholders were engaged at all levels (Table 2).

At the community level, seven (7) separate focus group discussions (FGDs) were organized, followed by a general discussion in a workshop setting. A total of 189 participants and farmhands were engaged across all the implementation sites (Table 2). Since most participants were unable to meet the survey team at the various implementation sites, separate phone interviews were conducted for participants under Model 1 whom the study team were able to reach on phone. Table 2 provides detailed information on the engagement conducted during the data collection process.

Table 2. Engagement approach and the total number of people consulted

Region / Place of engagement	Engagement approach	Beneficiaries and key stakeholders engaged	Total number of people engaged
Participants and beneficiaries			
Bono region	Face-to-face and phone interviews	Participants (unemployed graduates)	15
	Focus group discussions and workshops	Farmhands	32
Ashanti region	Face-to-face and phone interviews	Participants (unemployed graduates)	16
	Focus group discussions and workshops	Farmhands	59
Eastern region	Face-to-face and phone interviews	Participants (unemployed graduates)	8
	Focus group discussions and workshops	Farmhands	54
	Workshop	Additional farmhands	34
Volta region	Focus group discussions	Participating farmers	16
	Focus group discussions	Non-participating farmers who expressed interest in the programme	5

Region / Place of engagement	Engagement approach	Beneficiaries and key stakeholders engaged	Total number of people engaged
Other relevant stakeholders			
Project implementation Coordinators (FC)	Online zoom meeting	Project implementing coordinators	7
FPDFB	Phone interviews	Project Model formulators	3
Total			249

Two separate focus group discussions were held in the Bono and Ahafo regions. The first was conducted for farmhands and participants, and the second was for the participants only. In the Bono region, 32 farmhands (13 females, 19 males) and three participants (all male) were engaged on site (Plate 3). Additional 12 participants were engaged through phone interviews. A total of 59 farmhands (33 females, 26 males) and three participants (all males) were engaged on site in the Ahafo region (Plate 4 and 5). Thirteen (13) more Ashanti region participants were also engaged through phone interviews.

Plate 3. Focus group discussion with farmhands and participants at Odumasi in the Bono region

Plate 4. Engagement workshop with farmhands and participants at Mehame in the Ahafo region

Plate 5. Group photographs with farmhands and participants after the engagements at Mehame in the Ahafo region

In the Eastern region, four separate focus group discussions were held for a total of 88 farmers directly involved in the project. The first two separate focus group discussions involved 34 farmers (22 females, 12 males) living within the Essen Epam Forest Reserve (Akuamaase) but were not involved in the project from the onset. The

remaining two focus group discussions entailed 54 farmhands and one participant (13 females, 42 males). The only male participant was interviewed separately after the FGD. Eight (8) participant (Plate 6) beneficiaries of the Eastern regions were additionally engaged through phone interviews. In the Volta region, the focus group discussion held at Hohoe involved five youths enrolled in the model (4 males and 1 female) and five youth non-participants (4 males and 1 female) who were willing to be enrolled if given opportunities.

Plate 6. Engagement workshop with farmhands and participants at Akim Asantemang (left) and Akuamaase (right) in the Eastern region

2.2.3.2 Qualitative Data Analysis

The data was analyzed following the framework analytical approach often employed for focus group data analysis (Ritchie and Spencer, 1994). This analytical process involves five key interconnected steps from the data collection process to the analysis stage. These key steps include familiarization, identifying a thematic framework, indexing, charting, mapping and interpretation. Data from the field-level consultations was therefore analyzed by first transcribing all recorded statements made. These statements were further examined and categorized based on underlying evidence in order to address the initial goal of the study.

3. Results and Key Findings

3.1 Ecological Assessment of Established Plantations

3.1.1 Survival of Trees Planted

Model 1

Essen Epam

The overall survival rate of the two compartments assessed at Essen Epam was 77%. Compartment 14 had a higher survival rate (83%) than Compartment 12 (71%), although both compartments had the same species *Cedrela odorata* (Cedrela) and *Terminalia superba* (Ofram) and were planted within the same period i.e., 2020-2021 (Table 3).

Tain II

The species in all compartments at Tain II were Teak (Table 3). The overall survival rate of the five compartments assessed was 49%. Three of the compartments (381, 325 and 333) had less than 50% survival rates, while compartments 324 and 334 had an average survival rate of 58%.

Tinte Bepo

Regarding the two compartments assessed in Tinte Bepo, the overall survival rate was 59%, with survival rates of 56% and 61% for Compartments 92 and 93, respectively. However, species combinations were the same in the selected compartments i.e. Cedrela, *Khaya ivorensis* (Mahogany) and Ofram (Table 3).

Model 2

Volta Region

The average survival rate of Teak planted on the 13 farms assessed in the Volta region was 83%. Majority of the farms (85%) assessed had at least 70% survival rate (Table 4).

Table 3. Summary statistics of the growth performance of trees at Essen Epam, Tain II and Tinte Bepo Forest Reserves.

Forest Reserve	Com-partment	Survival (%)	DBH (cm)					Height (m)					
			Species	Mean	Min	Max	SD	MAI (cm/yr)	Mean	Min	Max	SD	MAI (m/yr)
Essen Epam	Cpt 12	60.21	Cedrela	5.26 ± 0.22	1.75	12.73	2.01	5.26 ± 0.22	3.93 ± 0.22	1.90	10.80	2.02	3.89 ± 0.22
		11.00	Ofram	2.55 ± 0.23	1.59	5.09	0.90	2.55 ± 0.23	2.25 ± 0.20	1.50	4.70	0.77	2.25 ± 0.20
	Cpt 14	69.70	Cedrela	7.18 ± 0.28	2.07	15.76	2.69	4.12 ± 0.13	6.07 ± 0.33	1.60	11.40	3.16	3.40 ± 0.16
		12.88	Ofram	3.88 ± 0.41	1.59	7.96	1.67	2.66 ± 0.18	3.18 ± 0.33	1.40	5.80	1.36	2.17 ± 0.13
Tain II	Cpt 381	46.33	Teak	5.06 ± 0.26	1.49	10.96	1.97	1.58 ± 0.04	6.53 ± 0.23	1.50	9.60	1.81	2.06 ± 0.03
	Cpt 324	57.67		4.20 ± 0.23	1.34	9.08	1.94	1.38 ± 0.04	4.70 ± 0.22	1.48	8.93	1.92	1.50 ± 0.05
	Cpt 325	39.67		3.81 ± 0.20	1.28	8.12	1.42	1.30 ± 0.04	3.60 ± 0.15	1.60	6.03	1.07	1.30 ± 0.04
	Cpt 333	42.00		3.59 ± 0.22	1.35	7.96	1.57	1.79 ± 0.07	3.23 ± 0.15	1.65	5.53	1.09	1.61 ± 0.06
	Cpt 334	58.67		5.08 ± 0.16	2.10	8.65	1.50	2.47 ± 0.06	4.95 ± 0.09	2.10	6.07	0.83	2.38 ± 0.06
Tinte Bepo	Cpt 92	33.41	Cedrela	9.99 ± 0.36	1.27	21.80	4.32	4.76 ± 0.19	7.01 ± 0.22	1.40	13.70	2.68	3.29 ± 0.12
		15.26	Mahogany	4.58 ± 1.32	1.56	7.99	0.24	1.90 ± 0.13	3.53 ± 0.20	1.30	7.10	1.42	1.69 ± 0.12
		13.26	Ofram	6.36 ± 0.45	2.01	13.37	2.60	3.13 ± 0.23	3.85 ± 0.18	1.50	5.30	1.03	1.89 ± 0.19
	Cpt 93	45.83	Cedrela	11.02 ± 0.32	3.57	23.40	3.69	5.51 ± 0.46	9.42 ± 0.22	3.8	14.70	2.60	5.01 ± 0.11
		15.91	Ofram	5.96 ± 0.47	1.53	10.22	2.41	2.98 ± 0.32	4.06 ± 0.18	2.5	5.3	0.89	2.13 ± 0.15
		11.36	Mahogany	5.14 ± 0.49	1.97	9.87	2.19	2.62 ± 0.55	3.78 ± 0.35	1.3	6.7	1.57	3.66 ± 0.39

NB: Cpt is compartment, Min is minimum, Max is maximum, SD is standard deviation, and MAI is the mean annual increment. The mean is given as the mean ± the standard error.

Table 4. Summary statistics of the growth performance of Teak trees in the Volta region.

	DBH (cm)						Height (m)				
Volta Region	**Survival (%)**	**Mean**	**Min**	**Max**	**SD**	**MAI (cm/yr)**	**Mean**	**Min**	**Max**	**SD**	**MAI (m/yr)**
Farm 1	74.00	5.44 ± 0.24	1.18	13.26	2.07	1.81 ± 0.06	5.56 ± 0.17	1.11	7.85	1.40	1.88 ± 0.04
Farm 2	89.77	6.83 ± 0.38	1.85	11.17	2.37	2.28 ± 0.09	6.04 ± 0.20	1.91	7.50	1.27	2.02 ± 0.05
Farm 3	100.00	6.09 ± 0.30	1.59	11.25	2.16	2.07 ± 0.08	4.42 ± 0.22	1.14	6.80	1.60	1.55 ± 0.06
Farm 4	82.95	9.14 ± 0.57	4.03	27.18	3.73	3.03 ± 0.15	8.01 ± 0.29	3.70	16.65	1.89	2.72 ± 0.09
Farm 5	100.00	6.02 ± 0.31	1.19	9.17	2.00	1.98 ± 0.07	5.61 ± 0.28	1.40	8.40	1.86	1.89 ± 0.07
Farm 6	75.00	4.13 ± 0.32	1.05	9.01	2.01	1.36 ± 0.07	3.89 ± 0.27	1.41	7.70	1.72	1.28 ± 0.06
Farm 7	96.59	6.13 ± 0.28	2.20	10.76	2.09	2.20 ± 0.07	6.66 ± 0.24	2.80	9.50	1.77	2.23 ± 0.06
Farm 8	92.05	6.13 ± 0.39	1.66	10.92	2.62	2.03 ± 0.10	6.48 ± 0.45	1.47	15.50	2.96	2.14 ± 0.11
Farm 9	87.50	2.97 ± 0.18	1.34	6.08	1.24	0.99 ± 0.04	2.85 ± 0.16	1.41	5.65	1.11	0.95 ± 0.04
Farm 10	45.45	6.15 ± 0.63	1.58	12.54	2.97	2.03 ± 0.14	5.35 ± 0.51	1.96	9.50	2.32	1.79 ± 0.10
Farm 11	93.18	7.24 ± 0.25	4.12	10.92	1.68	2.40 ± 0.06	7.44 ± 0.20	4.4	9.60	1.35	2.48 ± 0.05
Farm 12	45.32	8.00 ± 0.52	3.17	12.10	2.61	2.67 ± 0.12	7.32 ± 0.28	3.30	10.55	1.42	2.43 ± 0.07
Farm 13	87.50	5.41 ± 0.23	1.83	8.29	1.53	1.83 ± 0.06	5.21 ± 0.20	2.15	7.10	1.34	1.74 ± 0.05
Average	**82.79**	**6.13 ± 0.35**	**2.06**	**11.74**	**2.24**	**2.05 ± 0.09**	**5.76 ± 0.27**	**2.17**	**9.41**	**1.69**	**1.93 ± 0.07**

NB: Cpt is compartment, Min is minimum, Max is maximum, SD is standard deviation, and MAI is the mean annual increment. The mean is given as the mean ± the standard error.

3.1.2 Growth performance

Model 1

Essen Epam

The Cedrela and Ofram in compartment 14 were larger and taller than those in compartment 12. The Cedrela trees were larger and taller than the Ofram trees in both compartments (Table 4). Not surprisingly, the annual growth rate in terms of DBH and height of Cedrela was relatively faster than Ofram (Figures 2 & 3).

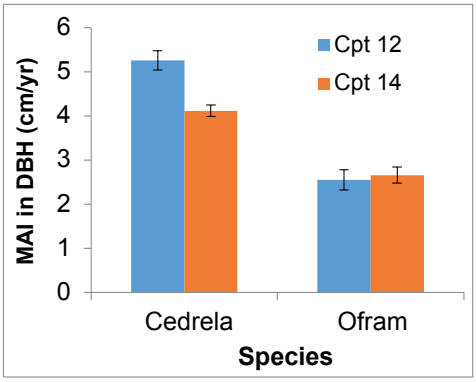


Figure 2. Mean annual increment (MAI) in diameter at breast height (DBH) of trees in Compartments (Cpt) 12 and 14 at Essen Epam Forest Reserve.

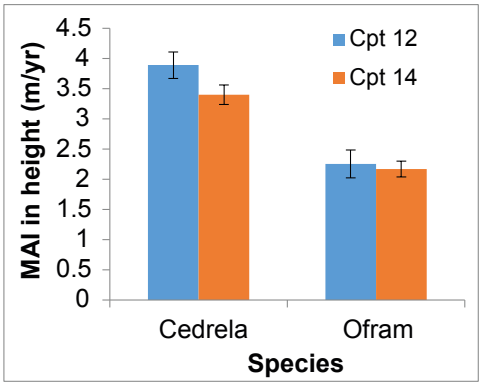


Figure 3. Mean annual increment (MAI) in height of trees in Compartments (Cpt) 12 and 14 at Essen Epam Forest Reserve

Tain II

The Teak trees at Tain II had an average DBH of 4.4 cm and a height of 4.6 m. The DBH of the five compartments ranged between 1.3 cm to 11.0 cm, and the height ranged between 1.5 m to 10.6 m (Table 4). On average, the annual growth rate of trees in four compartments was almost the same. However, the annual growth rate of Teak in compartment 334 was relatively faster than the other four compartments (Figures 4 & 5).

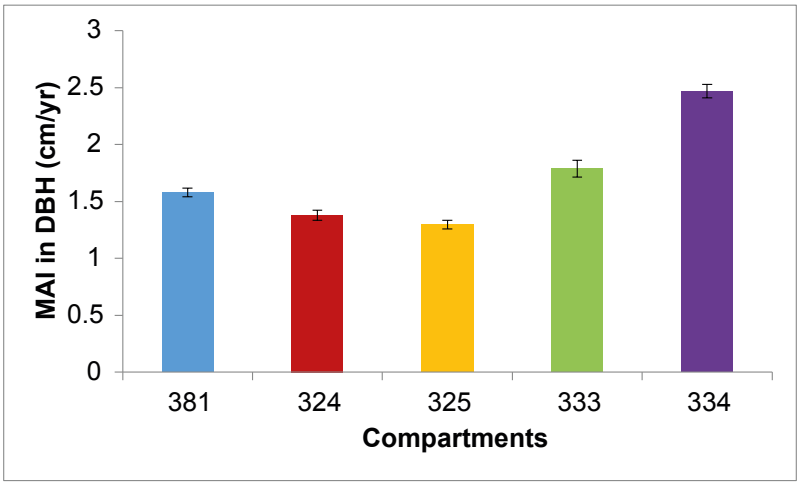


Figure 4. Mean annual increment (MAI) in diameter at breast height (DBH) of Teak trees in Compartments 381, 324, 325, 333 and 334 at Tain II Forest Reserve

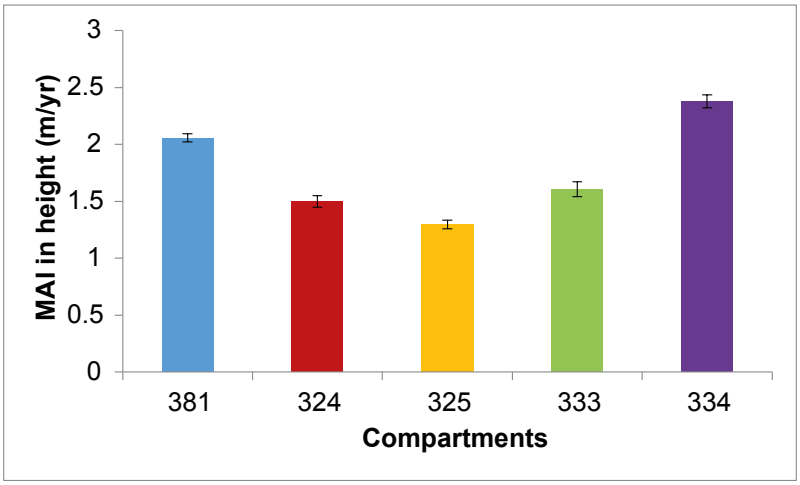


Figure 5. Mean annual increment (MAI) in height of Teak trees in Compartments 381, 324, 325, 333 and 334 at Tain II Forest Reserve.

Tinte Bepo

Amongst the three species (Cedrela, Mahogany and Ofram) in compartment 92, the Cedrela were larger and taller than the other two species. The DBH of the Cedrela ranged from 1.3 cm to 21.8 cm, while height ranged from 1.4 m to 13.7 m (Table 3). The Mahogany were the smallest in terms of DBH and height. The annual growth rate of the species followed the same trend, with Cedrela growing faster than Mahogany and Ofram (Figure 6). In compartment 93, a similar trend was also observed. Cedrela had larger DBH and height than Mahogany and Ofram. On average, the DBH of Cedrela and Mahogany in compartment 93 grew faster than in compartment

92, however, the annual growth in DBH of Ofram in compartment 92 was faster than in compartment 93 (Figure 6). The annual growth in height of all species in compartment 92 was slower than in compartment 93 (Figure 7).

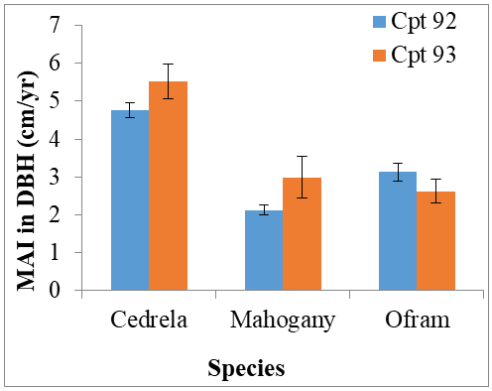


Figure 6. Mean annual increment (MAI) in diameter at breast height (DBH) of trees in Compartments (Cpt) 92 and 93 Tinte Bepo Forest Reserve.

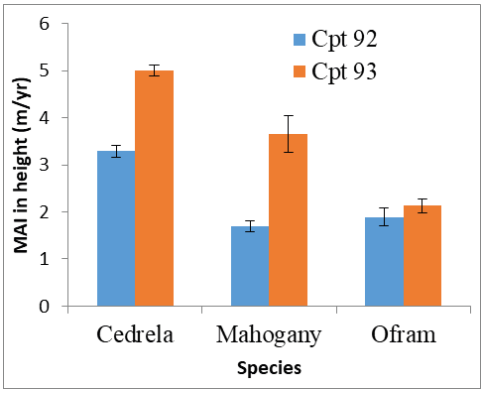


Figure 7. Mean annual increment (MAI) in height of trees in Compartments (Cpt) 92 and 93 Tinte Bepo Forest Reserve.

Model 2

Volta Region

The DBH of the Teak on the off-reserve farms ranged from 1.1 cm to 13.3 cm, while height ranged from 1.1 m to 15.5 m. On average, the DBH of Teak increased at an annual rate of 2.1 cm while height increased by 2.0 m (Table 4, Figure 8). On average, the annual increment in height was 1.9 m (Table 4, Figure 9).

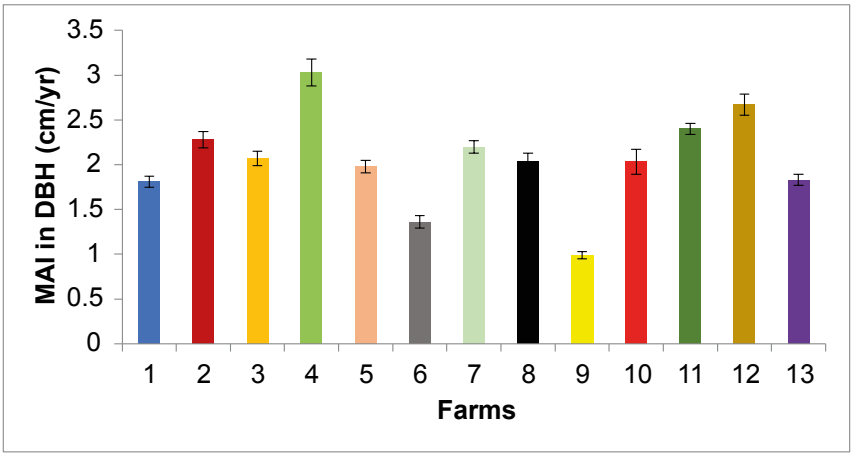


Figure 8. Mean annual increment (MAI) in diameter at breast height (dbh) of trees on selected farms in the Volta Region

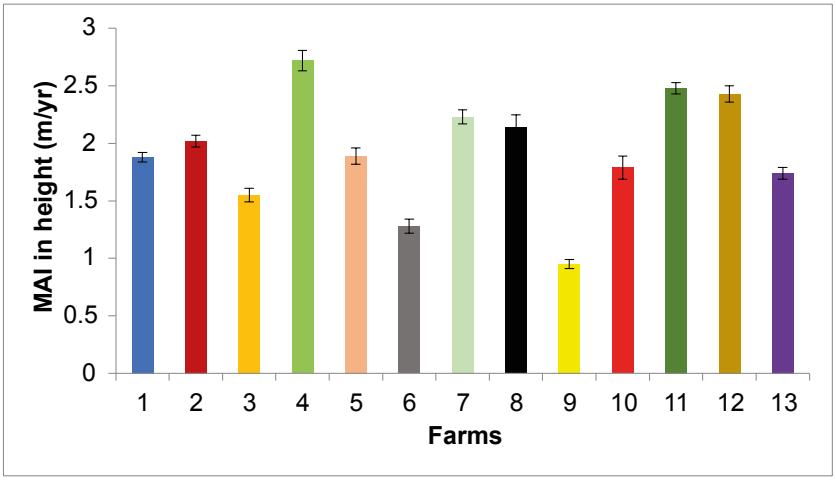


Figure 9. Mean annual increment (MAI) in height of trees on selected farms in the Volta Region

3.1.3 Silvicultural Indicators

Model 1

Essen Epam

At Essen Epam, weed control within the entire plantation was good (Plate 7). About 60% of the trees had good stem form. Plant vigor and singling were good in the established plantation. However, fire rides in the entire plantation were very poorly maintained (Figure 10). No encroachment, grazing and fire incidence was observed.

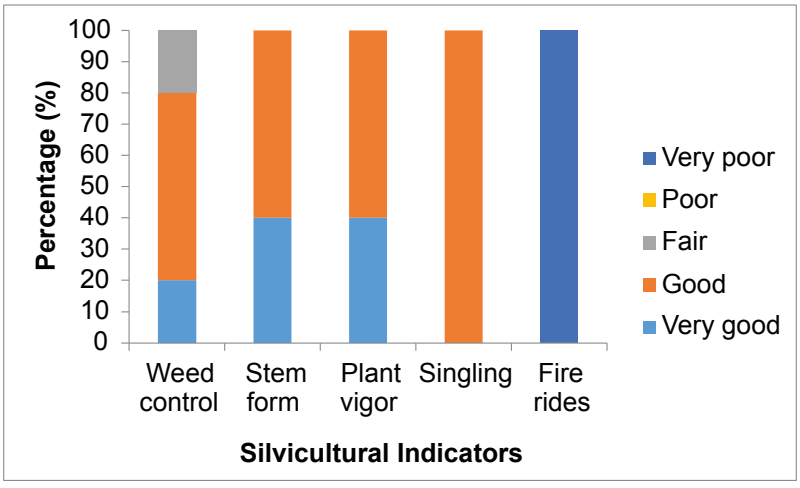


Figure 10. Silvicultural indicators in established plantations in Essen Epam Forest Reserve

Plate 7. Pictures showing good weed control at Essen Epam Forest Reserve

Tain II

Weed control was very good at Tain II Forest Reserve. Over 70% of the trees had good stem form and tree vigor (Figure 11, Plate 8). Singling was fairly carried out in almost half (46%) of the Teak plantations assessed. However, fire ride maintenance was very poor in about 54% of the entire plantation (Figure 11).

There was no encroachment in about 75% of the Teak plantation assessed. Grazing was noted to be very high (71%) (Figure 12, Plate 9). High (50%) fire incidence was also observed (Figure 12).

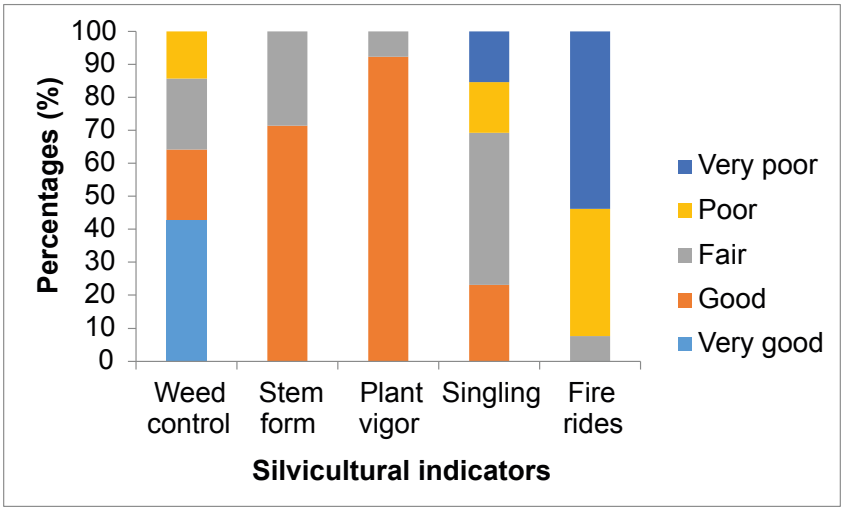


Figure 11. Silvicultural indicators of Teak plantations in Tain II Forest Reserve

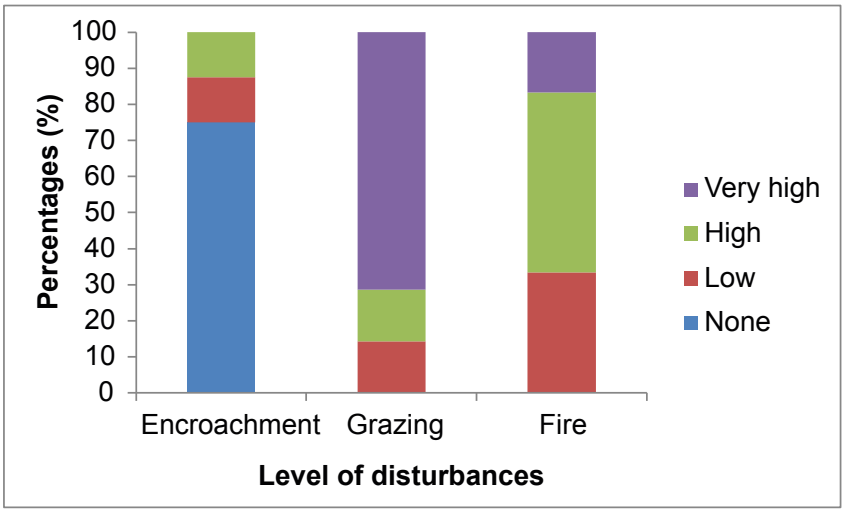


Figure 12. Level of disturbances of Teak plantations in Tain II Forest Reserve

Plate 8. Picture showing good weed control in Teak plantations at Tain II Forest Reserve

Plate 9. Cattle grazing in parts of the Tain II Forest Reserve

Tinte Bepo

In Tinte Bepo, about two-thirds of the plantations assessed had very good weed control, stem form and plant vigor (Plates 10 and 11). Singling and fire ride maintenance were at least good in 50% of the plantations assessed (Figure 13).

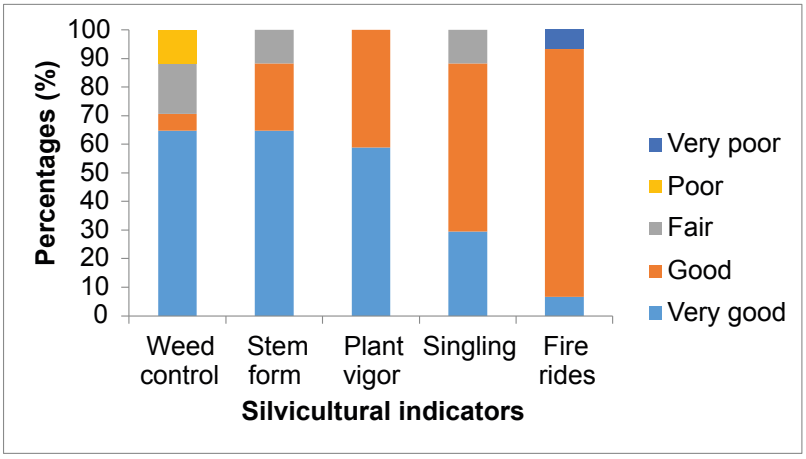


Figure 13. Silvicultural indicators in established plantations in Tinte Bepo Forest Reserve

No encroachment was observed in the plantations. However, there was minimal disturbance of grazing and fire in the plantations (Figure 14).

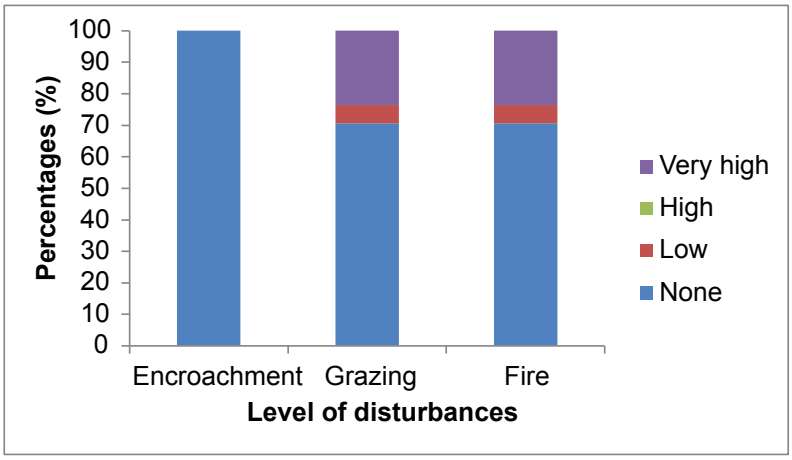


Figure 14. Level of disturbances of established plantations in Tinte Bepo Forest Reserve

Plate 10. Picture showing good weed control and stem form at Tinte Bepo Forest Reserve

Plate 11. Picture showing trees with good vigor at Tinte Bepo Forest Reserve

Model 2

Volta Region

In Volta region, weeding was fairly carried out within the plantation (Plate 12). About 31% of the trees had good stem form. Also, 62% of the trees had good plant vigor (Plate 13). Singling was done in almost half (46%) of the plantations assessed. No fire rides had been constructed in any of the plantations assessed (Figure 15).

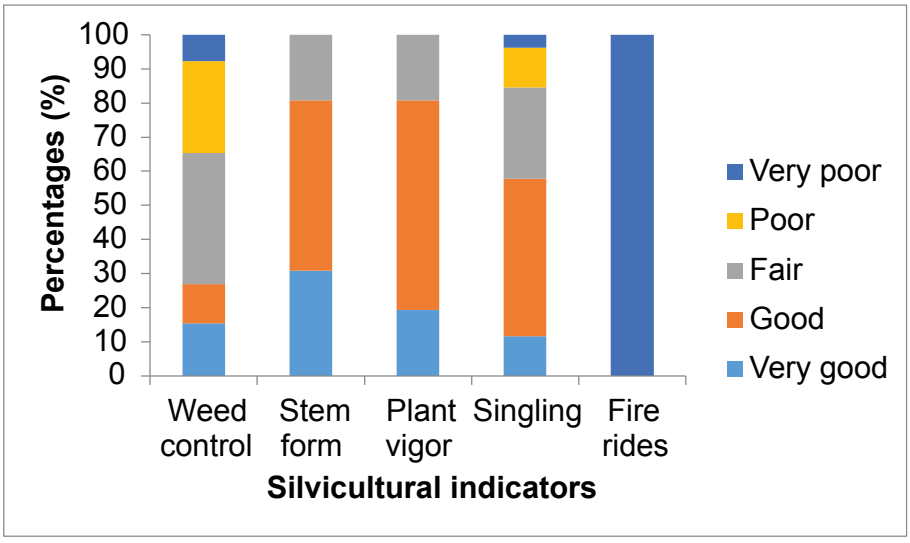


Figure 15. Silvicultural indicators of Teak plantations in Volta region

No grazing was observed in the plantations assessed. However, there were few areas in the plantations which had been encroached (8%) and had experienced very high fire disturbance (8%) (Figure 16).

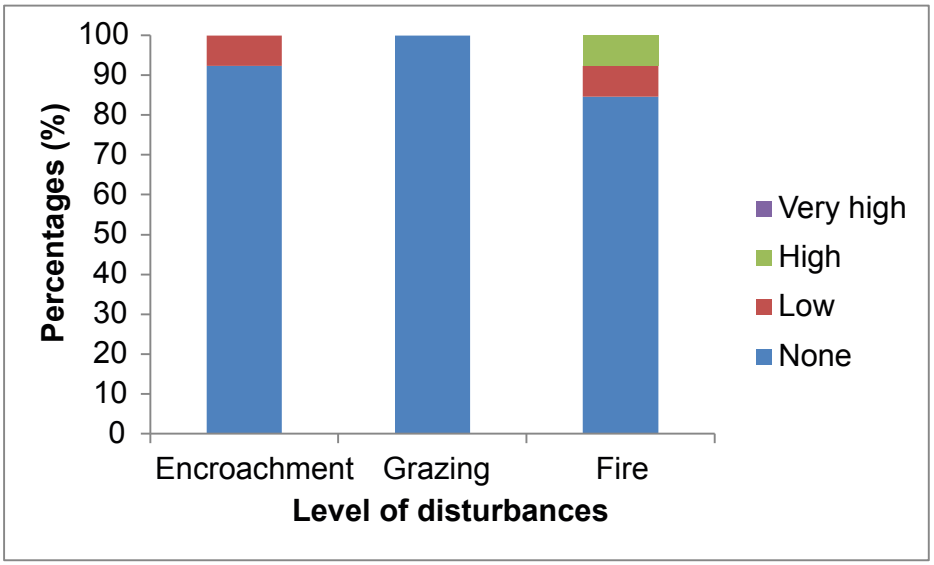


Figure 16. Level of disturbances of Teak plantations in Volta region

Plate 12. Picture showing poor weed control in Teak plantations in the Volta Region (Model 2)

Plate 13. Picture showing Teak plantation with good vigor in the Volta Region (Model 2)

3.2 Governance Arrangements in the Implementation of the Reforestation Models

3.2.1 Reforestation Model Architecture employed under the Project

The plantation establishment was designed under three entrepreneurship model strategies. The models focused on the youth seeking to develop a livelihood through plantation forestry as a business (Figure 17). Model 1 targeted unemployed graduate foresters or unemployed graduates of similar backgrounds and was piloted in three (3) regions - Eastern, Ashanti and Bono. Three groups each comprised of twenty-five (25) people were expected to operate in one selected Forest Reserve in each of the three (3) regions. In total, seventy-five (75) participants (i.e. twenty-five from each region) were enrolled into the project. Each participant was projected to establish 5 hectares in a selected Forest Reserve on one compartment, making a total of 125 hectares per Forest Reserve.

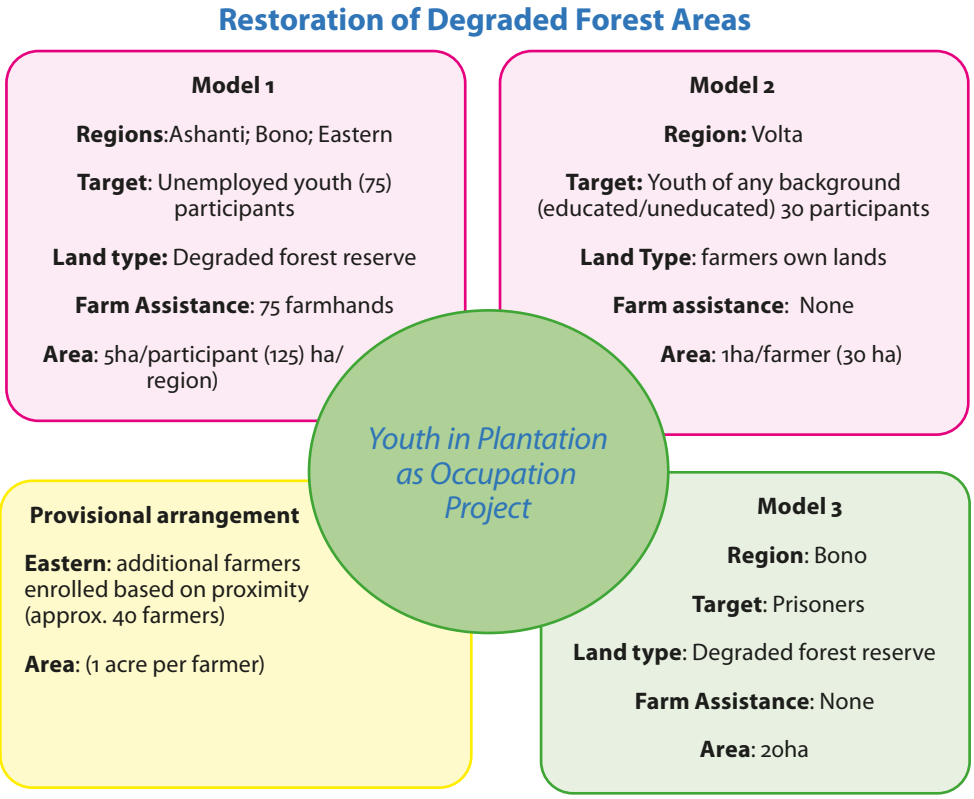


Figure 17. Model architecture under the youth in plantation as an occupation program.

Model 2 targeted youth of any background educated or uneducated, and was piloted in the Jasikan Forest District in the Volta region. Thirty (30) participants were enrolled at the onset for the establishment of 1-hectare plantation, each on their own land outside Forest Reserves. A third model, Model 3 was envisioned to focus on offering financial support to prisons close to forest reserves to undertake plantation establishment while at the same time meeting their food needs from the foodstuffs produced from the farms. This model intended to develop a scheme whereby the plantations will be owned by the prison service while the prisoners can own part of the plantation upon their release and most importantly be a source of employment for prisoners who are rejected by their relatives and society after their release to always come back to settle on the plantation and make a living. However Model 3 is yet to be piloted as projected.

The projected implementation modalities for Model 1 and Model 2 are highlighted in Text Box 1.

TEXT BOX 1- Projected Implementation Modalities of Models

Model 1

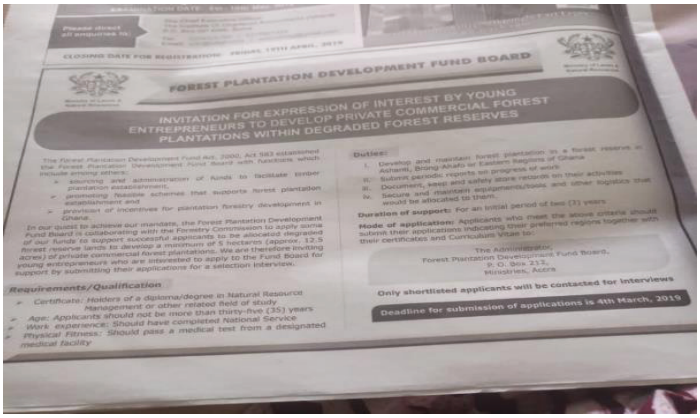
- **Target groups**: Unemployed graduates
- **Cost Coverage**: Entire establishment costs at least for the first two years until they are in a position to go in for loans
- **Seedlings provision:** Seedlings required for planting to be supplied by FPDFB - sourced from high quality contracted seedling producers
- **Livelihood support**: Allowance at the rate equivalent to national service personnel for 2 years
- **Establishment Area: 25 participants to a** compartment of 125 hectares (5 ha per participant)
- **Farmhands assistance: 5 ha attracts** 5 workers to each participant on part-time basis and daily rated but paid monthly at a rate of Gh¢10.00 per day and will work 25 days in a month (monthly wage to Gh¢250.00)
- **Workload:** All establishment and silvicultural management works to be undertaken by participants and 5 farmhands on the 5 ha throughout the year
- **Monitoring and evaluation:** conducted on a monthly basis by coordinators

Model 2

- **Establishment cost & Seedlings provision** – Same as model 1
- **Livelihood support:** Annual livelihood support allowance of Gh¢2000.00 per farmer per year
- **Farmhands assistance:** 1 farm worker per farmer @ Gh¢3000.00 per worker per year
- **Establishment Area:** 30 farmers – 1 ha per farmer (farmers own land 30 hectares)
- **Workload:** All establishment and silviculture management works to be undertaken
- **Monitoring and evaluation:** conducted on a monthly basis by coordinators

3.2.2 Selection Process of Beneficiaries

Implementation of the project began with wider dissemination of the concept to the general public through media publications. A follow-up call for applications from interested target groups through different communication platforms (e.g. newspaper publications and information center announcements) was done to ensure fair representation and transparency in the execution of the project. Regarding the model targeting unemployed graduate participants, the FPDFB placed an advert in the newspapers titled "Invitation for expression of interest by young entrepreneurs to develop private commercial forest plantations within degraded forest reserves" (See plate 14).


FOREST PLANTATION DEVELOPMENT FUND BOARD

INVITATION FOR EXPRESSION OF INTEREST BY YOUNG ENTREPRENEURS TO DEVELOP PRIVATE COMMERCIAL FOREST PLANTATIONS WITHIN DEGRADED FOREST RESERVES

Duties:

i. Develop and maintain forest plantation in a forest reserve in Ashanti, Brong-Ahafo or Eastern Regions of Ghana
ii. Submit periodic reports on progress of work
iii. Document, keep and safely store records on their activities
iv. Secure and maintain equipments/tools and other logistics that would be allocated to them.

Duration of support: For an initial period of two (2) years

Mode of application: Applicants who meet the above criteria should submit their applications indicating their preferred regions together with their certificates and Curriculum Vitae to:

The Administrator,
Forest Plantation Development Fund Board,
P. O. Box 213,
Ministries, Accra

Only shortlisted applicants will be contacted for interviews

Deadline for submission of applications is 4th March, 2019

Plate 14. Newspaper advert for the expression of interest in 2019.

Shortlisted applicants were interviewed at a centralized location – Forestry Commission Wood Industry Training Center, Akyawkrom in the Ashanti region. Successful applicants were offered employment letters thereafter. A total of 25 participants in each region were offered employment by the FPDFB as projected under the models. The employment letters issued effective 1st June 2019, contained defined conditions of service (e.g., payment of a monthly allowance for livelihood support, provision of free seedlings, labour assistant provided for each hectare to take care of field activities throughout the year, etc.) The participants confirmed during the study that three farmhands were assigned to each graduate participant to provide labour support on their allocated plots as projected in the modalities of implementation of Model 1.

The farmhands from the Bono and Ashanti regions were mainly recruited from the fringe communities through community-level information center announcements by the project coordinators and assemblymen of their respective communities. Participants during the FGD revealed that the announcement conveyed information on a proposed tree planting with food inter-crop initiatives in forest reserves with a call for interested persons to submit their names at these centers for screening and consideration. From the field engagements, the study noted that the recruitment of farmhands in the Eastern region had a different approach. Interested persons were recruited directly by the FPDFB coordinator in charge of the Essen Epam in collaboration with some key community leadership from the forest fringe communities. One such community where interested farmhands were recruited to participate in the project was Akim Asantemang. Overall, a total of 75 farmhands were employed in each region. The farmhands recruited to work in the Tain II forest reserve are from the forest fringe communities, namely Odumase, Kwatire, Dumasue, and Andoe whiles those recruited to work in Tinte Bepo are noted to be from Dunyankwanta, Mehame, Barniehkrom, Bonsukrom, Sunkwa and Mankrangya. The farmhands recruited to work in the Essen Epam Forest Reserve are from the fringe communities of Akim Asantemang and Akim Baadu.

In the Eastern Region, the assessment revealed that the project recruited additional farmhands from communities within close proximity of the forest reserve. Although these farmers were not enrolled at the onset, the proximity of their settlement provided them a good basis to be included in the programme. One such community is Akuamaase, where 40 farmers were later selected to participate in the project in 2020. A different arrangement was made with these as new entrants since the FPDB had exhausted the 75 farmhands for the region. Under this new arrangement, each farmer was given at most 1 acre of land in the forest reserve to integrate food crops and cater for the trees planted.

The selection process under Model 2- Volta region was somewhat similar to the processes in Model 1. During the FGDs in the Volta region, participants revealed that they first heard the information through radio announcements and from the office of the District Chief Executive (DCE). The announcement requested for interested farmers willing to establish 1-hectare tree plantations on their own land to submit their names for screening and consideration. According to the beneficiaries of Model 2, they were shortlisted and interviewed by the FPDFB followed by inspection of their respective lands before being recruited to enroll in the programme. Additionally, site plan documentation of their plots were demanded and prepared at the cost of Gh¢2500.00 per person.

3.2.3 Training provided to beneficiaries of the Project

Three key institutions were projected to provide technical and support services during the implementation of the project. These institutions include:

- Department of Forestry at the University of Energy and Natural Resources (UENR)
- Council for Scientific and Industrial Research-Forestry Research Institute of Ghana (CSIR-FORIG)
- Forestry Commission (FC)

The study revealed that the projections for these institutions to provide technical and support services have since not materialized. For example, CSIR-FORIG, which has the National Tree Seed Center for the supply of quality seeds and seedlings, prior to these assessments, has not been involved in offering technical support to the project. No prior training on plantation establishment and silvicultural management techniques were provided for both the farmhands and participants who needed them based on their academic backgrounds. It was noted from the assessment that participants only received tutorials on planting distance from the project coordinators from the FC. Many of the unemployed graduate participants were employed based on their knowledge in natural resource management and perhaps assumed not to require further training. However, while some of the participants interviewed have degrees in natural resource management, others have backgrounds

in environmental science, social science and psychology, and planning monitoring and evaluation. Similarly, all the farmhands interviewed during the FGDs indicated that they did not receive prior training for the plantation work assigned to them. The following are two statements of opinions from two participants of the FGD in Mehame and Odumasi in the Ahafo and Bono regions respectively.

Apart from the training on pegging and planting, we were not trained on how to manage and take care of the planted trees before we started the project. We have also not received any capacity building or any support from any institution. We have heard that CSIR-FORIG provides some training to people involved in plantation development and how to manage their established plantations, but we have not received any such training from them. A participant from the FGD in Mehame, December, 2022.

We acknowledge the importance of receiving some needed support in the development and management of forest plantations from relevant institutions. But my colleagues and I can confirm that apart from the project coordinators from FC that provided some technical support to us, we have not seen the involvement of CSIR-FORIG and UENR in the implementation of the project. A participant from the FGD in Odumase, December, 2022.

The study further revealed that, due to the lack of prior training on the establishment and management of plantations with food intercrops, poor farm management practices were employed by the farmhands. Our study revealed that the farmhands paid no particular management attention to nurturing naturally occurring trees growing in the plots. Majority of them indicated during the FGD that they are of the opinion that FPDFB wanted to protect only the established trees, hence they resorted to cutting any other trees growing in their plots during farming activities.

3.2.4 Silvicultural Management, Monitoring and Reporting Procedures for the Established Plantations

Findings from the study revealed that for Model 1, the implementation modalities followed the projected plans as described in Textbox 1 with not much deviation. Figure 18 shows highlights of the implementation modalities described by participants and farmhands as pertaining to the situation on the ground/perspectives.

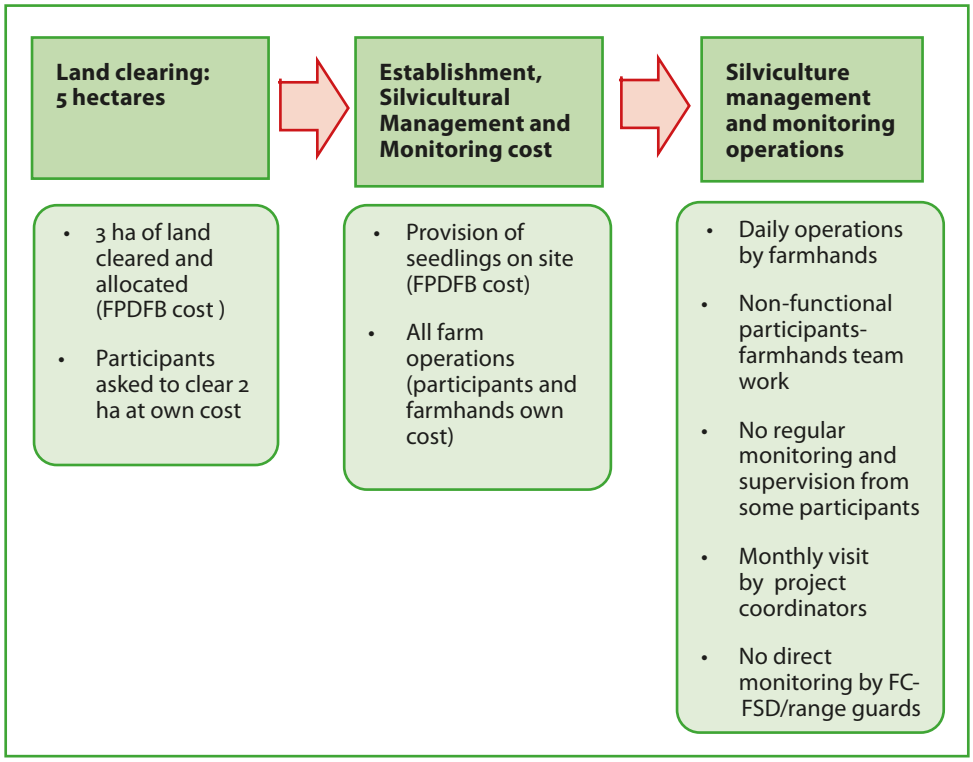


Figure 18. Perspectives of farmhands and participants on implementation modalities

According to participants, for the first year of operation, the FPDFB cleared 3 ha of land allocated to the participants. The participants were then tasked to clear the remaining 2 ha at their own cost. Subsequent management of the plantation is the responsibility of the participant, with help from the farmhands. Ten hectares were demarcated for each participant in the Tain II and Tinte Bepo forest reserve, while 5 ha were demarcated for the participants in the Essen Epam Forest Reserve. However, each participant was instructed by FPDFB to initially work on 5 ha, after which an assessment will be conducted, and successful participants be asked to develop the other 5 ha. This reported modality contrasts with what was stated in their appointment letters because each participant was supposed to establish 3 ha in the first year and complete the 7 ha in the second year. Participants working in the Tain II Forest Reserve adhered to the directive of initially establishing the 5 ha. However, the arrangement was different for participants working in the Tinte Bepo Forest Reserve. Initially, 18 participants received 10 ha each. According to the participants, all 25 participants could not receive the 10 ha earmarked by the FPDFB because one of the compartments had less land for development. The 10 ha received by some participants was then reduced to 5 ha for the other 7 participants to have access to land. Meanwhile, some of the participants who retained the 10 ha in the Tinte Bepo Forest Reserve were allowed to develop the 10 ha at the outset.

Activities farmhands are engaged in include pegging, beating up and weeding. According to these farmers, they were allowed to plant any crop from the onset except for cassava which they had to wait until the trees were matured before they could plant. Despite this directive, the farmers indicated during the interviews that most farmers planted cassava at the outset when the trees were very young because they claimed other food crops do not grow well in the area. The farmhands and participants further stated that besides the coordinators assigned to the projects, the Forest Services Division of the Forestry Commission does not play any supervisory role and is not involved in the project. They further expressed that the range guards are unaware of the ongoing project in the Forest Reserves and requested that the FPDFB sensitize the range guards on activities regarding the plantation establishment. This will help protect the trees from illegal loggers at the community level who have threatened to cut them when they mature.

According to the farmhands, their activities in the Forest Reserves are supposed to be monitored by the participants. However, most farmhands reported that they had seen their participants only once, i.e. the day they were assigned to them. Others indicated that they had never seen their participants before. Some participants indicated that they do not know all the three farmhands allotted to them. The participants, in their defense indicated they do not have authority over the farmhands since they were not involved in the selection of farmhands, and the monthly allowance for farmhands is sent to them directly without their notice. For example, Tain II Forest Reserve participants are unaware that their farmhands are still being paid their monthly allowance. According to some farmhands, some participants frequently visit their field plots to inspect their work, while others call them on the phone to ask about work progress. The participants disclosed that the coordinators from FPDFB visit their fields at least once a month. Official reports required from participants to the board were noted to be seldomly done, instead participants resort to discussing issues about their work with the coordinators during visits.

For Model 2, beneficiaries were paid directly to undertake the land preparation activities, contrary to practices in Model 1 where land clearing was done for participants. According to the beneficiary youths, an amount of four thousand Ghana cedis (GH¢4000.00) was given in two tranches (GH¢2000.00 cedis each) to them as a startup amount for land preparation activities. Teak seedlings were subsequently provided for planting. Payment of the monthly allowance of GH¢200.00 cedis for plot maintenance was also reportedly provided. Furthermore, it was agreed that the monthly allowance of two hundred cedis was for the first two years but was extended for another year at the end of the first two years. They were made to understand that after the 3 years, when the monthly allowance stops, they will be provided with loans to be used for maintaining the fields, but the loans have still not been provided.

3.2.5 Seed Sources and Seedling provisions

Sources of seeds/seedlings, how seedlings were raised, supplied and timing

Provision of quality seedlings for planting forms an integral part of implementing any plantation establishment/development. First, the study sought to investigate the sources and the timing of the seeds/seedlings supplied to farmers for planting. Second, to have an overview of how seedlings were raised if a community nursery was used. Table 5 presents key findings on seed sources and seedling provisions from the farmhands and participants perspectives.

Table 5. Seed sources and seedling provisions

Forest Reserve	Reported seedlings supplied	Reports on seedlings conditions	Remarks/ Actions/ Strategies
Tain II Forest Reserve	*Tectona grandis* (Teak)	• Seedlings were immature • Inadequate for the 5 ha plantation • Poor quality • Supplied late after the rainy season, and dead upon arrival in the community.	This led the participants to pick teak stumps from the forest to supplement the inadequate seedlings. FPDFB supplied teak stumps for beating up, which were also of poor quality
Tinte Bepo Forest Reserve	• *Cedrela odorata* (Cedrela) • *Terminalia superba* (ofram) • Khaya species (Mahogany).	• Seedlings reportedly supplied for the initial planting and beating up were of good quality • Seedlings were in the right quantities. • Seedlings, however were supplied late, with some being provided in November when the rains had virtually stopped.	• Believed that Mahogany is not suitable for planting in the Tinte Bepo Forest Reserve because they have stunted growth, and most were diseased after planting. • Cedrela in their opinion needs pruning after two years of planting because of its form, but the coordinators think otherwise

Forest Reserve	Reported seedlings supplied	Reports on seedlings conditions	Remarks/ Actions/ Strategies
Essen Epam Forest Reserve	• *Cedrela odorata* (Cedrela) • *Terminalia superba* (ofram)	• Late supply of seedlings. • The seedlings supplied were from long distances thus most of them were dead on arrival or did not survive when planted.	Proposed the establishment of nurseries in the forest fringe communities to ensure that seedlings are close to the site and are readily available and on time for planting during the raining season. This was reechoed by all farmhands in the other two regions. ** According to one farmhand working in Essen Epam Forest Reserve during the FGD, "*The seedlings supplied are from Afram Plains, and due to the long distance, most of the seedlings do not survive when planted. Also, the seedlings are supplied late. We want to establish nurseries in the forest fringe communities where we can manage and transport them easily to the forest reserve whenever the weather is favourable*". Farmhand FGD, Akuamaase, December 2022).
Off-reserve – farmers own lands	Tectona grandis (Teak)	• Initially provided with potted seedlings, and later stumps were supplied for beating up. • Seedlings supplied were of good quality. • The required quantity was supplied, but the time of supply (i.e. July) was a bit late.	Recommendation for seedling supply must be in March-April. Proposed the establishment of community nurseries for easy transportation of seedlings to individual farms and reduce transportation cost.

NB: ** Qualitative statement from a farmhand during the FGD at Akim Asantemang, Eastern Region.

3.2.6 Provision of Livelihood Support

The implementation design was associated with livelihood support to incentivize both the farmhands and the participants in their line of duty. Table 6 outlines the key findings on livelihood support for farmhands and participants noted from the assessment study.

Table 6. Livelihood support for farmhands and participants

Projected implementation modalities	Compliance/ Comments and Perspectives on provision of livelihoods	Remarks
Farmhands enrolled in the programme:		
Monthly payment of GH¢250.00 agreed to be paid on a monthly bases for a period of 2 years during the establishment and maintenance phase	*Payment received through registered mobile money* In 2020, the amount was increased to GH¢350 per head per month because the initial 3 ha plots increased to 5 ha.	Confirmation of receipt of livelihood support as projected
	Reported payments were suspended from January to May 2020 but continued to work on the plots	Complains on outstanding 5 months payment *-miscommunication on break in the project within this period by coordinators*
	In June 2022, the livelihood support increased to GH¢500 per month per head when work supposedly resumed because of the increase in workload.	Increment not in initial project modalities
Logistics	One-time provision of a pair of wellington boots, hand gloves and one cutlass at the beginning of the project to each participant.	Confirmation of receipt of logistics by participants
Others	Christmas gifts given for two consecutive years, after which it has not been forthcoming	
Unemployed Graduate Participants		
Monthly allowance equivalent to national service personnel	*Payment through Agriculture Development Bank (ADB) bank account of participants* Continuously received a livelihood support monthly allowance of GH¢500 until appointment expired in May 2021.	Confirmation of receipt of regular monthly allowance as projected

Projected implementation modalities	Compliance/ Comments and Perspectives on provision of livelihoods	Remarks
Facilitation for access to credit facilities	*Reported* FPDFB promised to facilitate in securing loan facility during one of their meetings at Akyaakrom, to enable them continue with the plantation development, but to date, nothing has been heard.	FPDPB – yet to explore such opportunities for committed members

3.2.7 Benefit-sharing Arrangements

A clear understanding of the benefit-sharing arrangement of established plantations in forest reserves is very crucial for all interested parties. Investment decisions are made based on agreed and signed benefit-sharing arrangements by the different stakeholders involved. The FC, in a quest to increase forest cover and reduce deforestation, often allocates degraded forest reserves to private entities for plantation development. Currently, Ghana's existing benefit-sharing arrangement for plantation establishment in forest reserve and off-reserve areas are outlined in Table 7 as follows:

Table 7. Existing benefit-sharing arrangement for plantation establishment in Ghana

Stakeholders	Forest Reserve	Off-reserve	
		Sole landowner	Developer not a landowner
Private entity	90%	100%	67%
Landowner	6%	-	33%
Forestry Commission	2%	-	-
Local Community	2%	-	-

Source: Dumenu et al., 2014; Weyns, 2014; MLNR, 2016

A review of the offer letter to participants shows the mention of applying the agreement pertaining under the private plantation agreement benefit-sharing arrangement for the YIP project for Model 1. It further states that the board will facilitate the preparation of such lease benefit-sharing agreement. Assessment of the participants' understanding of the benefit-sharing agreement of their contract revealed that almost all the participants are well informed of 90% ownership of the established plantation at maturity. However, they expressed their frustration about the delay in the issuance of a signed documented benefit-sharing agreement between them as private and the government entities.

One participant assigned to Tinte Bepo forest reserve had this to say during the FGDs. "*We were informed that we will have 90% ownership, but up till now, no formal*

written contract pertaining to the sharing arrangement has been made with us". A Participant assigned to Tinte Bepo Forest Reserve, FGD, December 2022.

The participants at the Tain II Forest Reserve further revealed that they have since been informed by FPDFB that some documents (probably the contract) were ready for collection at the Fund Board office in Accra. However, participants from the Tinte Bepo Forest Reserve indicated they were not privy to any such information.

The benefits for the farmhands under this arrangement are the projected food inter-crops before canopy closure of the planted trees in the reserve. According to the farmhands, the only benefits they derive in working for FPDFB are the food inter-crops because no benefit-sharing arrangements regarding the trees have been discussed.

One participant assigned to Tinte Bepo forest reserve had this to say during the FGDs. *The coordinators made it clear to us at the start of the project that we do not have any share or benefits in the established trees. However, we are rather the sole owners of the food crops we will integrate into the established plantation (100% ownership) in the forest reserve". A Participant assigned to Tinte Bepo Forest Reserve, FGD, December 2022.*

The key issues regarding benefit-sharing arrangements highlighted by the farmhands during the FGD include:

- Almost all the farmhands were of the view that since most of the participants have abandoned the project, they are continuously managing and maintaining the established trees. Hence, a revised contract should be made to allow them a share of the established trees when the canopy closes and are moved to other areas for the plantation development.
- Farmhands working in the Tain II Forest Reserve pointed out the challenge of cattle grazing in the forest reserve, hence are unable to integrate food crops in the plantation and are therefore not deriving the anticipated food crop benefits from the project.
- All the farmhands expressed their interest in working directly with the FPDFB to establish their own plantations and requested for some compartments to be allocated to them directly to help manage and protect the trees from illegal chainsaw operators.

3.3 Constraints and Challenges

Several challenges and constraints were outlined by all the stakeholders interviewed during the study (Appendix 2). These challenges and constraints cut across all the areas under the project and can be categorized under the following thematic areas:

i) **Poor Participation and Lack of Commitment:** The project targeted unemployed graduates who were looking for better job opportunities. However, most participants seemed not to have a clear understanding of the project concept from the onset. These unemployed graduates tend to abandon their farm sites and commitment to plantation activities when they find alternative opportunities. Again, many participants were not residing in communities close to the farm sites, making it difficult for them to visit the fields regularly and be committed to the project. In addition, some farmhands were not committed to the project because the participants did not have authority over them. Some farmhands are advanced in age and cannot work as expected, although they are experienced.

ii) **Inadequate Incentives and Logistical Support:** The funds provided to the farmhands under the project were reported to be inadequate. Both the farmhands and participants reported hiring additional labour to support the management of the plantation. In addition, some farmhands live far from the forest reserve resulting in high transportation costs. According to them, the activities require huge labour investment, which the livelihood allowance under the project is unable to cover. Furthermore, there are also delays in receiving the funds.

iii) **Low Quality Seed Sources and Delays in Seedling Supply:** The study noted that seeds for mahogany seedlings in the first year of project implementation were not procured from accredited sources. The participants and farmhands reportedly do not receive seedlings for the plantation establishment on time. Seedlings are reported to be oftentimes immature and of poor quality, especially teak seedlings and stumps, which affect the growth and development of the teak plantation. Delays in the supply of seedlings often occur since most of the seedlings are transported from other regions to the farm sites. This subjects the seedlings to stress and, thus, affects their survival rate. It was also noted that, in some instances, the seedlings supplied were not adequate.

iv) **Inadequate Supply of Farm Inputs and Lack of Access to Credit Facilities:** There is reportedly inadequate supply of farm inputs such as cutlasses, wellington boots, uniforms and raincoats to participants/farmhands for working in the plantation. It was also noted that the participants had difficulty accessing credit facilities to continue with the silvicultural management of the plantations beyond the project contract duration.

v) **Cattle Grazing and Wildfire:** There is reportedly high rate of wildfire occurrence and cattle grazing in the Tain II Forest Reserve. This makes it impossible for farmhands to integrate food crops into the plantation. Fulani herdsmen allow their cattle to overgraze in the plantations (Plate 9). This demotivates the participants and farmhands to continue working on the plantation site.

vi) **Lack of Documentation on Benefit-Sharing Agreement:** There is no signed documentation covering the benefit-sharing agreement between the participants and FPDFB/Forestry Commission (FC). Although the participants reportedly are aware that they are entitled to 90% share of the established plantations, there is no formal agreement signed with the FPDFB/FC. This reportedly demoralizes the participants in continuing with and investing in the plantation establishment. The lack of clarity on ownership rights would serve as a demotivation for them to continue beyond the project contract duration.

vii) **Lack of Technical Know-How of Participants on Plantation Development:** The study noted that majority of the participants did not have good technical knowledge on how to manage the established plantations. This is largely because the participants had not received any technical training from any relevant institution, such as CSIR-FORIG or UENR on management of forest plantations. The participants and the farmhands also lack the necessary equipment to carry out activities such as pruning.

viii) **Lack of Coordination with Forestry Commission and Lack of Research Components:** The participation, coordination and commitment of the Forestry Commission in the project was reportedly low or non-existent. The need for a research component in the project layout, particularly site species matching for increased growth and survival to avoid huge loses, was reportedly lacking. In addition, fire management training among farmhands was reportedly lacking.

4. Synthesis and Lessons Learnt

This section provides a synthesis of the findings from the study. It focuses on highlighting the key ecological issues of the established plantations and the governance processes for the project implementation. It provides lessons learnt and the way forward for improving the project.

4.1 Performance of Established Trees in Plantations

Assessment of survival rates

The seedling survival rates in both Model 1 (77%) and Model 2 (83%) could be generally described as being good, except in Tain II Forest Reserve where survival was 49%. However, the survival rates in this study (except Essen Epam and the Volta region) are low in comparison with studies from plantations in similar locations under similar ecological conditions. For instance, Guuroh et al. (2021) reported higher survival rates (ranging between 73% to 92%) for different species in plantations at Pamu Berekum Forest Reserve, which has similar ecological conditions to Tain II Forest Reserve. For instance, the survival rates for teak, ceiba, mahogany, ofram, and Cedrela were 73%, 90%, 87%, 92% and 92% respectively.

Growth rates, plant vigour and stand form

The superior growth rate of Cedrela than Ofram in both DBH and height observed at both Essen Epam and Tinte Bepo indicates that Cedrela generally has a faster growth rate than Ofram regardless of site, ecological conditions and management interventions. This result is similar to findings by Guuroh et al. (2021) and Akowuah et al. (2023), as well as a recent study in Tinte Bepo Forest Reserve (Nero and Opoku, 2022). This is reflective of the well-reported superior growth rates of most exotic species in comparison with indigenous species (see Guuroh et al., 2020). However, it is worth mentioning that some indigenous species, such as Ceiba also compete favorably with exotic species in growth.

In the current study, Cedrela recorded the fastest growth rate at Tinte Bepo even performing better than Ofram and Mahogany in both diameter and height. The growth rate of Mahogany in Tinte Bepo (MAI in dbh = 1.9 cm yr^{-1} and MAI in height = 1.69 m yr^{-1}) is comparable to the results of Opuni-Frimpong et al. (2014), who reported a MAI in dbh of 2.64 cm yr^{-1} and a MAI in height of 2.19 m yr^{-1}.

The growth rates recorded in this study for teak (MAI in dbh = 1.70 cm yr^{-1}) is lower than those reported by Guuroh et al. (2021) in Mankrang Forest Reserve (1.9 cm yr^{-1}) and Pamu Berekum Forest Reserve (2.6 cm yr^{-1}) although those reserves are also located in the dry semi-deciduous ecological zone and thus have similar conditions as Tain II Forest Reserve which was the focus of the current study. However, the

growth rates of teak under Model 2 (in the Volta region) were higher than Tain II and more comparable to those reported by Guuroh et al. (2021).

Ecological meaning and implications of the plantation performance

The observed variations in survival rates, growth rates, plant vigour and stand forms between plots and compartments might be attributable to more local (site-specific) variations such as soil, topography, grazing, and weed control.

The high variations observed in survival rates, growth rates, plant vigour and stand form between the three Forest Reserves/ sites might be reflective of variations in ecological factors that characterize the three sites as well as genetic causes related to the species and the type and source of planting materials used in the plantation establishment. The source of planting materials used for plantations has a huge impact on the success of such projects. Generally, ecological factors that influence plant success are categorized into biotic and abiotic variables. The abiotic variables likely to account for differences include: climatic conditions, edaphic conditions, topographic conditions, and fires. The biotic variables, on the other hand, include: human land use activities and plantation management.

Climate (especially rainfall and temperature) is a well-known factor that influences plant growth and survival. Besides mean annual values in climatic variables, ecologists have often also investigated other aspects of climatic variables, such as length of rainy season and inter-annual variability in rainfall among others. Sankaran et al. (2007) cited climate and its variability as the most important driver of vegetation distribution. It is therefore not surprising that Essen Epam, which is the wettest (mean annual rainfall of 1,580 mm) among the three sites also recorded the best survival, while the lowest survival was recorded in Tain II, which is the driest (mean annual rainfall of 1200 mm) among the three sites. However, it was unexpected to find slightly higher growth rates of ofram and cedrela in Tinte Bepo compared with Essen Epam. Such a result might be attributed to better site conditions or better management regimes in Tinte Bepo than Essen Epam. Although climate is an overarching factor that affects plant growth, other site-specific variations as well as land use or management interventions have the potential to over-ride climatic impacts. For example, poor site-species matching, selection of inappropriate planting materials, or failure to regularly control weeds could slow growth of a species in a wetter location compared to a drier area.

Apart from climate, it is a well-established knowledge in plant science that more local variables such as soil and topography also tend to influence plant growth and development. Therefore, these two variables might also be partly accountable for the variations observed in the survival and growth rates observed in the study. Since this study did not collect and analyze soil properties at plot, compartment or even site (forest reserve) level, it is not possible to directly link certain performance observations to these important ecological drivers.

An important factor in this study was fire events. Ecological assessment revealed very high fire events at Tain II, unlike Tinte Bepo (low likelihood of fire) and Essen Epam (no fire event). Fires could destroy planted seedlings if the intensity is high. Quite fortunately, the most fire-prone area in this study (Tain II) was also planted with teak, which has higher fire resistance than other species such as Cedrela, ofram among others. Although the fires most likely affected survival, growth, vigour and stand form at Tain II, the fire effects would have been more devastating if similar fires had occurred in Tinte Bepo or Essen Epam. This explains why fire education and prevention are very important activities of every landscape restoration initiative that aims for success.

Under the FC/Industry plantations project, being implemented by CSIR-FORIG, for instance, fire education is regularly conducted in fringe communities to educate people against setting fires. Other activities aimed at controlling fires in plantation forestry include creation of community fire volunteer groups, provision of basic fire-fighting tools, creation and maintenance of fire rides, and close collaboration with the Ghana Fire Service. In the current study, it was observed that much attention and effort has not been given to fire issues. Despite being the most fire-prone site, Tain II also had the worst situation regarding fire ride creation and maintenance, followed by Tinte Bepo, which had good fire rides. Essen Epam and farms under Model 2 had well-constructed fire rides. At all sites, there was no mention of fire ride education activities or the existence of fire volunteer groups. These are recommended best-practice activities that must be incorporated to ensure sustainability in the program. Institutions such as CSIR-FORIG and other research institutions have the experience and requisite expertise to support the plantation programme in these areas.

In view of the limiting role of climate and other local site drivers such as soil, fire, etc., it is important that tree planting initiatives carefully review species characteristics vis a vis the intended planting sites. In current global climatic changes, amidst other ecological stressors, species that possess superior qualities/ traits to perform well under harsh conditions must be identified and included in tree planting projects. In this regard, one species that stands tall is *Gmelina arborea*. It is a fast-growing tree with frequent inclusion in plantations to produce wood for light construction, crafts, decorative veneers, pulp, fuel and charcoal, among others. The species is known for its relatively fast growth ability coupled with high tolerance and resilience to harsh environmental conditions and poor soils, making it an ideal species for plantations (even in harsh areas). For instance, in an experimental trial evaluating the potential of *Senna siamea*, *Terminalia superba*, *Nauclea diderrichii* and *Gmelina arborea* for restoring degraded mined lands in Ghana, Guuroh et al. (2020), reported superior survival and growth (diameter and height) of *Gmelina arborea* than the other three species on both the unmined and mined soils. In the severely degraded mined soils, *Gmelina arborea* was the only species that maintained a survival greater than 80% after ten months. Similarly, *Gmelina arborea* recorded the highest diameter and

height relative growth rates in the mined soils and was significantly different from all the other species.

Besides abiotic drivers of plant growth such as climate, soil and topography, biotic conditions also play a critical role. These factors are largely related to human activities and their effects on plants. Important biotic variables that could probably have accounted for the variations in survival, growth, plant vigour and stand forms of the planted areas include encroachment, farming activities, livestock grazing and the silvicultural management interventions implemented in the planted areas. Management interventions include weed control, singling, and creation/ maintenance of fire rides.

On farming activities, field observations revealed that food crops were being integrated into the planted areas at all sites under Model 1 (i.e., Tain II, Tinte Bepo and Essen Epam). However, it appeared this practice was lower at the drier Tain II site than at the other two wetter locations. At Tain II, the few who integrated food crops mainly planted maize while at the other two sites, crops integrated were mainly cassava and plantain. Although food crop integration in plantations in itself is not a bad practice, a lot depends on how well it is planned and executed. To obtain optimum results without negatively affecting the trees, farmers need to choose crop types that are compatible with tree seedlings which will not compete below-ground (in terms of roots) or above-ground in terms of sunlight. Also, the design of food crop integration must be well planned and not done haphazardly because this ultimately has implications for below-ground and above-ground competition. It was observed in some plots, especially at Tinte Bepo and Essen Epam that plantain plants were either too many (dense) on the plot or not well located hence creating, in some cases, too much shade that negatively affected young seedlings. Also, at the same sites, cassava was also observed in the plantations and especially at Essen Epam, the density of cassava was too high in several plots implying that farmers planted them without following any guidelines. Best practice requires such food crops to be well spaced out and located in between the lines of the tree seedlings. This is one area where the experience and expertise of CSIR-FORIG plantation team could offer training and support.

Another important factor that exerts high impact on plantation success is the management and silvicultural interventions that are implemented. Key management interventions include weed control, singling, pruning, fire ride creation and maintenance, and thinning. In the case of young plantations, as in the case of this project, regular weed control is critical. This ensures that the young seedlings are freed from competition by weeds which largely cause stunted growth of seedlings or even outright mortality. In the FC/Industry Plantations project, being implemented by CSIR-FORIG, for example, two cycles of weeding are implemented during the first year of plantation establishment since the planting would usually end around June or July. In subsequent years, until the plantation is 4 years old, the weed control is carried out quarterly: therefore, four weeding cycles in a year. Such a regime of

weed control, if implemented, would result in higher survival and fast growth of the seedlings ensuring that they out-grow the weeds within the shortest possible time. Apart from total weeding regimes, CSIR-FORIG also carries out circle weeding and line weeding at certain times. In the current study, weed control varied across the sites and compartments but was generally good during the time of field visits. However, what is not known is the regularity of weeding in a year, especially during the critical periods of the first three years after establishment. For instance, lack of regular weed control in the first three years after planting could have contributed to the low survival and growth rates observed in Tain II.

Plantations are also negatively affected by grazing activities, especially in the case of cattle grazing. High intensity grazing has the potential to cause mortality (from browsing of planted seedlings or trampling) as well as causing poor plant vigour and growth forms mainly due to trampling. Another negative effect of grazing could be compaction of soil which affects water infiltration.

4.2 Governance Arrangement of the Plantation Establishment

Models and implementation process

The models designed for the establishment of plantations in degraded reserves under this project were found to be generally good. It intended to provide entrepreneurship opportunities for unemployed graduates and financial investment with lucrative future implications while contributing to the drive for increasing Ghana's forest cover. With effective governance structures and commitment from beneficiaries, the implementation has the potential to achieve its intended goals. Specific to the model governance processes, overall, the study assessment revealed that the FPDFB adhered to ensuring transparency and inclusiveness in the recruitment processes. The FPDFB advertised and coordinated the different activities, such as prior sensitization and wider publicization of the project through newspaper announcements and community-level communication channels. These processes ensured transparency and fair selection of the different beneficiary target groups (participants, farmhands and additional farmers in close proximity to the forest reserve).

In every forest plantation development project, prior training on establishment and silviculture management of the plantations is essential for all interested investors. The study noted that such prior training was missing in the implementation process for the beneficiaries of the models. The implementation strategies of the project made provision for relevant institutions such as CSIR-FORIG and UENR to provide directional support to the project. This was necessary for the participants to receive needed support in the development and management of the forest plantations. For this to succeed, it is important for the relevant institutions to have been involved in the planning and execution of the project. However, the study noted that both CSIR-FORIG and UENR were not involved in the implementation of the project. Hence the participants did not receive any training or support from these institutions. The

lack of prior training and support on the management of the established plantations may probably be one of the main reasons for the low commitment in the project. It is important to note that providing a clear understanding and skills on forest sector entrepreneurship and the business of plantation development is very crucial. This will ensure the potential entrepreneurs are motivated about the program as well as gain insights into the financial implications and associated future benefits. Hence, involving the relevant institutions to provide training and directional support is imperative.

The study also noted a general trend where majority of the participants under Model 1 became inactive, leaving the entire field activities in the hands of the farmhands during the implementation process. The key underlying drivers for this trend include the lack of a clear road map and documentation of a benefit-sharing agreement, proximity and access to the forest reserves, inadequate financial support and limited access to credit facilities to maintain the plantations beyond the project duration and poor commitment on the part of participants because of the sense of being politically connected.

Benefit sharing process

The existence of benefit-sharing arrangement envisioned under the project model provides a clear road map for sharing arrangements between participants and other stakeholders as with any other existing benefit-sharing arrangement for plantation establishment in the forest reserve and off-reserve areas. Participants were noted to be aware of the share of benefits from the established plantations. However, no documentation of the benefits sharing has taken effect or has been signed between the parties involved. The study also noted that the farmhands were not included in the benefit-sharing arrangement regarding the benefits of the planted trees. However, it became evidently clear during the study assessment that the farmhands were fully responsible for all the field activities and had ensured the plantations are managed to the best of their knowledge. Farmhands are therefore key actors in the plantation establishment and should be included in the benefit-sharing arrangements.

FC commitment to the entire project

The full commitment of FC remains key in all plantation establishments both in off-reserve farmlands and degraded forest reserves. The FC provides several technical support services, including monitoring and evaluation, on-farm tree registration, safeguarding and benefit-sharing arrangement and documentation. The study noted that the limited involvement of the FC is a key challenge affecting active supervisory and monitoring of the established plantations. Other important areas affected include processing and signing the benefit-sharing agreement specified under the scheme almost four years after the plantation establishment. Although the assigned project coordinators (seconded from FC) were noted to play key roles in the entire project implementation, involving the relevant departments of the FC to ensure a holistic project commitment and coordination is essential.

Seeds and Seedling supply

Good quality seeds are needed to produce quality seedlings for plantation establishment. The study noted that quality seeds of a few species were obtained from the National Tree Seed centers at CSIR-FORIG. All project beneficiaries identified challenges with seedling supply, including late supply of seedlings, and immature seedlings of poor quality. It was suggested that nurseries should be established in the communities to ensure readily available seasonal supply of seedlings. This will further create employment opportunities for the youth, particularly women and young adults, in the fringe communities securing the goodwill and participation of the communities in close proximity to the forest reserves. Apart from the benefits of creating jobs with onsite community nursery establishments, it is also important to procure seeds for seedling production from accredited seed sources to ensure quality seedlings are raised for distribution. The relevant institutions, such as the National Tree Seed Center at CSIR-FORIG could be relied on for regular technical support and training services for all seedling contractors used under the project.

4.3 Limitations of the Study

The following are the limitations of the study. However, none of the limitations seriously affected the trends presented in the report, as adequate scientific measures were adopted to ensure reliable results under the circumstances.

- Unavailability of adequate resources coupled with time constraints restricted the number of sample plots that could have been included in the ecological study
- Inability to fully assess Model 3 because it had not been piloted yet
- Information on issues of how seedlings are raised and supplied to the various sites were scantly obtained from participants.

5. Conclusions and Way Forward

This section provides a summary of the key findings of the study and their implications for continuing and replicating the youth in plantation establishment drive of the FPDFB in other areas. This study has focused on assessing the extent to which the project goals were met, the challenges and lessons learnt in the implementation process for future implications of the project in other landscapes. Perspectives of different stakeholders were sought through FGDs and key informant interviews.

Ecological field assessment of the established plantations showed that, on the whole, the survival and growth of the plantations were quite good. However, the assessment also revealed some aspects that could be further improved. In this regard, it is recommended to include training on different silvicultural management practices for all beneficiaries of the project. In particular, there is a need for training to be provided on the best practice approaches for pruning and thinning, which will soon be required in the various sites. This would also go a long way to avoid errors and ensure greater success of the plantation project, e.g. in terms of obtaining high-quality wood. Furthermore, coordinated efforts to expedite actions to control illegal logging, fire incidences (e.g. fire management training), and cattle grazing are warranted. Including other suitable fast-growing species, such as *Gmelina arborea,* would provide additional motivation and assurance of benefits in a short period of time for participants, given the relatively fast growth ability of the species. Additionally, *G. arborea* has the ability to grow and perform well in harsh environmental conditions (such as drier, less fertile and marginal soils), which would make it an ideal species in the drier sites under the project, such as the Tain II Forest Reserve.

The implementation framework of the current models is good, with reasonable impacts in its current form. However, several weaknesses need to be addressed. This requires some modifications of the models to ensure effectiveness. Model 1, in its current form, needs revision along the following dimensions:

i) **The benefit-sharing arrangement should include the farmhands who live in close proximity to the sites of implementation and have been responsible for the active silviculture management of the plantations:** With most of the unemployed graduate participants living outside the districts of the degraded reserves, their shared responsibility on the project will still remain as supervisors and project managers (e.g. exploring funding opportunities) beyond the active funding period of the FPDFB. The shared responsibility for the farmhands beyond the FPDFB project period will be to continue providing labour support and the silviculture management required to maintain the established plantation.

ii) **Develop entrepreneurship training on green economy and the business of plantation development for all beneficiaries:** All beneficiaries of the scheme should be well-sensitized on the project concept and provided with entrepreneurship training on green economy and the business of plantation development right from the onset. The training should include building the capacity of trainees on silvicultural management practices, including fire management. This will ensure that the capacities of beneficiaries are built on the entire value chain of plantation development with associated cost and profit implications.

iii) **Provide a clear roadmap on ownership of the established plantations:** Expedite actions on negotiating and signing the benefit-sharing agreement for the existing plantations. Moving forward, negotiating and signing the benefit-sharing agreement should be promptly done in the first year of field activities to provide a clear roadmap on ownership to boost the confidence of beneficiaries as well as motivate them for their active participation.

Under Model 2, the governance process was found to be very useful and achieved great results. This model can be expanded to include more local committed farmers willing to enroll in the project. Issues of diversity in site-specific species in a mixed plantation are highly recommended besides monoculture system where only teak is encouraged and supplied for planting. Issues of ownership right and benefit-sharing under Model 2 should be promptly addressed.

The intentions envisioned under Model 3 are commendable, as it aims to split ownership rights of established plantations between the Ghana Prisons Service as an institution and the individual prisoners involved. With this proposed model, we envisage greater sustainability of the project with the added advantage that the Prison Service would be able to use the proceeds from the plantations to improve their services. Generally, prisoners are typically rotated and are mostly not from the areas of the specific prison of incarceration. The involvement of prisoners in plantation establishment can be a fulfillment of the hard labour conditions often associated with their sentence. An alternative arrangement that can maintain the original intent of Model 3 could perhaps be seed money or incentives provided from funds accruing from benefit-sharing remuneration from the involvement of any plantation establishment upon release from prison.

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Appendices

Appendix 1: Checklist for focus group discussions and key informant interviews

1 A: Checklist for Model 1 and 2 Beneficiaries

1. Can you share your thoughts about the Youth in Plantation (YIP) Programme? Is it a good programme and something that needs to be encouraged and supported?
2. How did you hear about the Programme?
3. How were you selected to participate in the programme?
4. What training was provided to you? Were the training frequent or occasional?
5. What livelihood supports were provided to the participants?
6. What is the benefit-sharing arrangement of the forest plantation establishment like?
7. Is there a contract on benefit-sharing arrangements for participants?
8. What seedlings were provided to participants?
9. How were the seedlings distributed to participants?
10. Were the seedlings distributed on time to participants?
11. What were the key challenges of the YIP Programme?
12. What are the possible solutions to tackle the challenges?

1 B: Checklist for Coordinators

1. What is your personal experience on the Youth in Plantation (YIP) Program?
2. How were the beneficiaries selected? Was it fair and transparent?
3. What training was provided to the beneficiaries? Were the training frequent or occasional?
4. Who were the trainers? Do they have the technical know-how?
5. Do you have a framework for monitoring and evaluating beneficiaries' activities?
6. Do you monitor beneficiaries' fields?
7. How often do you monitor them?
8. What livelihood support was provided to the participants?
9. How were the livelihood supports provided to the participants?
10. What management support do you provide to the participants after establishing their trees?
11. What is the benefit-sharing arrangement like?

12. Were participants engaged and consulted on the benefit-sharing arrangements?
13. What seedlings were provided to the participants?
14. How were the seedlings distributed to the participants?
15. Were the seedlings distributed on time to participants?
16. What are the key challenges of the YIP Program?
17. What are the possible solutions to tackle the challenges?

1 C: Checklist for Selected FPDFB members

1. Based on your experience, what is your general impression of the youth in plantation as an occupation project?
2. Based on your experience, what would you describe as the key challenges you've encountered so far in the implementation of the project
3. What would be your suggestions in addressing these challenges outlined in 2 above
4. What would be your recommendations for revising/modifying the implementation of the models going forward?

Appendix 2: Challenges and constraints outlined by the different stakeholders engaged during the study.

Stakeholders	Site	Challenges and constraints
Model 1		
Coordinators	All sites	• Lack of interest and understanding of the program
		• Poor participation
		• Inadequate incentives for farmhands
		• Issues with transportation and difficulty in conveying farmhands to the site at the same time
		• Inadequate supply of seedlings
		• Delays in seedlings supply
		• Cattle grazing
		• Some participants do not know their boundaries
		• Lack of technical-know of participants on plantation establishment
		• Lack of extensive consultation in the selection of tree species
		• Lack of signed benefit-sharing agreement contract documentation with participants
Participants	All sites	• Hiring additional labour to manage the plantations because the farmhands are not enough
		• Lack of commitment of the farmhands because the participants do not have any authority over them. Some farmhands are also old and cannot work as expected
		• Proximity of farmhands from the different established sites prevents frequent visits
		• Accessibility to the reserves (difficult to get transportation to commute, hindering frequency of monitoring visits)
		• No benefit-sharing agreement documentation prevents further investment into the plantation
		• Inadequate tools, such as cutlasses, wellington boots, uniforms and raincoats for working in the plantation
		• Difficulty in accessing credit facilities to continue with silvicultural activities beyond the project contract duration
	Tain II and Tinte Bepo Forest Reserves	• Illegal logging in Tain II and Tinte Bepo Forest Reserves, thereby demotivating the participants in the plantation establishment

Farmhands	All sites	• Allowance provided is inadequate; workload is just too much and tedious. Additional labour assistants are often employed and paid to get work done
		• Immature teak seedling supply, late supply of seedlings and poor teak seedling and stump quality which is affecting the growth and development of the teak plantation
		• Delays in receiving the monthly livelihood support allowance
		• Inadequate supply of logistics (e.g. cutlasses, wellington boots hand gloves) for farm activities
	Essen Epam Forest Reserve	• Some farmhands and participants have rented part of their land to other farmers who are not included in the project. These farmers do not take proper care of the trees since they have no requisite background of the project and training
Model 2		
Farmer beneficiaries	Off-reserve (farmlands)	• No farm assistance was given apart from the 200 cedis monthly allowance contrary to the 1 assistant promised; allowance not enough to cater for the high cost of labour in the area.
		• Wildfire outbreaks occur during the dry season, and there is the need to do fire rides which is also costly.
		• No pruning equipment to prune the trees as they are growing tall, and cutlass cannot be used.
		• No written agreement on the ownership of the trees of farms. No documentation on how the trees are going to be shared.
Other Perspectives		
	All sites	• Lack of participants commitment to the project – long term investment in plantations is a disincentive for most youth
		• The graduates lack interest and passion for the plantation establishment and were only interested in the stipends
		• Delays in getting the benefit-sharing documentation prepared for participants to clarify ownership issues in order to motivate them beyond the project contract duration (FC & FPDFB)
		• Lack of coordination and commitment from the Forestry Commission on the entire project models
		• Bush fire requiring the need for fire management training among farmhands
		• Issues with cattle grazing
		• Need for research component in the project layout, particularly site species matching for increased growth and survival to avoid huge loses