Forest Landscape Restoration in Ghana
Ernest Foli
Forest Research Institute of Ghana

PART 1: Description of Landscape Restoration activities in the Dormaa Central Municipality in the Bono Region of Ghana

1. Geographical location

The degraded landscape is located in the Dormaa Central Municipality, which is found in the western part of the Bono Region of Ghana. Dormaa Central lies within latitude 7° 30’ N and longitude 3° 30’ W, and covers a total land area of 917 square kilometres, which is about 3.1% of the total land area of Bono and Ahafo Regions. The Municipality shares common boundaries with Jaman South and Berekum Municipal to the North, Asunafo North Municipal on the South, Sunyani Municipal on the East and La Cote D’Ivoire on the West.

1.1 Biophysical features

Dormaa Central Municipality lies on a relatively flat terrain with elevation ranging from approximately 180 m to 665 m above sea level (Appiah et al. 2009). The area is located within the semi-equatorial climate region, and it is characterized by bi-modal rainfall pattern. The major rainfall occurs between April and August with an average annual rainfall between 1,250 mm and 1,750 mm.

The minor rainfall season starts from September to October. The dry season is quite pronounced, beginning from November and ending in February. Average monthly minimum and maximum temperatures range between 26.1 °C and 30 °C, with the highest average temperature occurring in April and the lowest temperature in August. A recent analysis of the historical changes in climatic patterns across Ghana has shown that the Municipality has experienced significant increase in average temperature but no changes in annual rainfall from 1900 - 2014 (ABBAM et al. 2018). Relative humidity ranges between 70% and 80%.

The soils in the area are dominated by Forest Ochrosols (Hall and Swaine, 1981), which is the same as Acrisol for the FAO soil classification or Ultisol for the USA soil classification system. The soils have developed on Precambrian Birimian and Tarkwain rocks, and generally are deeply weathered, well drained and fertile. The soils are grouped into associations of Bekwai-Nzema Compound and Nkrankwanta (Adjei-Gyapong and Asiamah, 2000). In addition, large parts of the area fall under the Kokofu, Oda, and Wenchi soil series. Perennial rivers such as Pamu and Tain Rivers drain the area.

1.2 Socio-political context

The Dormaa Central Municipality is one of the twelve Municipal and District Assemblies in the Bono Region, with Dormaa Ahenkro as its capital. The Municipality has a population of 50,871, made up of 23,970 males (47%) and 26,901 females (53%) (Ghana Statistical Service, 2014). Majority of the population (69%) live in the rural areas, while 31% reside in urban areas. The Municipality has 81 settlements, a population density of 55 persons per square kilometre, and an average household size of 5.2 persons per household (DCMA, 2016). There are seven Area Councils with 30 electoral areas and Unit Committees (DCMA, 2015). It has one traditional authority, and the predominant land ownership systems are customary and state lands.
1.3 Economic context

About 74% of population aged 15 years and older is economically active in the Dormaa Central Municipality. The majority of the population (56%) is engaged in agriculture (DCMA, 2015). Indeed, 39% of rural households and 18% of urban households are engaged in agriculture, particularly crop production. Although the major cash crops produced in the Municipality are cocoa, cashew, coffee, oil palm, citrus and cola, majority of farmers are engaged in food crops production. The food crops include maize, rice, cocoyam, cassava and plantain. Typically, those engaged in food crop production are smallholder farmers who use traditional farming systems, including slash and burn and shifting cultivation (Amishah et al. 2011; DCMA, 2016).

While farming is a major economic activity in the area, many households lack access to secure land (Blay et al. 2008). Apart from crops, poultry production is also an important economic activity in the Municipality (Kusi et al. 2015). In fact, commercial poultry production employs 5% of the youth, and serves as major source of income for local farmers (DCMA, 2015). Others are also engaged in teak (Tectona grandis) production, as well as lumber and wood processing, especially in communities such as Nsuhia, Asuni, Badukrom and Nsesereso (Kobina and Bannor, 2014; DCMA, 2015). Wholesale and retail trading also serve as major income generating activities for the youth and women in the Municipality.

1.4 Ecological context

The area comprises of a mosaic of vegetation types, including forests and grassland. The Municipality lies within both the moist semi-deciduous and dry semi-deciduous forest zones (Hall and Swaine, 1981). However, most parts of the area fall within the forest-savannah transition in the dry semi-deciduous fire zone due to excessive human influences. The area has three forest reserves, namely Mpameso, Tain II and Pamu-Berekum Forest Reserves that support diverse tree species such as Entandrophragma utile, Chlamydocarya thomsoniana, Guibourtia ehibe, Pericopsis elata and Khaya anthotheca but has been seriously degraded by recurrent annual bushfires, excessive logging and slash and burn agriculture (FORIG, 2003; Blay et al. 2008). The recurring bushfires and other human activities have converted large portions of the remaining forests into savannah woodland and grassland. Consequently, the vegetation, including portions of forest reserves has changed, and is now characterized by few scattered remnant dominant trees of the original high forest and sparse woody understory and the presence of fire resistant species.

The high levels of deforestation and forest degradation have led to massive investment efforts by both government and private entities to restore the integrity of the landscape (Blay et al. 2008; Appiah, et al., 2009; Agyeman, et al., 2010).

2. Land use/cover

The area has six major land-cover types: (i) closed forests, (ii) secondary forests, (iii) planted forests, (iv) farmlands, (v) grassland and (vi) settlements (Appiah, 2012; Kosoe et al. 2015). In the past there were large portions of the Municipality that were forested but few areas, especially within forest reserves and along water bodies, still have closed forests.

Due to persistent annual bushfires from the early 1980s and other human activities the closed forests have been degraded, and declined overtime. For example, the Pamu Berekum Forest Reserve, covering an area of 189 square km in 1932, had reduced in size to one square km in 2000, losing about 188 square km in 68 years (GBN, 2015). Furthermore, between 1986 and 2007, the Tain II Forest Reserve lost about 81% of closed forests from 451 square km in 1986
Agriculture remains the mainstay of the local economy, and therefore large areas are actively cultivated for cash and food crops.

Increasing population, coupled with the need for more fertile land for farming has put pressure on the remaining forestlands. Usually, farmers either cultivated their own lands or encroached into forest reserves to farm and expand their farmlands. Most farmers engage in poor farming practices of shifting cultivation and slash and burn that have contributed to the persistent bushfires in the area (Amissah et al., 2011; Kosoe et al. 2015). These unsustainable farming practices have been exacerbated by other activities such as firewood gathering, charcoal production, over-exploitation of timber and illegal timber harvesting, which have further reduced the forestlands into woodland and grassland (Appiah et al. 2009). In fact, about 82% of households of the Municipality depend on firewood and charcoal for domestic cooking (Ghana Statistical Service, 2014).

Large portions of the degraded areas, including both reserved and off reserve areas have been reforested through plantation establishment and the use of agroforestry-based Modified Taungya System (Blay et al., 2008; Owusu-Afriyie et al., 2012). For instance, fast-growing monocultures of exotic species such as teak (*Tectona grandis*) and cedrela (*Cedrela odorata*) at various stages of development dominate the landscape (Owusu-Afriyie et al. 2012; Kobina and Bannor, 2014).

Indeed, government and the private timber industry have promoted the planting of teak, in particular, mainly to satisfy the growing demand for industrial wood products and to meet the dwindling supply of timber from the natural forests. Mixed stands of exotic and native species in various combinations have also been planted to provide multiple socio-economic and ecological benefits (Danquah et al. 2012). Native tree species that have been planted in mixtures include *Terminalia superba*, *Khaya spp.*, *Mansonia alliissima*, *Triplochiton scleroxylon*, *Bombax buonopozense*, *Ceiba pentandra*, *Nauclea diderrichii*, *Cola gigantea*, *Albizia ferruginea*, and *Pericopsis elata*.

3. Desired future landscape

The Dormaa Central Municipality represents one of the few areas in Ghana where the government, international organizations, private individuals and local communities are acting together as stakeholders in degraded forest rehabilitation, resources conservation and sustainable management. Regaining the natural forest cover, restoring forest resources and ecosystem services and having access to fertile land for farming remain priority issues to stakeholders in the area.
PART II: Forest Landscape Restoration Initiatives/Projects

Several approaches have been adopted to restore degraded forests and their surrounding landscapes involving different stakeholders, including the government, private sector, local and international organizations and local communities. Altogether these efforts aim to restore ecological integrity, while improving the well-being and livelihoods of local communities. Three of such successful initiatives that are driven by strong local community participation are discussed in the following sections.

Description of Community-based Forestland Restoration activities in Pamu Berekum Forest Reserve

1.0 Introduction

The first project is the Community-based Rehabilitation and Management of Degraded Forests Project (Phases I and II) that was initiated by the CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) and was supported financially by the International Tropical Timber Organization (ITTO) and partly by the Government of Ghana.

The first phase of the project was initiated in 2000 while the second phase started in 2012, and was implemented in three Forest Districts, including Dormaa Forest District, which represented a dry through transition to moist forest gradient (Hall and Swaine, 1981). The sites were selected because they had been severely disturbed after years of shifting cultivation, heavy timber exploitation, and rampant bushfires (Appiah et al. 2009; 2010). In addition, the local communities in these areas consider the forest as a major source of food and income, and the conversion of forestlands for farming was important for their livelihood (Appiah et al. 2009). Consequently, the forests in these areas were either heavily degraded or had been converted to farmlands.

For the purpose of this study we focus attention on Pamu-Berekum Forest Reserve in the Dormaa Forest District where government, non-governmental agencies, international agencies and private individuals are collaborating in forest restoration efforts.

The Pamu-Berekum Forest Reserve covers an area of 189 square km and lies within latitude 7° 30′ N and longitude 3° 30′ W. The reserve lies within the dry semi-deciduous forest zone, and used to be dominated by rich flora consisting of both evergreen and deciduous canopy trees. The surrounding areas also used to be one of the richest and leading producers of cocoa and citrus in the country. However, recurring bushfires since 1983 and other human activities led to the conversion of large portions of the remaining forests into savannah woodland and grassland (Appiah et al. 2009; 2010). Indeed during recent interviews with farmers from five local communities (N=10), all the respondents (100%) identified bushfire, unsustainable agriculture and uncontrolled logging as the major causes of forest loss and degradation in the area. In a focus group discussion, access to land was also mentioned as a critical factor that has contributed to the loss of vegetation within the reserve. The project was therefore a critical intervention to restore the landscape.

The overall aim of the project was to reduce the decline and degradation of forests, as well as improve livelihood of local communities. Specifically, the project determined the underlying causes and impact of degradation on local communities and ecosystems, restoration of the degraded forest with active participation of local communities, and sought to develop models, identify strategies and use them for management of forests established by local communities leading to enhanced conservation and provision of forest goods and services.
Although, the project predates the Bonn Challenge initiative, its objective has a strong linkage to the overarching aim of restoring 150 million ha of deforested and degraded lands and constitutes part of Ghana’s earlier efforts to restore the degraded forests in the country (Danquah et al. 2011; Owusu-Afriyie et al. 2012). The government of Ghana pledged to restore 2 million ha of degraded and deforested lands between 2015 and 2030 as part of its commitment to the Bonn Challenge (Dave et al. 2019).

![Map of the Bono Region of Ghana, showing the locations of Forest Landscape Projects in the Pamu-Berekum and Tain II Forest Reserves.](image)

**Figure 1:** Map of the Bono Region of Ghana, showing the locations of Forest Landscape Projects in the Pamu-Berekum and Tain II Forest Reserves.

### 2.0 Implementation

#### 2.1 Project stakeholders

The project was initiated by the CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) and implemented through a participatory approach involving the Faculty of Renewable Natural Resources (FRNR) of the Kwame Nkrumah University of Science and Technology (KNUST), the Forest Services Division (FSD) of the Forestry Commission of Ghana, the local communities and several other different stakeholders. The stakeholders were involved throughout the planning and implementation stages.

Each stakeholder was assigned specific roles/tasks that were monitored by the project Steering Committee. For instance, CSIR-FORIG served as the lead agency responsible for coordinating all the project activities. FRNR was responsible for all training activities, and the technical officers of FSD were involved in identifying local communities and farmers, establishment and management of nurseries and plantations, and tree inventory. At the heart of the implementation were the farmers and traditional authorities (i.e. landowners) from local communities such as Twumkrom, Abosrakrom, Ntabene, Kosen, Kwadaso, and Kyinkrom communities that fringe the forest reserve (Blay et al., 2008). Their critical roles were clearly demonstrated during the personal interviews. In fact, a female farmer from Twumkrom community noted that ‘I was directly involved in the land preparation, planting, and maintenance of the trees together with crops’ (Madam Biafra Mary, 2019). In addition to
the stakeholder communities, the project implementation team consisted of personnel specialized in ecology, silviculture, agroforestry, gis/remote sensing, sociology, agriculture, rural development, governance and economics. They had the skill, expertise and motivation to ensure that the project succeeded.

2.2 Technical design of restoration interventions and enabling activities

The project focused on promoting the restoration of degraded forest by means of enrichment planting, direct plantation establishment and agroforestry integrating both indigenous and exotic tree species in a Modified Taungya System (MTS). Through the MTS farmers were allocated land to grow annual crops along with tree species during the early years of the plantation. Food crops and vegetables, such as plantain, cocoyam, maize and pepper were typically cultivated for three years, after which the farmer had to leave the land so that the trees could grow and establish.

Restoring degraded areas using plantation and agroforestry practices is in line with best practice guidelines suggested in the literature (e.g. Stanturf et al., 2017). The project also introduced alternative income generating activities such as domestication (rearing) of the cane rat (grass-cutter; *Thyonomys swinderianus*) to improve the living conditions of the local people.

The overall approach was based on the Knowledge-Empowerment-Governance strategy, which encompasses building the capacities of stakeholders, especially local communities thus empowering them to deliver on their roles through a structured governance system. Through this approach collaboration with the local communities became key to the implementation of the project.

Critical to the project implementation was the identification of priority native tree species that were not just suitable for establishing plantations, but acceptable to the local people. This was done through literature search and by consulting local farmers. Eventually, thirteen priority tree species were identified, including one exotic (*Cedrela odorata*) and twelve native species (*Albizia zygia*, *Alstonia boonei*, *Aningeria robusta*, *Ceiba pentandra*, *Entandrophragma angolense*, *E. utile*, *Khaya anthotheca*, *K. ivorensis*, *Nauclea diderrichii*, *Pericopsis elata*, *Terminalia ivorensis* and *Terminalia superba* (Blay et al. 2008). The tree species were selected for their significant timber and non-timber values, including medicinal properties (FORIG, 2006).

Further, measures that are important to the establishment, maintenance and management of plantations were identified. Key among them was land preparation, seedling supply, nursery management, spacing and maintenance of planted trees. Regarding land preparation, it involved slashing and burning of ground vegetation, which is the typical practice in Ghana (Amisah et al. 2010; Appiah et al. 2010). The degraded sites, as well as community farmlands, were cleared manually and prepared for planting – but during weeding, care was taken not to remove naturally regenerated seedlings. Farmers and other interested local people were trained to manage the nurseries that supplied seedlings. The project provided extension services on the techniques for raising seedlings of the various tree species and supported the individuals to manage the nurseries.

Seedlings were planted at wide spacing of 6 m x 6 m and 8 m x 3 m to prevent the early canopy closure and allow the farmers to work on the farms a little longer to tend the trees. The farmers maintained the plantations through regular weeding to reduce competition from weeds. Since the sites were high fire risk zones, the farmers and other community groups were trained in the prevention and suppression of bushfires.
Monitoring

A Monitoring and Evaluation Plan was developed prior to assessing the baseline conditions, and the implementation of the project. The Monitoring Plan had certain key features, including ensuring the participation of all stakeholders in its design and implementation. To ensure the effectiveness of the process, monitoring occurred at two levels; first, there was a local monitoring team (Project Steering Committee) comprising the Project Leader, heads of institutions involved in the project, and two persons representing the local communities that assessed and determined the success or otherwise of achieving the project objectives. They also determined whether the interventions and activities were carried out as planned. For instance, the monitoring activity assessed nursery practices and supply of seedlings. In addition, the project management team had short-term monitoring campaigns (every six months) to assess the ecological, socioeconomic and management impacts of the project interventions (FORIG, 2006). This was possible because at the start of the project a baseline assessment was carried out to determine the underlying causes of deforestation and degradation, and impacts on communities, and inventory farmers and their land holdings, etc (Appiah et al., 2009; Buckingham and Weber, 2015).

During these monitoring campaigns, both socio-economic (e.g. household incomes) and biophysical indicators (e.g. survival and growth rate, extent of forest cover, compositional and structural diversity, and soil properties) were assessed. For instance, four years after the project initiation, more than 97% of six of the selected native species had survived (FORIG, 2006).

Annual monitoring by ITTO (the funding agency) and the executing agency was also carried out to ensure the successful implementation of the planned project activities, and to identify the challenges that needed to be addressed. According to the Project Coordinator (Phase II) those ITTO field visits contributed significantly to the successful implementation of the project (Lawrence Damnyag; personal communication). Indeed it was during a monitoring exercise that an activity on the inventory and registration of farmers was identified and carried out.

Outcomes/Benefits

The project has made significant contribution to increasing forest and tree cover and the provision of ecosystem services. It also enhanced the livelihood and well-being of local communities.

Local livelihoods improvements

Through the project local farmers had access to fertile land. Access to land had been a major challenge for farmers in the area but through the project degraded lands were allocated to farmers at no cost to integrate their crops with trees for at least three years, and then were moved to other degraded forestlands to repeat the agroforestry system of restoration.

An earlier survey of 143 beneficiary households in four communities reported that most respondents (72%) mentioned access to land for farming as the most significant benefit of the project (Blay et al. 2008). Previous reports also showed that the project resulted in improved food security through increasing food production and helped farmers to diversify their income (e.g. FORIG, 2006).

From the recent one-on-one interview and focus group discussion with ten farmers from five communities who took part in this Forest Landscape Restoration Snapshot project, all the respondents (100%) noted that access to fertile land helped to improve crop yield, which
enabled them to feed their families. Farmers also improved their household incomes through the sale of food crops, including maize, cocoyam, and plantain and Non Timber Forest Products (NTFPs) such as medicinal plants (23.5%), bush meat (17.6%), firewood (15.7%) and others that enabled them to pay for the cost of health services, school fees and agricultural inputs.

As part of the project implementation farmers were trained in alternative livelihood schemes, including cane rat (grass-cutter) rearing, and the cultivation of different NTFPs (e.g. *Piper guineense*, *Xylopia aethiopica*, *Myristica fragrans* and *Nephelium lappaceum*) which were integrated into the established plantations (FORIG, 2016). The project also provided indirect jobs to local communities through activities such as seedling production, tree planting and maintenance of plantations. In addition, it ensured improved tree tenure rights for farmers and local communities through a benefit-sharing arrangement. A document that recognizes the rights of farmers and local communities to have a share in the future timber products was produced; however the benefit-sharing agreement is yet to be signed by government and distributed to participating farmers. With this arrangement the farmers who planted the trees and local communities are entitled to 40% of the revenue from future timber sales.

4.2 National benefits

While the benefits of restoring parts of the degraded landscape through the community-based rehabilitation project may extend beyond the local forest fringe communities, it could also have a long-term impact on the country. Based on the benefit-sharing arrangement the Government of Ghana, through the Forestry Commission, is expected to receive 20% of timber revenue from any future harvest. There are other non-monetary benefits, including contribution to the national landscape restoration agenda, restoration of ecosystem services, climate change mitigation/ adaptation efforts, as well as Ghana’s Poverty Reduction Strategy. Specifically, the restored forest cover contributes to the country meeting its obligation under the Bonn Challenge. In addition, planting degraded sites contributes to restoration and climate change mitigation strategies adopted in the 2012 National Climate Change Policy and the National Forest and Wildlife Policy. Also management options, techniques, strategies and governance lessons for engaging local communities to restore degraded forest reserves were developed, which may serve as a guide for future landscape restoration projects/initiatives. Finally, the capacity building activities have enhanced the leadership capacity of local communities in managing forests.

4.3 Ecological benefits

Through the support of local communities, 250 ha of plantations were established to rehabilitate some of the degraded portions of the reserve. This demonstrates that the project helped to increase forest cover, thus helping to restore the ecological integrity of the area. Apart from this, the planted forests served as nurse crops that facilitated natural regeneration, and also enhanced tree species composition and diversity. For instance, species composition and diversity were significantly higher in mixed mahogany (*K. anthotheca* and *K. ivorensis*) plantation than nearby naturally regenerated stand 10 years after the project started (Danquah et al., 2011).

Another study that assessed the understory plant diversity of an 8-year-old mixed species plantation reported that species richness increased by 24% per 1,000 square metres between 2001 and 2008 (Appiah, 2012). Again, there was improved soil fertility, and increased carbon sequestration due to increased tree cover. Danquah et al. (2012) also determined the effect of mixed mahogany plantation on the soil chemical properties 10 years after establishment in Panu-Berekum Forest Reserve. They reported that with the exception of available soil P, all
the properties, including pH, cation exchange capacity, organic carbon and nitrogen were significantly higher in soils sampled from the mixed mahogany stands compared to an adjacent degraded site. These findings suggest that the conversion of degraded forests to plantations could facilitate the restoration of key tree species that dominated the original forest and other critical ecosystem services.

Figure 2: Understorey vegetation of a 20-year-old mixed plantation established in collaboration with local communities (Photo credit: Shalom Addo-Danso).

5.0 Financing

The project was supported financially by the International Tropical Timber Organisation (ITTO) and partly by the Government of Ghana. The total budget for both Phases I and II was US$979,175. Of the total amount ITTO provided US$899,236 and the Ghana Government contributed US$79,939.

6.0 Communication

The project was communicated to local communities and the various stakeholders through workshops, technical reports and journal publications. Prior to the project inception, there were start-up workshops organized to sensitize and engage the local communities and other stakeholders on all aspects of the project. Other workshops were also organized at different stages of the project. Technical reports were submitted periodically to the project steering committee, and the funding agency on the progress of project interventions and actions. Furthermore, results of the project interventions were disseminated to wider international audiences through journal publications (e.g. Blay et al. 2008; Appiah et al. 2009; Appiah, 2012).

7.0 Lessons Learned

The key lessons learned through the implementation of the project are these:

- A stakeholder-driven communication process involving traditional leaders and with effective participation of all stakeholders during planning and implementation ensures success in landscape restoration projects
• It is important to deploy effective communication tools to inform stakeholders on implementation progress
• Providing appropriate incentives to local communities will engender their effective participation in project implementation
• Initial assessment and progress monitoring can be facilitated by remote sensing and GIS tools
• Strong commitment from resource managers is required to control illegal harvesting and farming
Description of Forestland Restoration activities in Pamu Berekum Forest Reserve

1.0 Introduction

The second project is the plantation development programme established through collaboration between Ghana Forestry Commission (FC) and the Timber Industry (FC/Industry plantations). Located in Pamu-Berekum Forest Reserve and other degraded forest reserves in Ghana, these plantations serve as a contribution towards reforestation of Ghana’s forest estate.

The project is managed under the auspices of the FC/Industry Plantations Fund Board, which engaged CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) to establish best practice plantations of fast growing indigenous and exotic commercial species at various locations in the country. Accordingly, since 2010 CSIR-FORIG has been establishing forest plantations funded through the FC/Industry Fund. The overall aim of the project is to ensure the development of timber plantations of both indigenous and exotic species to supplement raw material supply to the timber industry. The specific objectives of the project were: (i) to restore degraded forest lands, (ii) to develop timber resource base of both indigenous and exotic tree species, and (iii) to serve as outstation center for research and training, as well as support job creation. By so doing, this project contributes greatly to achieving the Sustainable Development Goals (SDGs) particularly SDGs 13 (Climate Action; Target 13.2.1) and 15 (Life on Land; Targets 15.2, 15.5 and 15.9). The project also links to and contributes to meeting Ghana’s target for the Bonn challenge as it aims to bring over 5,000 ha of degraded forests into restoration.

Within the framework of this project, CSIR-FORIG undertakes forest plantation development in degraded forest reserves managed by the Forest Services Division (FSD) of the Forestry Commission. Since the inception of this project in 2010, a total of 2,832 ha of the degraded forestlands in five forest reserves have been planted with indigenous species including *Terminalia superba*, *Nauclea diderrichii*, *Ceiba pentandra*, *Triplochiton scleroxylon*, *Mansonia altissima*, *Khaya ivorensis*, *Pycnanthus angolensis* and exotic species such as *Cedrela odorata*, *Tectona grandis*, *Paulownia elongata* and *Paulownia fortunei*. Of the total area planted 1,358 ha has been established as monoculture and mixed species stands in the degraded Pamu-Berekum Forest Reserve.

For the purpose of this report, the description of restoration interventions below refers to plantations established in the Pama Berekum Forest Reserve.

*Figure 3:* Current state of parts of Pamu Berekum Forest Reserve, which is completely deforested following years of steady degradation attributed to unsustainable logging and fire. (Photo credit: Ernest Foli).
2.0 Implementation

2.1 Project stakeholders

The stakeholders involved in the implementation of this project are the Forest Service Division of the Forestry Commission of Ghana, the CSIR-Forestry Research Institute of Ghana (CSIR-FORIG), the timber industry of Ghana and local forest fringe communities, including JiniJini, Kwadaso, Abansre, Botokrom, Biadan and Nkyenkyemam.

2.2 Technical Design of Restoration Interventions.

The restoration intervention involved planting of both indigenous and exotic tree species depending on the environmental conditions and suitability of species at specific sites. Plantations were established as either monoculture of especially teak, or mixed stands of two to four native tree species. The planting distances depended on the species and the site. At Pamu-Berekum, Tectona grandis was planted at 3 m x 3 m while the mixture of indigenous species including Triplochiton scleroxylon, Terminalia superba, Terminalia ivorensis, Ceiba pentandra, Nauclea diderrichii and Cedrela odorata (exotic tree species) were planted at 6 m x 6 m.

2.3 Enabling Activities

The project has been successful so far because there are close connections between various stakeholders, and also there is the desire and commitment on the part of stakeholders to achieve the project goals and targets. The project fits well within the framework of the Ghana Forests Plantation Strategy (2016 – 2040).

The project implementation is conducted in close collaboration with forest fringe communities and this approach helps to improve successful execution of project activities. The farmers are allowed to plant food crops between trees for the first three years of tree planting in a Modified Taungya System (MTS), and this provides an additional incentive to get full support of fringe communities.

During establishment, sites were prepared by clearing the weeds, removing stumps, and subsequently the site was pegged and planted. Seedlings were raised from seeds that were collected from trusted provenances. After planting there is a well-planned maintenance scheme involving weeding, pruning and thinning. The local people were directly involved in the land preparation and tree planting.

Figure 4: A 3-year-old Tectona grandis plantation established in degraded Pamu-Berekum Forest Reserve. (Photo credit: Shalom Addo-Danso)
3.0 Monitoring

According to the Project Co-ordinator (Reginald Guuroh, personal communication), monitoring is an important aspect of the project implementation. There are three levels of monitoring; the first level is the Project Co-ordinator at CSIR-FORIG visits the project sites every month to inspect progress and provide technical support to the technicians. Monthly reports are produced and presented to the project managers. At the second level monitoring is done by a Project Management Committee at CSIR-FORIG that conducts quarterly monitoring visits. The third level of monitoring involves the FC/Industry Fund Board, which is responsible for approving funds for project activities and aims to embark on at least one monitoring campaign during the year.

Progress reports are discussed at quarterly meetings of the Project Management Committee, chaired by the Chairperson of the FC/Industry Fund Board and the necessary guidance provided for ensuring that planned activities and targets are achieved.

4.0 Outcomes/ benefits

4.1 Local Livelihood Improvement

The project provides several benefits to improve the livelihoods of local communities. For instance, during a recent visit to the site, the responses from 26 farmers who were interviewed indicated that the project is benefitting them in several ways. About 97% of respondents mentioned that access to fertile land through the taungya system had increased food production. Others (33%) indicated that the monthly allowance they receive and selling of food crops (75%) have improved their cash income and enabled them to pay their children’s school fees.

The project has also constructed two ponds (Figure 7) that serve as source of water for fringe communities who require water for various activities on their farms. With these ponds, farmers (especially women) no longer have to carry water for long distances from home to their farms.

Figure 5: Interaction with a section of fringe community members near degraded Pamu-Berekum Forest Reserve. (Photo credit: Reginald Guuroh).
A female farmer stated that “the project has made it possible for farmers like me to intercrop maize with tree species. Further, I sell some of the products, which has improved my income, and this has helped me pay my children’s school fees” (Madam Ataa Akua Alice, Nkyenkyemam community). Another person indicated that “the establishment of the plantation has helped improved my livelihood, since I am able to farm and sell maize and other vegetables that helped me increase my income level and enabled me to take care of my family” (Kwadwo Yeboah, Nkyenkyemam community).
4.2. National Benefits

Through the project, the national economy has been enhanced through the creation of more employment for local communities fringing the site who hitherto did not have regular monthly incomes. Apart from this, through carbon sequestration, the plantations will contribute to reducing the adverse effect of climate change in the country. They also fall in line with Ghana’s Intended Nationally Determined Contribution (INDC) in fulfilment of its obligations as party to the United Nations Framework Convention on Climate Change (UNFCCC). There are therefore possibilities of gaining carbon credits for this effort.

4.3 Ecological Benefits

The ecological benefits provided by the project include increased floral and faunal biodiversity in the areas. For example ground squirrels, cane rats (grass-cutters) and African bush fowl are common in the restored areas. Improving the forest cover is contributing to reducing soil erosion and soil degradation, while improving soil productivity. The forest cover has also enhanced carbon sequestration.

5.0 Financing

The project is fully financed by the Forestry Commission/Industry Plantation Development Fund. The annual budget is US$200,000 for maintenance of plantations. A small portion of the budget (5%) is allocated to project monitoring and management.

6.0 Communication

The main source of communication is in the project reports. These include monthly reports and annual reports that contain information about the progress of the project, the area planted, the species planted, etc. These bits of information are also available at the Forestry Commission website and a dedicated website (http://csir-forig.org.gh/fcindustry/) developed by CSIR-FORIG for this purpose. Posters are also developed annually to communicate basic information about the project.

7.0 Lessons learned

The key lessons learned during the implementation of this project, and which can facilitate successful replication of these interventions in other restoration areas are that:

- Strong and well-structured institutional partnerships are crucial for the success of landscape restoration efforts
- Design and implementation of landscape restoration projects should depart from the conventional top-down approach and rather foster closer collaboration with smallholder farmers and other stakeholders in the fringing communities
- Effective community involvement is key to successful landscape restoration
Description of Forestland Restoration activities in Tain II Forest Reserve

1.0 Introduction

The third project is the Tain II Forest Landscape Restoration Programme (TLP), which is a Public-Private Partnership (PPP) arrangement initiated by Form Ghana Ltd., with traditional landowners and the FC of Ghana (Naaijen and Hol, 2018). The PPP arrangement started in 2012 and it is expected to restore 14,500 ha in four years. The PPP is part of the national policy to restore degraded forest reserves in Ghana, which is a strong policy instrument showing the commitment of the Government of Ghana to conserve and restore natural resources and to promote the sustainable use of forest resources in the country.

The TLP is being implemented in and around the severely degraded Tain II Tributaries Forest Reserve in the Bono Region. The reserve covers an area of ca. 509 square km, and lies within latitude 7° 28′ N and longitude 2° 40′ W. The Tain II Tributaries Forest Reserve forms part of the dry semi-deciduous forest zone, where fire is predominant (Hall and Swaine, 1981). Over the years the reserve has been degraded to the extent that much of it is finally completely deforested with large portions converted to farmlands and settlements as result of annual bushfires, logging, slash and burn agriculture, and felling of trees for fuelwood (Kosoe et al. 2015). The remaining vegetation is now a mosaic of savannah, farmlands, unmanaged teak plantation and degraded forest (Tollenaar, 2013). There have been efforts through both government and private sector initiatives to reforest the degraded/deforested reserve (Owusu-Afriyie et al. 2012; Kosoe et al. 2015).

Form Ghana Ltd. was established in 2007 as a forest plantation management company based in central Ghana, and has been active in this area since 2013. It is a commercial enterprise with large-scale investment in landscape restoration in Ghana (visit their website on www.formghana.com). In addition to commercial interests the company has co-developed ecological and social sustainability models with the business, and since 2007 it has achieved very tangible sustainability results. Socially, excellent relations have also been developed with local communities, traditional authorities and the government.

Form Ghana and its partners initiated the TLP with the overall goal of the integrated management of the landscape in and around the reserve with all stakeholders to improve livelihoods, productivity and protection of biodiversity. By 2030 the vision is to establish a productive on-going collaboration and dialogue between all stakeholders, and ensure that the land becomes more productive and that farmers engage in agriculture practices that will be more resilient to climate change. The goal of the programme is in line with the Bonn Challenge because its long-term objective is to restore an area of 100,000 ha of degraded forests and lands in and around the Tain II Tributaries Forest Reserve through a multi-stakeholder Public-Private-Partnership model.

The specific objectives of the TLP are to:

- Increase tree cover by initially restoring 2,000 ha of the degraded forest
- Ensure a successful collaboration model of sustainable forest plantation development by smallholders and Form Ghana to restore degraded forest with mutual economic benefit and fair balance of revenues versus investment
- Improve productivity and economic performance of forest plantations
- Assist local communities to engage in climate smart agriculture and forestry outgrowing activities
- Support local communities to be more resilient to threats such as climate change
- Strengthen forest landscape governance to achieve good land stewardship
- Reduce fire risks and improve fire management in the surrounding landscape, and
• Combat forest encroachment and illegal logging

**Figure 8:** Map showing desired future landscape around the Tain II Forest Reserve. (Source: Naaijen and Hol (2018)).

**Figure 9:** The landscape restoration model adopted by FORM Ghana entails the planting of trees without removing the remnant tree vegetation of the original forest. The picture shows teak growing together with the original forest trees in the heavily degraded Asubima forest reserve. (Photo credit: Ernest Foli).
2.0 Implementation

2.1 Project stakeholders

The objectives of the programme were to be achieved through a balanced stakeholder framework between the company, local communities and the government through the FC. Through a participatory approach, the programme seeks to develop a governance structure for a sustainable regional development, promote and pilot commercial tree and crop plantations and catalyze economic development (Naaijen and Hol, 2018). This participatory approach ensures that key stakeholders, including the Berekum and Seikwa Traditional Councils, the Municipal Assembly, Ministry of Food and Agriculture (MOFA), government agencies (FC and Ghana Fire Service), as well as local communities (e.g. Kotaa, Akroforo, Seikwa, and Oforikrom) have become integral to the planning and implementation of the programme.

Prior to the start of the programme, key stakeholders signed a Memorandum of Understanding (MoU), as the basis for collaborating towards the common vision and goals. In this MoU the partnership was formalized, the common vision defined, and priorities, roles, targets and strategy were clearly defined. Furthermore, the partners have set-up a Landscape Governance Board and three Working Groups on ecological restoration, agroforestry development and fire risk reduction. Together they are supposed to develop restoration goals and interventions to ensure the long-term restoration of the landscape.

The Landscape Programme is implemented by a project team under the supervision of the Managing Directors of Form International and Form Ghana Ltd. The project team consists of an Operations Manager, a Coordinator, three Field Extension Supervisors, a Financial Manager, and a financial administrative employee.

2.2 Technical design of restoration interventions and enabling activities

The programme seeks to restore the degraded landscape by establishing commercial plantations (90% teak and 10% mixed native tree species), through the use of agroforestry models, and to conserve and restore natural, riparian buffer zones. The TLP also seeks to guarantee financial and economic sustainability by providing support to smallholder farmers to develop climate smart agriculture, woodlots and crops. The goal is to ensure that all activities achieve economic, social and ecological sustainability through the active participation of the surrounding smallholder communities. Although the commercial plantation involves the planting of mostly teak, native tree species have also been planted in the past four years.

The establishment of the plantation involved several activities, including site preparation, planting and maintenance of the planted crops. The site was cleared through manual cutting of weeds and bushes; small trees were removed by means of chainsaw. The slash was burned, and later ploughed. Since teak was the principal species chosen for the plantation, the programme established a teak clonal/provenance orchard where future seeds will be collected to raise seedlings for the plantation (Amoako and Wanders, 2016). Teak was planted at a spacing of 3 m x 6 m. Key native species that have both timber and non-economic values, including Albizia ferruginea, Terminalia superba, Erythrophleum ivorenisis, Khaya anthotheca, Cola gigantea, Talbotiella gentii, Mansonia altissima, Pericopsis elata, Ceiba pentandra, and Aningeria robusta were planted. The plantation was maintained through regular weeding and occasional application of glyphosate on weeds that usually resprouted after clearing. For the agroforestry model, farmers were assisted to plant trees and cash crops, including teak and maize, and cashew. Protection against annual bush fire is achieved through greenbelt construction and the use of community fire squads.
Apart from these activities, the programme also seeks to focus attention on other activities that may have indirect influence on the success of the restoration efforts. For instance, the programme is creating an enabling environment for farmers to invest in more intensive and higher-yielding agricultural practices and crops, cash crop planting and tree planting. The programme has also engaged the local Municipal Assembly, and the traditional council to revise the current bylaw proposals on bush fire and cattle ranching. Fire is regarded as the most important threat to the restoration programme, and therefore there is Community Fire Management component that trains and builds the capacity of local people in bushfire management and control. In addition, Form Ghana, through what it calls ‘Farmer Land Incineration Aid’ assists farmers to burn their farms during land preparation for the cropping season (Amoako and Wanders, 2016).

3.0 Monitoring

The TLP has a monitoring framework through which information on several indicators are collected and verified to assess the success of the programme’s interventions. Specific indicators that are linked to management objectives are monitored annually or bi-annually. The Project Team is responsible for monitoring activities, and key indicators ranging from biophysical, social and economic factors are assessed during monitoring campaigns (Amoako and Wanders, 2016). For instance, indicators such as area planted with teak and native species, changes in planted area, flora and fauna diversity, and fire frequency have been used to monitor the plantation established under the programme (Amoako and Wanders, 2016; Wanders, 2018). Through these monitoring activities, it was reported that Form Ghana had established about 4,363 ha of plantation, consisting of 94% teak and 6% native species between 2013 and 2016 (Amoako and Wanders, 2016). Within the same period, about 37 ha of riparian forest were conserved. For the agroforestry component of the programme, farmer household income, farm productivity, number of ha planted under the agroforestry system, participating female farmers, and diversification of farming options are used as monitoring indicators. Furthermore, the component on Community Fire Management typically assesses indicators such as the number of communities and area covered by fire awareness raising activities, as well as community fire teams that have been trained and are operational. Annual reports are produced and the information is used to make adjustment to the programme when necessary.

4.0 Outcomes/benefits

4.1 Local livelihoods improvements

The TLP is already improving the livelihood and income situation of participating local communities. Through the programme roads have been constructed that ease the transportation of farm produce into urban centres. By the end of 2016, a total of 537 farmers had registered and been trained in climate-smart agricultural and agroforestry practices. Further, the programme has employed 156 local people, including women and youth from fringing communities as permanent staff, and provided indirect jobs to 569 people as casual and contract workers (Wanders, 2018). The programme has also introduced farmers to new marketable cash crops, thereby helping to diversity their income. Apart from these, Form Ghana Ltd. has an agreement with the National Health Insurance Authority of Ghana to insure all permanent workers for free access to medical care (Amoako and Wanders, 2016). In close collaboration with the traditional landowners, the TLP is supporting smallholder farmers with formal benefit sharing agreement with landowners. Lastly, vulnerable groups including women and youth are being empowered, and the capacity of workers of government agencies such as MOFA, FC and the Ghana Fire Service is also enhanced.
4.2. National benefits

In the long-term, the agroforestry and climate smart farming models that are now developed under the TLP may be scaled up to other degraded landscapes, which will benefit the nation. Planting trees and creating a buffer zone around the Forest Reserve, as well as managing bushfires and encroachment of cattle will contribute to productive soils and climate change mitigation. When soils become more productive, farmers would be capable of longer-term investments on their land; this would improve their livelihoods.

4.3. Ecological benefits

So far 5,009.80 ha of plantations have been established, and 370 ha of riparian buffer vegetation has been conserved, enhancing tree species composition and diversity (Wanders, 2018). For instance, 60 species of birds and mammals such as African brush-tailed porcupine (Atherurus africanus), Striped Ground Squirrel (Xerus erythropus), Bushbuck (Tragelaphus scriptus), Maxwell’s duiker (Philantomba maxwellii), Common dwarf mongoose (Helogale parvula) and Red river Hog (Potamochoerus porcus) have been recorded in the forest reserve (Wanders, 2018). Restoring and conserving the buffer zones along watercourses could help reduce erosion and prevent sedimentation or chemical inputs into streams. Indeed, an assessment of water quality of streams draining the reserve showed that turbidity and total dissolved solids were low in the water (Amoako and Wanders, 2016). An important component of the programme is the re-introduction of an endangered native tree species, Talbotiella gentii, in a conservation block of 50 hectares inside the Tain II Forest Reserve as part of the restoration activity.

5.0 Financing

The TLP is fully financed by Partnerships of Forest of UKAid and DOB Ecology. There is no information on the budget and how much is allocated for monitoring.

6.0 Communication

The programme uses different strategies to communicate and inform stakeholders, donors and the public on its activities. Media outlets, including community radio stations are used to inform participating local communities on issues relevant to the programme. Technical reports are also submitted annually to funding agencies on the progress of project interventions and actions. Furthermore, information is disseminated to wider international audience through Facebook, YouTube (https://www.youtube.com/channel/UC2h309UNsd-dmqH1VVENwxQ), Linked-IN, Form Ghana’s monthly Newsletter and journal publications and (e.g. Naaijen and Hol, 2018). Brochures and T-shirts have also been printed to enhance the visibility of the activities of Form Ghana to the general public.

7.0 Lessons learned

- Government’s support and cooperation is required for successful implementation of large-scale restoration projects
- Commercial reforestation can be an alternative approach to scale up restoration of degraded landscapes
- Support from grassroots local communities is key to successful landscape restoration
- Cross-border collaboration is required to deal with threats to restoration activities
References


Tollenaar, M. 2013, Social and Environmental Impact Assessment Tain II Forest Reserve, Ghana