



Social and Environmental Impact Assessment

Form Ghana reforestation project in
Tain Tributaries Block II Forest Reserve,
Ghana



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ACRONYMS

AfDB	African Development Bank
DBH	Diameter at Breast Height (+/- 1.30m)
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
HPIC	Highly Indebted Poor Countries
IFC	International Finance Corporation
FR	Forest Reserve
FSC	Forest Stewardship Council
FG	Form Ghana
HCVF	High Conservation Value Forests
NGO	Non-Governmental Organisation
NTFP	Non-Timber Forest Product
NCCE	National Commission for Civic Education
PEFC	Programme for the endorsement of Forest Certification
PPP	Public Private Partnership
PtCo	Platinum-Cobalt Scale
RAP	Resettlement Action Plan
SEIA	Social and Environmental Impact Assessment
SEP	Stakeholder Engagement Plan
SWOT	Strengths, Weaknesses, Opportunities and Threats
USDA	United States Agriculture Department
Tain II FR	Tain Tributaries Block II Forest Reserve
WHO	World Health Organisation
WRB	World Reference Base for Soil Resources

SUMMARY

Form Ghana has commissioned Form international to conduct a Social and Environmental Impact Assessment (SEIA) to contribute to the sustainable implementation of the company's reforestation activities in the degraded Tain II Forest Reserve, Brong-Ahafo Region, Ghana.



Figure 1. Patch of remaining riparian forest in Tain II Forest Reserve

Preparatory studies

Literature was consulted and field work was executed in the proposed project area to collect baseline information. Socio-economic studies identified social, economic and cultural factors and processes that can be affected by the proposed project. Interviews were held with local communities around the project site, key informants and officials from the Forestry Department. Environmental auditing and flora and fauna inventory studies were carried out to determine present ecological state of the reserve. A hydrological and soil survey were conducted to determine the potential for the project's impact on soils and water bodies, and the environmental and social benefits for those living near the forest.

Impact assessment

Form Ghana intends to plant at least 90% of the area with Teak (*Tectona grandis*). Approximately 10% of the area will be planted with indigenous tree species or managed to restore naturally. The indigenous trees will be planted in the buffer zones bordering the waterways and on suitable areas.

The potential impacts of all forest plantation operations throughout the lifecycle of the project on the identified baseline conditions regarding ecology, hydrology, soil and the socio-economic environment were identified. The magnitude of each potential impact was analyzed using a social and environmental impact matrix. For all issues which form a moderate or major negative impact for the project, mitigation measures were proposed.

Three project alternatives were analysed: indigenous tree species plantation, alternative site and no project option.

Impact statement

Considering the highly degraded current state of the forest reserve, the consultants and relevant stakeholders concluded that the reforestation project by Form Ghana is likely to have a positive impact on the environment as well as on the local society. The intended forest cover has the potential to enhance water, soil, forest and general ecological integrity (biodiversity). The environment benefits from the reforestation of the area with Teak can reduce many of the negative impacts caused by land degradation in Tain II Forest Reserve. At the same time, through a.o. employment the project can provide a sustainable source of income and other goods and services for local communities. Economically, commercial Teak planting offers a respectable and readily profitable market worldwide. In potential, this provides a sustainable basis for the responsible management of Tain II Forest Reserve.

Although threats to the project have been identified in this report, most of them can be prevented or mitigated with appropriate management solutions. Recommended mitigation measures are described in paragraph 10.2. Based on the outcomes of this report, benefits seem to outweigh the negative effects of this project.

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1. INTRODUCTION

1.1 Form Ghana

Form Ghana is a reforestation company which aims at large-scale reforestation of degraded forest reserves in Ghana, while conserving and restoring natural, riparian forest. Form Ghana is already established in the north of the Ashanti Region, near Akumadan, where the company has reforested the degraded Asubima and Afrensu Brohuma Forest Reserves between 2008 and 2012. Form Ghana has recently set up a Public Private Partnership (PPP) with the Forestry Commission of Ghana for the development of a commercial forest plantation within Tain II Forest Reserve.

Form Ghana wants to execute the project according to the operational safeguards of the African Development Bank (AfDB) and according to the Principles and Criteria of the Forest Stewardship Council (FSC). Both organizations require an Environmental and Social Impact Assessment (ESIA) to be performed prior to the start of the activities.

Before starting up the operations, Form Ghana therefore commissioned Form international to conduct a Social and Environmental Impact Assessment (SEIA) to contribute to the sustainable implementation of the company's reforestation activities in Tain Tributaries Block II Forest Reserve (Tain II FR).

1.2 Form international

Form international is a Dutch consultancy firm established in 1992. It offers high quality advice on forest management, certification and technical assistance to plantation establishment and management. Form international has extensive experience in tropical forest management, mainly in West and Central Africa and is also active in Europe on Chain-of-Custody certification and PEFC conformity assessments.

Form international advises branch organizations, international timber and forest companies, NGO's and many other organizations that play a role in the direct or indirect amelioration of forest management. Using a pragmatic approach, Form international's knowledge and experience in the field of sustainable forest management and certification is translated into a concrete advice ready to be implemented in the day-to-day forest operations of her clients.

1.3 Environmental and social impact assessment

1.3.1 Objectives

The ESIA for the proposed project was undertaken before the project implementation, so as to identify environmental and social impacts at an early stage and offer mitigation measures to the anticipated impacts. The ESIA was to achieve the following objectives:

- Obtain the public opinion about the plantation establishment project in order to capture major concerns and fears as well as appreciation with a view of developing appropriate interventions to create more acceptability and enhance awareness on potential values of the established forest plantation;
- Identify suitable alternatives with respect to ecological, social and economic suitability as well as political acceptability;
- Justify the proposed plantation establishment with respect to social development, economic growth (local and national) and conservation opportunities;
- Identify all potential significant adverse environmental and social impacts of the plantation establishment on resources utilization, agriculture, environmental conservation, health & safety and demographic patterns
- Recommend relevant mitigation measures against any potential negative impacts identified.

1.3.2 Terms of Reference

The ESIA was carried out in compliance with the Government of Ghana's Environmental Assessment Regulations of 1999. The study is in compliance with AfDB requirements as well as FSC Principles and Criteria. These are further elaborated in chapter 4.

The scope of this assignment includes the following:

- Review of the existing data on the proposed plantation project and social and economic activities in the project study area;
- Collection of socio-economic, cultural, flora, fauna and water baseline data that are necessary to optimize the design of the plantation establishment project and serve as a baseline measurement for impacts generated by the project in the future;
- Identification of potential environmental and social impacts that could result from the project throughout all project phases, including occupational Health & Safety concerns;
- Public participation and consultations on the positive and negative impacts of the project;
- Mitigation measures for the identified environmental and social impacts.

The various baseline studies and stakeholder consultations were conducted in the year prior to project establishment, in 2012. The original report from 2013 has been updated in 2015 to fulfill all AfDB requirements regarding a SEIA (or ESIA).

Separately from this study, the following reports have been prepared:

- Stakeholder Engagement Plan
- High Conservation Value Forest analysis
- Resettlement Action Plan
- Management Plan, including social and environmental aspects
- Reforestation Project Budget
- Monitoring Plan

This report indicates the links with these documents, but to keep it clear it does not copy the content.

1.4 Report content

This report starts with a project background in chapter 2, followed by a more detailed forest plantation project description in chapter 3.

The policy and legal framework is outlined in chapter 4 with relevant national policies and legislation, applicable international conventions and AfDB standards.

Chapter 5 and 6 present the environmental and the socio-economic settings of the project area. In chapter 7 the project is described and in chapter 8, the three alternative project scenarios are described.

The impact analyses are presented in chapter 9 with the negative and positive impacts of forest plantation establishment and construction of necessary buildings and facilities on all environmental components: ecology, hydrology, soil and the socio-economic situation. Also, cumulative impacts and a SWOT analysis of the project are included in this chapter.

Chapter 10 lists the proposed mitigation measures to avoid/ minimize any negative impacts arising from the project as well as enhancement measures to maximize the benefits of positive impacts.

Finally, chapter 11 outlines the environmental and social management plan of the project as well as the monitoring plan.

2. PROJECT BACKGROUND

2.1 Project overview

Public Private Partnership

The Forestry Commission and Form Ghana signed a 50-year Public-Private Partnership (PPP) Lease Agreement to jointly reforest an estimated 14,596 ha of degraded forest land within the Tain II Forest Reserve near Berekum in the Brong-Ahafo Region. Additionally, the Forestry Commission, Form Ghana and the Berekum Traditional Council signed a Benefit Sharing Agreement to formally document the responsibilities and future benefits of each of the three key stakeholders.

Forest plantation establishment and management

Form Ghana has planned to plant about 2,000 ha per year, so that by 2020 the entire area will be reforested. Trees planted on the plantations consist of Teak and a mix of local (indigenous) species. After the forest plantation establishment phase follows the maintenance phase (subdivided in a stage before canopy closure and a stage after canopy closure) and the production phase. After 20 years the Teak trees will be ready for final felling, after which the area will be replanted and a new forest plantation cycle begins. More information about the specific operations in each of the phases can be found in chapter 7.

In order to facilitate the smooth operating of the forest plantation throughout the various phases, some supportive infrastructures will be created. Form Ghana will establish a Teak nursery on-site the project area, whereas indigenous seedlings will be transported to Tain II FR from the Akumadan site indigenous nursery. There will be a complex with office buildings, residences for expats, a power house (solar and diesel), a training center a workshop and a clinic. This complex will be constructed off-site on privately owned land, outside of a community.

Unique sustainability concept

Form Ghana's vision is to operate in a sustainable environment and to contribute significantly to the quality of people's life related to or affected by the company, to environmental protection and to the Ghanaian economy. Form Ghana is therefore committed to operate in compliance with the Principles and Criteria of the Forest Stewardship Council TM (FSC TM), see the box below.

FSC™ Principles - 10 rules for responsible forest management

Principle 1: Compliance with laws and FSC Principles

Comply with all laws, regulations, treaties, conventions and agreements, together with all FSC Principles and Criteria.

Principle 2: Tenure and use rights and responsibilities

Define, document and legally establish long-term tenure and use rights.

Principle 3: Indigenous peoples' rights

Identify and uphold indigenous peoples' rights of ownership and use of land and resources.

Principle 4: Community relations and worker's rights

Maintain or enhance forest workers' and local communities' social and economic well-being.

Principle 5: Benefits from the forest

Maintain or enhance long term economic, social and environmental benefits from the forest.

Principle 6: Environmental impact

Maintain or restore the ecosystem, its biodiversity, resources and landscapes.

Principle 7: Management plan

Have a management plan, implemented, monitored and documented.

Principle 8: Monitoring and assessment

Demonstrate progress towards management objectives.

Principle 9: Maintenance of high conservation value forests

Maintain or enhance the attributes which define such forests.

Principle 10: Plantations

Plan and manage plantations in accordance with FSC Principles and Criteria.

Source: www.FSC.org

An FSC certificate ensures an improved social standard and employment for the local population, the enhancement of the local economy, conservation of ecology and a guaranteed timber supply for the forest industry.

The following objectives have been stated by Form Ghana regarding this commitment:

- Both Teak and indigenous tree species are planted on the lease area;
- Degraded riparian zones will be actively restored and conserved;
- The project will be executed in close collaboration with local communities and other stakeholders;
- There will be transparent benefit sharing with relevant stakeholders;
- Job opportunities will be created for local people in several plantation activities;
- Farmers are offered the opportunity for intercropping between the one- and two-year old seedlings.

Biological diversity, water sources and fragile ecosystems found in or near the plantations will be conserved or restored where possible. This includes the ripari-

an buffer zones; 30 meters on each side of the waterway. The carbon storage function of the plantation forests contributes to climate change mitigation.

An overview of the social, ecological and economic benefits of the proposed reforestation project is given in the figure below.

The unique sustainability concept of Form Ghana

Social	Ecological	Economical
<ul style="list-style-type: none"> • Landlease instead of purchase • Creating local employment • Intercropping by farmers • Trainings for employees • Revenues partly return to local community • Stimulate outgrowing 	<ul style="list-style-type: none"> • Reforestation of degraded land • Part of the planted seedlings are local species • Conservation and restoration of bufferzones along waterways • Enhance biodiversity • Protect wildlife with poaching control and refugia 	<ul style="list-style-type: none"> • Yield much higher than from natural forest • Shorter harvesting cycle • Respond to declining supply and growing demand for sustainable timber • Boost local economy

2.2 Project location

The proposed project site is located in Tain Tributaries Block II Forest Reserve, further referred to as Tain II Forest Reserve (Tain II FR) in Berekum District, Brong-Ahafo region. Tain II FR lies around a grid reference of 7N35, 2W30. The forest area is 409.2 km², with a perimeter of 269.43 km. Approximately 14,596 ha of this reserve is allocated to Form Ghana Ltd. for commercial forest plantation development, divided into 3 blocks (figure 2).

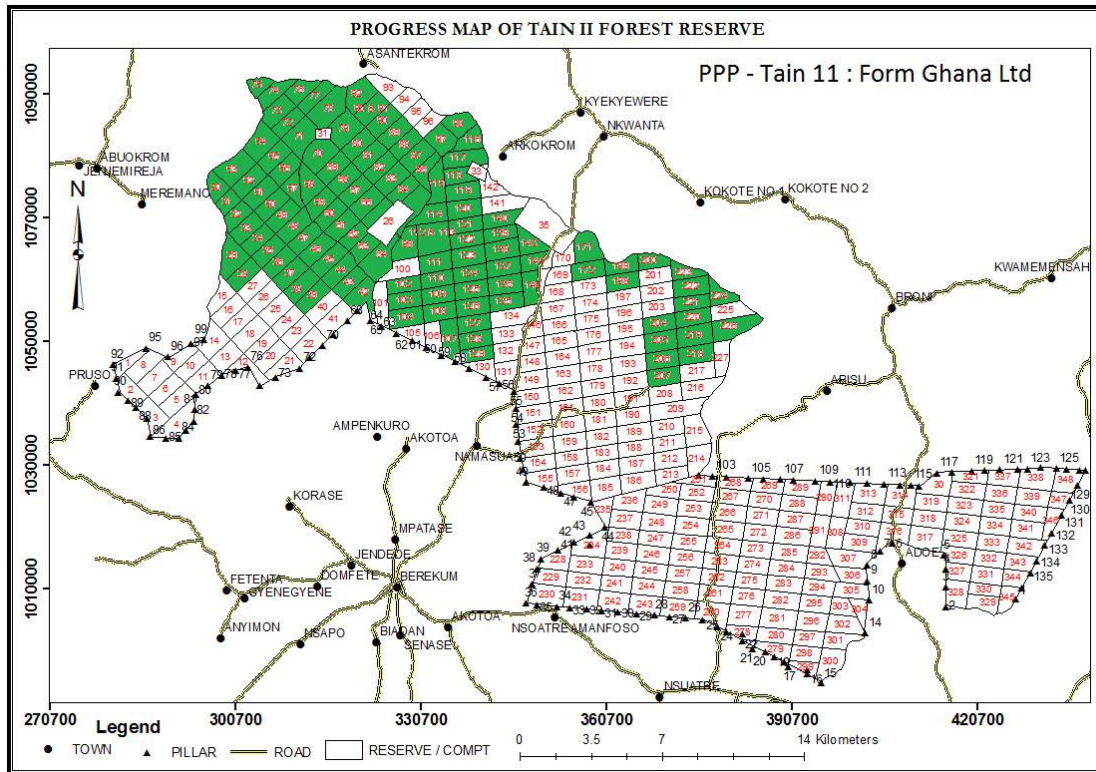


Figure 2. Map showing the three blocks allocated to Form Ghana in Tain II.

Vegetation

The entire reserve is located within the dry semi-deciduous forest zone (Hall and Swaine, 1981). The terrain is undulating and covered with savannah vegetation with a very open canopy, alternating with forested and open sandy-rock patches.

Originally, the main vegetation type in the reserve was the dry semi-deciduous forest, which generally contains valuable timber trees such as Wawa (*Triplochiton scleroxylon*), Odum (*Milicia excelsa*), Sapele (*Entandrophragma cylindricum*) and Kokrodua (*Pericopsis elata*) (Amponsa-kwatiah, 1993). Today however, large areas of the reserve are covered by savannah, resulting from human induced land degradation (see satellite image figure 4). Due to intensive farming and reported annual fires very little of the original forest remains and has been replaced by secondary forest and grassland. In the past, farmers protected the large trees on their farms but most of them have been logged eventually so that very few still remain today.

Climate

Tain II Forest Reserve has a bi-modal rainfall pattern with a major and minor peak in June and October respectively. The main dry season is from November to March and there is a second dry spell in August. The mean annual rainfall is 1,200mm and the maximum and minimum annual temperature for 26 years were

23.6°C and 26°C (Orgle, 1994). Relative humidity in the dry season ranges from 100% at night to 30% near midday when the Harmattan is strongest.

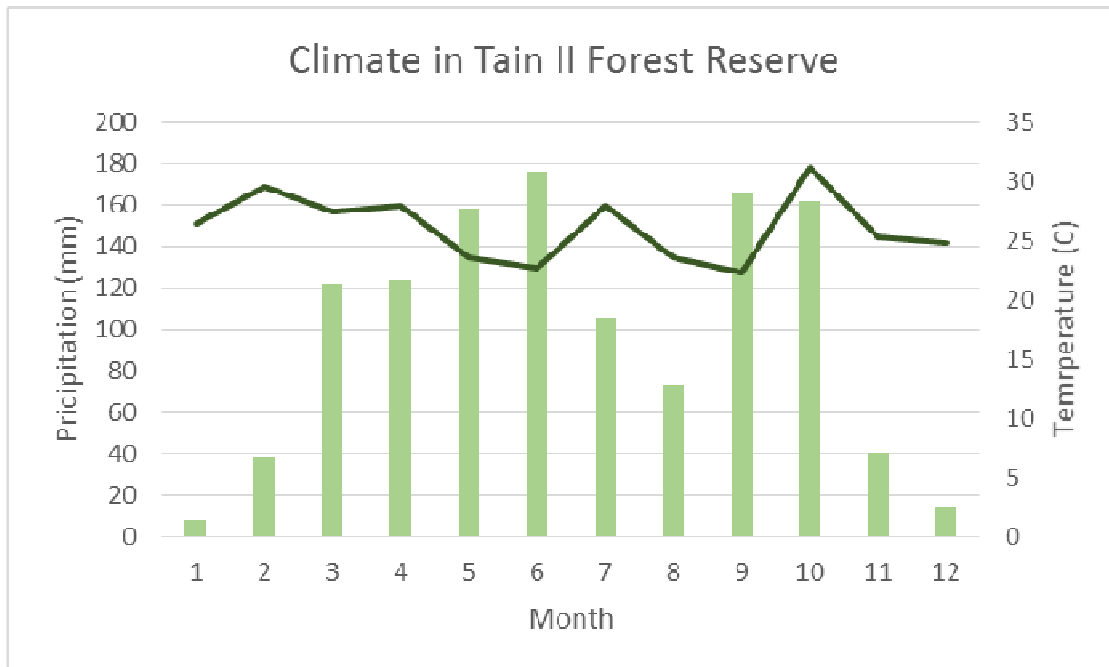


Figure 3. Graph showing temperature and precipitation (based on <http://en.climate-data.org>)

Historic development

The establishment of Tain 2 Forest Reserve started in 1931 and was finalized in 1932. Taungya systems were introduced in the reserve in 1964, allowing farmers to intercrop with commercial tree species like Ofram (*Terminalia superba*) and Emeri (*Terminalia ivorensis*). In 1970, an agreement was signed for the adoption of the current forest management plan. Included in this plan was the establishment of pilot Teak plantations within the reserve. Large scale degradation of the entire reserve occurred in 1983, during a large bushfire. The patches of Teak were harvested (clear-felled) between 2000 and 2008. Trees have coppiced but there is no coppice management.

2.3 Project justification

Fit with national policy and plans

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 degraded forest reserves are of major concern to the Government of Ghana, because approximately 94% is in a deplorable condition as a result of unsustainable harvesting, encroachment of illegal farmers and devastating wildfires. Restoring these areas is there-

fore a key component of Ghana's 1994 Forest and Wildlife Policy and the 1996-2020 Forestry Development Master Plan as well as other related sector policies including the Ghana Poverty Reduction Strategy paper. The proposed reforestation project in Tain II Forest Reserve fits well within this policy.

Need for reforestation

The reserve has been declared degraded by the Forestry Commission and has suffered from ongoing degradation since then. Based on the series of satellite images below (figure 4), it is evident that most of the forest reserve was deforested by 2012.

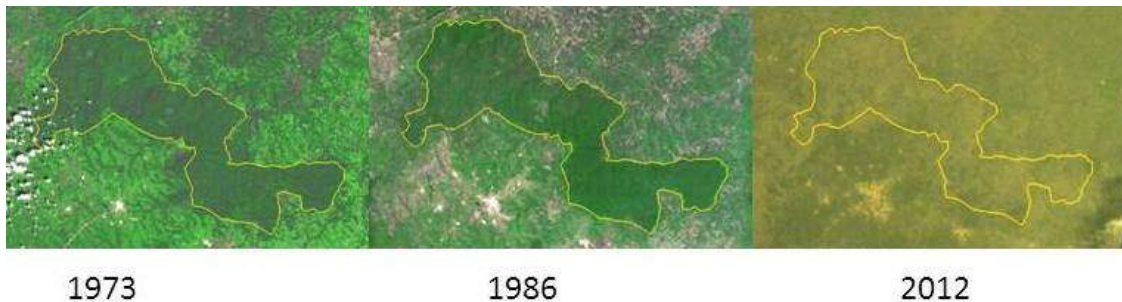


Figure 4. Deforestation of Tain II Forest Reserve 1973 to 2012. Source: Google Earth.

In its current state Tain II FR is no longer able to supply timber and other forest products and services for the forestry sector and the local population. The forest reserve is in urgent need of restoration activities in order to restore forest cover and related ecosystem services, restore its production potential and reclaim it for commercial timber production.

Sustainability

Form Ghana is a reforestation company established in Ghana in 2007, which aims at large-scale reforestation of degraded Forest Reserves in Ghana while conserving and restoring natural, riparian forest. Their vision is to operate in a sustainable environment and to contribute significantly to the quality of people's life in the project area, to environmental protection and to the Ghanaian economy. Form Ghana is therefore committed to operate in compliance with the FSC Principles and Criteria.

Experience Form Ghana

Form Ghana is already active in the north of the Ashanti Region, near Akumadan, where the company has reforested part of the degraded Asubima and Afrensu Brohuma Forest Reserves between 2008 and 2012. The experiences from reforestation activities at the Akumadan site will be incorporated in the management of the new Tain site.

Social benefits

Employees are offered a safe and healthy working environment, with good employment terms, favorable (health) insurance policy conditions and pension build-

up. The amount of jobs that will be created in this project can be approximated by extrapolating from previous projects, established by this company. In an area of 3,500 ha there are at max. 200 seasonal (contract) workers and 150 permanent workers. Extrapolating this to the 14,596 ha in Tain, that means 800 seasonal and 600 permanent workers.

Local communities benefit directly or indirectly from Form Ghana through employment opportunities, revenue sharing, community services and technical assistance. Farmers are offered the opportunity to intercrop within the plantation, with respect for the terms and conditions that apply under FSC certification and Form Ghana policy. These terms and conditions describe restrictions on type of crop, planting density, restrictions for the farmer, harvesting regulations, farmer's responsibilities etc. Farmers will be issued an intercropping permit upon signing the regulations, to show their understanding. This permit is valid for one year. The intercropping agreement is attached to Protocol 2: Prevention of Illegal Activities.

Environmental benefits

Biological diversity, water sources, and fragile ecosystems found in or near the plantations will be conserved or restored where possible. The carbon storage function of the plantation forests contributes to climate change mitigation. Trees planted on the plantations consist for a maximum of 90% Teak and at least 10% mixed local species or natural regeneration.

The indigenous trees that are planted serve two purposes: active restoration of degraded buffer zones and planting of areas less suitable for Teak. Part of them are planted never to be harvested again. These are the indigenous trees (irrespective of the species) that are planted within 30 meters of water bodies. They constitute the buffer zones and are protected by law. The trees that were planted on the remaining terrain can in principle be harvested. This will most likely not happen during the project cycle. The harvesting will only concern the commercial species and the production cycle for these is expected to range from 40 to 80 years. This will depend on when these trees attain the legal minimal felling diameter. Thinning will be done in these stands to promote growth.

Economic benefits

There is an increasing need for timber from sustainable sources. The conversion of degraded land into well-managed forest plantations provides a sound solution for the required increase in supply. This makes (plantation) forestry an interesting investment opportunity.

Form Ghana will rent the land from the Forestry Commission with a renewable lease for 50 years. There will be a Benefit Sharing Agreement with the Forestry Commission, where a percentage of the Standing Tree Value (STV) is paid to the Forestry Commission. The Forestry Commission then distributes the money between the government, the local land owners and the communities.

2.4 Scope

The operations of Form Ghana's reforestation project include the forest plantation establishment in the specific blocks of Tain II FR managed by Form Ghana as well as the supportive infrastructures that will be constructed, like roads, an office, houses, a workshop, etc. This section describes the scope of the project impacts or project influence area that is considered in this SEIA.

2.4.1 *Geographical limitation: water catchment area*

The Tain II Forest Reserve is named after the Tain River and forms the border of the reserve to the north. The Tain River originates in Ivory Coast from where it flows eastwards into Ghana through Jaman North, Jaman South, Berekum, Sunyani, and forms a boundary between the Tain District and the Wenchi Municipality.

The river changes direction from the boundary of the forest reserve towards the north to pass through Banda district and join the Black Volta River downstream of the Bui dam. Further east/north-east the Black Volta River is joined by other major rivers and finally ends up in Lake Volta (Appendix A2). The ground level elevation of the Tain sub-basin ranges from 240 to 300 m above sea level with some few areas either undulating or rugged (Dramani et al., 2014).

Tain II Forest Reserve is drained by various seasonal streams that all end up in the Tain River, from east to west: the Fete, Dwumasu, Apaye and Woro (Appendix A3). All the streams in Tain II Forest Reserve are seasonal. Even the Tain River dries up in the dry season, apart from a few pools where the water remains throughout the year.

2.4.2 *Stakeholders and public consultation*

Local communities

A number of communities is located in the direct surroundings of the project area on the banks of the Tain River, just outside the forest reserve, from upstream to downstream: Yaw Twenekrom, Yam Dabikrom, Akoroforo, Asantekrom, (Kwadwoako), Akokurom/ Arkokrom, Akoroforo, Kogua, Nfodwokrom and Dadease. Oforikrom is located along the Apaye side branch of the Tain River and Tainso along the Bengribenum side branch of the Tain River.

The communities mentioned above are included in this impact assessment because they are located in the direct vicinity of the project. This means that these people will be potential workers for the reforestation project, potential farmers in the intercropping system and that a good neighbor relation will need to be built with them. These are also the people that are located directly downstream of the

streams that drain the project area. Most of these communities have access to a borehole or tap water, but in practice many people still make use of the Tain River for their drinking water because some boreholes no longer function and because of traditional preferences. This means that any impacts on the water conditions by the proposed project will also have an impact on them. It was not considered relevant to include communities further downstream the Tain river, since the streams within the project area are seasonal and therefore have a relatively small impact on the Tain River.

Admitted farms

Within the project area, there are 3 admitted farm areas. These are areas that have been excluded from the forest reserve and the project area managed by Form Ghana, but are direct neighbors of the reforestation project.

Fulani herdsmen

Within the Tain II FR and the project area, cattle grazing takes place, lead by Fulani herdsmen.

Other stakeholders

Key stakeholders include the local government, especially the Forestry department and the Fire department.

All stakeholders and the way they are implicated in the various phases of the reforestation project are elaborated in the Stakeholder Engagement Plan.

The extent of involvements in respect of acquisitions and compensation factors (mainly people economically dependent on the land) was determined through additional studies by Form international in accordance with the appropriate land acquisition procedures. The Resettlement Action Plan (RAP) outlines these issues as well as the way to deal with them.

Infrastructure

The infrastructure taken into account for this study concern the infrastructure created and managed by Form Ghana such as roads, buildings and nursery. The public roads where transport of personnel takes place are also included.

2.4.3 Timescale

The reforestation project comprises several phases: an establishment phase, maintenance phase and production phase (see chapter 7 for the various operations in each phase). For the main tree species planted, Teak, one logging cycle takes 20 years. After final felling, the area will be replanted, so that a second cycle will begin. This impact assessment covers the operations in all three phases and their impact on the project environment.

2.5 Key environmental and social linkages

Restoration of forest cover and the establishment of a commercial Teak plantation have notable potential social, economic and environmental linkages. The environmental and social impacts study is designed to identify these linkages and establish enhancement approaches for the positive aspects while developing mitigation measures for the negative impacts. The key areas of interest for this project are included in the table below.

Table 1. Key environmental and social linkages

Focal Areas	Linkages/Environmental Concerns
Natural Resources (wildlife, forests, vegetation/plant species, water sources, land, air, wetlands, etc.)	<ul style="list-style-type: none"> • Land degradation through soil loosening and loss through erosion during plantation establishment; • Siltation of small streams; • Water quality degradation from road construction and use of herbicides; • Permanent destruction of vegetation cover along the roads, replacement of existing vegetation with commercial plantation; • Disruption of general biodiversity; • Emissions into the air of dust (during earth moving and machinery movement) and smoke during forest fires; • Restoration of indigenous forest through planting and protection against fire; • Increase in forest wildlife populations through vegetation restoration and wildlife protection against poaching; • Introduction of exotic species.
Physical Environment (topography, land forms, geology, drainage, climate, etc.)	<ul style="list-style-type: none"> • Effects on the drainage systems and hydrological regimes; • Increased water holding capacity of the soil through forest planting and restoration of stream side buffer-zones; • Interference with sensitive features such as old trees, existing indigenous vegetation.
Social and economic environment (populations trends, settlement, land use, infrastructure, economic activities, etc.)	<ul style="list-style-type: none"> • Population and settlement trends and projections upon plantation establishment; • Migration of people into the project area for job opportunities; • Increased moral challenges during plantation establishment; • Changes in land use; • Loss of farm Land; • Changes in economic activities e.g. trad-

Focal Areas	Linkages/Environmental Concerns
	ing, etc.; <ul style="list-style-type: none"> • Benefits of the plantation to the local communities; • Gender issues; • Changes in socio-cultural practices due to external influence; • Potential displacement of persons and economic activities; • Cross cutting issues – poverty, youth, persons with disabilities.
Health, Safety and Security aspects (work safety measures, role of company in security)	<ul style="list-style-type: none"> • Safety of the plantation equipment to the workers and nearby residents; • HIV/AIDS cases; • Noise and vibrations trends along the roads; • Easy access by medical suppliers and security agents to the benefit of the workers; • Handling of health risk sites and materials (graves, pit latrines, cattle dips, etc.).

While appreciating the benefits of forest plantation development, it is also necessary to note that development of new plantations may have potential negative effects to the physical, environmental and social settings. The potential negative impacts from forest plantation establishment projects could include:

- Environmental pollution from plantation establishment activities;
- Land and soil degradation and change of vegetation cover;
- Risks to health and safety of the residents and contractor employees during establishment;
- Displacement of residents and economic facilities as well as loss of productive farm land;
- Potential to disrupt natural habitats such as grazing and breeding grounds for wildlife;
- Displacement of species;
- Introduction of exotic plant species.

In view of the above observations, comprehensive environmental and social impact assessment study (SEIA) is necessary.

3. METHODOLOGY

The Environmental and Social Impact Assessment (ESIA) was designed to establish the relationship between the plantation project, natural ecosystems and social settings. The study, therefore, related to the project and key environmental, social and economic areas and related linkages for ease of integration in the implementation of the project right from the planning stage through plantation establishment, long-term management and timber harvesting.

In order to establish a reference situation, literature review was done (see 3.1.1) and a number of baseline studies were undertaken: socio-economic study (3.1.3), a biodiversity study (3.1.4), water sampling (3.1.5) and a soil study (3.1.6). Next, the (potential) positive and negative impacts of the project's operations on the environment were identified and their importance analyzed (see 3.1.7).

3.1.1 *Documentary Review*

Desk studies were executed to provide information with respect to proposed project site, spatial vegetation coverage, project design, project magnitude, project implementation schedules and costs as well as human resources.

The project plans were among key documents being reviewed. This document review provided further understanding of local environmental conditions, local climatic conditions, historical information on vegetation and ecology, data on demographic trends, land use practices, development strategies and plans (local and national) as well as the policy and legal documents including the African Development Banks social and environment safeguards and the FSC principles and criteria.

3.1.2 *Field Assessment*

Physical evaluation of the project area was carried out with specific focus on social survey, land use patterns, biodiversity, natural resources, hydrology and climate of the proposed project site. This was also an evaluation of the current environmental status with respect to physical, biological and socio-cultural perspectives. It was a systematic field inspection backed with available documentation and direct interviews. Field surveys were executed to enable determination of the exact physical environmental features to be affected within the proposed plantation site. In addition to identifying the potential positive and negative impacts, field assessments contributed towards selection of the most suitable site for project activities (planting Teak, biodiversity restoration).

The field assessments achieved the following:

- (i) Collection of additional information and data from local public offices;

- (ii) Verification of environmental settings and making general observations on topography, land use trends, surface water sources, public amenities, settlements, soils, flora and fauna, etc.;
- (iii) Identify land cover variations in the affected area;
- (iv) Rapid assessment of population densities, human settlement trends, social and economic activities; and
- (v) Public consultations focusing on traditional landowners, local farmers, neighbouring communities, business people, institutions and organizations.

The main survey was sectioned into three parts:

Table 2. Studies conducted per subject

Socio-economic situation	Ecology	Physical environment
Interviews with community members	Flora study	Hydrological survey
Discussions with traditional landowners	Mammal survey	Soil research
Discussions with institutions	Bird survey	Topography

The different parts of the assessment will be discussed in the sections below..

3.1.3 Socio - economic study

The social impact assessment was executed by a field team consisting of M. Tolenaar, consultant at Form international and M. Armani, independent consultant. In the period of 31 October to 17 November 2012, structured field data was collected and informal interviews with stakeholders were held. Stakeholders are defined as parties that are likely to be affected by the proposed project. Included in this assignment were the following stakeholders: Berekum district fire service, Ghana Education Service, Berekum Holy Family Hospital, Berekum District Assembly, Agriculture Office, Chiefs and paramount chiefs of Berekum and Seikwa, NCCE and Sunyani District Forestry Office. Interviews were held about their perception of the impact of the proposed project. See the detailed stakeholder engagement plan for Tain.

In addition to the service providers and government agencies, farmers were also included in the stakeholder assessment. Eighteen communities were selected for this assessment (Table and Figure 2).

During the fieldwork of the socio-economic study, structured stakeholder consultation meetings were organized in the settlements surrounding the project area to capture the views of the parties affected. These intensive stakeholders' consultations aimed to obtain the opinions and views of stakeholders and local communities on the proposed project with the main focus on social, cultural, economic and conservation aspects as well as the perceived associated impacts. Stakeholders were also asked about any concerns and expectations they have regarding the project.

In each of the communities, 2-8 households were asked to fill out a questionnaire (Appendix C) and a group discussion was held with the focal people and opinion leaders of the villages (chief, assembly man, village elders etc.) to acquire general information on the village (Appendix D).

Table 3. Villages included in Social Impact Assessment, per district

District	Village	Number of people inter-viewed	Number of households	Average nr. of people per household	
Berekum	Akrofoa	31	5	6	
	Ampenkrom	25	2	13	
	Domeabra	20	2	10	
	Kotaa	67	8	8	
	Kutre 1	61	8	8	
	Kutre 2	79	8	10	
	Mpatapo	69	8	9	
	Mpatasie	63	8	8	
	Namasua	55	8	7	
	Oforikrom	11	3	4	
	Pepaase	70	8	9	
	Seikwa	Arkokrom	28	4	7
		Dadease	20	4	5
Kojoakokrom		-----Only group discussion-----			
Nfodwokrom		32	4	8	
Tainso		58	8	7	
Jaman North	Asantekrom	28	4	7	
Jaman South	Meremano	61	7	9	
	Total	781	99	8	

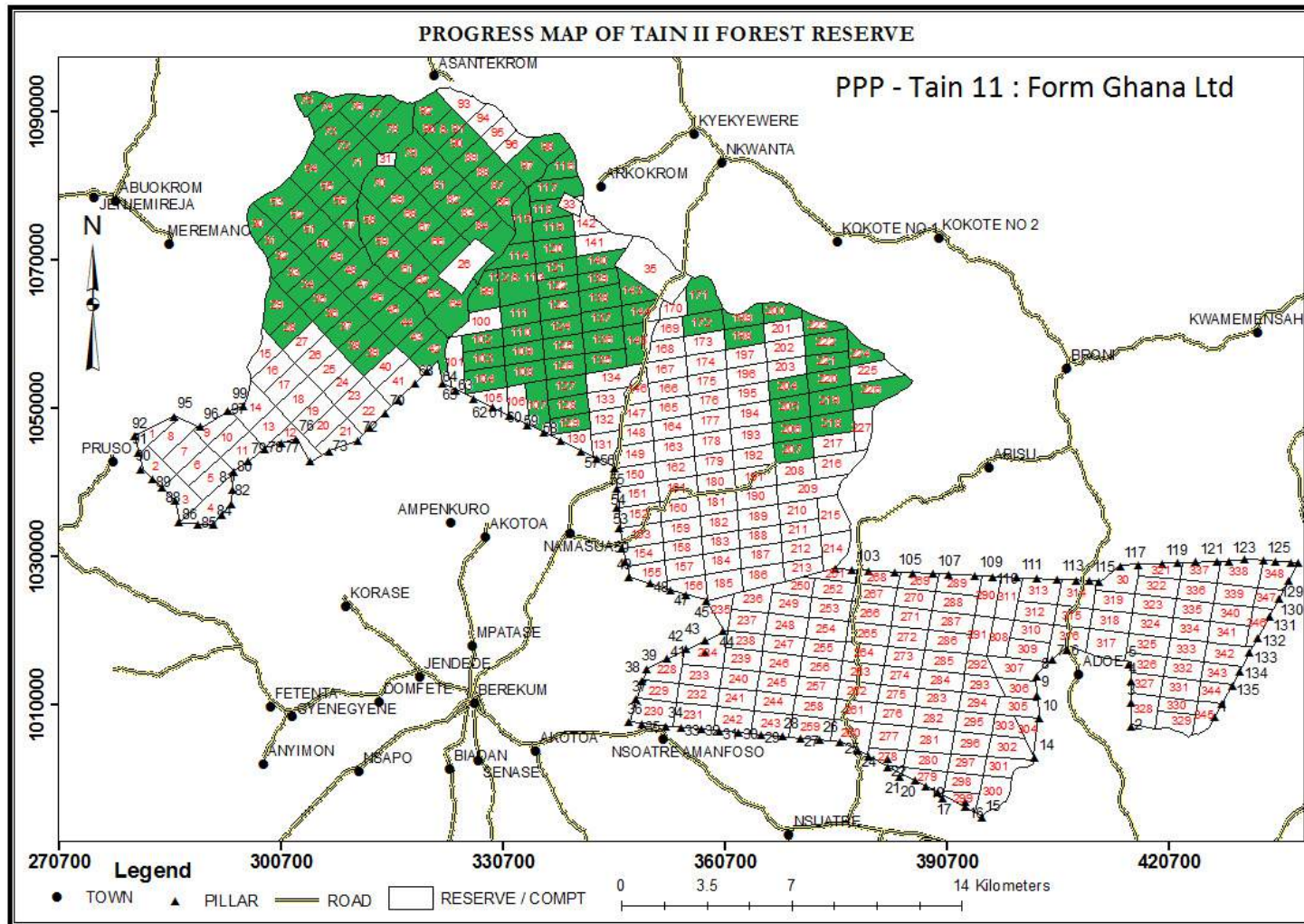


Figure 2. Map showing selected villages for interviews and questionnaires.

3.1.4 Ecological survey

A biodiversity assessment was conducted by W. Oduro and a team of experts in November 2012. Data collection included: vegetation type distribution; recording of trees, saplings, shrubs, herbs and grasses; small-sized mammal trappings, medium- and large-sized mammal recording along transects based on direct and indirect signs, direct observations of reptiles and systematic bird recording based on sightings and vocalizations. For the detailed methodology adopted and data analyses, see Annex M.



Figure 6. Road between Asuokokoo to Asantekrom

3.1.5 Hydrological survey

A hydrological survey was undertaken in Tain II Forest Reserve by Form Ghana in November 2012. Out of 32 intended water sample points, 29 samples were obtained (Figure). The other 3 samples (20, 21 and 32) could not be taken due to inaccessibility of the site or desiccation of the water source. The samples were analyzed in the laboratory of the Ghana Water Authority for the Ashanti region. The following parameters were measured and the values compared to the maximum values for safe drinking water according to the World Health Organization: pH, Apparent color (PtCo), Turbidity (NTU), Conductivity ($\mu\text{s}/\text{cm}$), Dissolved/Suspended solids, Alkalinity, Hardness, Calci-

um/Magnesium Hardness, Calcium, Magnesium, Chloride, Nitrate, Sulphate, Copper, Iron.

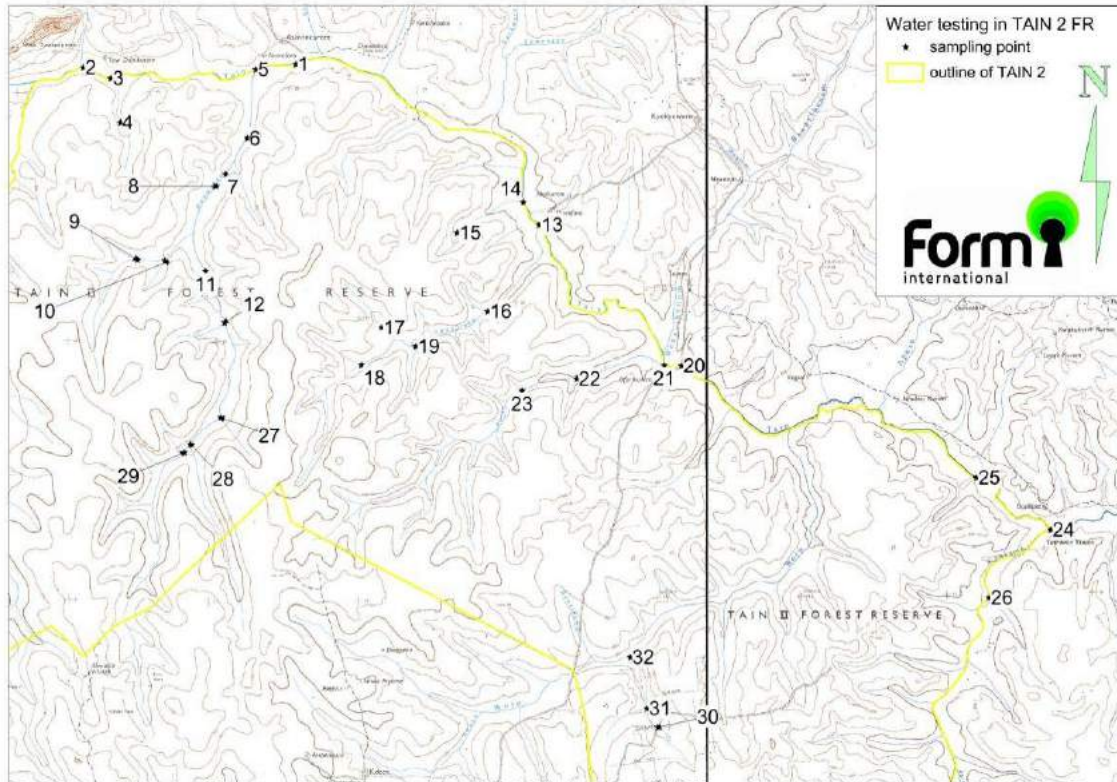


Figure 7. Water sample points in Tain II Forest Reserve.

3.1.6 Soil survey

Data for the soil survey were obtained from the soil reconnaissance assessment in Tain II Forest Reserve, executed in September/October 2012 by a soil survey team from Soil Research Institute of Ghana consisting of Mr. Dwomo Owusu and Mr. Enim Oafo. The team was later assisted by Mr. A. Augustine of Form Ghana.

The study was carried out to map out the soil units. Chisel and auger examination borings were made at 200m regular intervals and at breaks of slopes along tractor tracks, footpaths, streams and river courses and along the forest reserve boundary in the various compartments. At each examination point, the soils were examined and identified. The measured parameters included soil texture, structure, consistency, color, drainage, coarse fragments content and land use. The GPS coordinates were taken from each of the observed point and plotted area base map.

A total of 162 soil observations was made and five profile pits measuring 1.5m x 1.0m x 1.5m were dug. For the Wenchi series, pits were dug until the lithic surface was reached and for the Oda series until groundwater level was reached. The soil boundaries were drawn by interpolation with the aid of a topographic map of the area.

Land evaluation was completed using the Food and Agriculture Organization (FAO) land evaluation methodologies (FAO, 1976). The soils were classified using the World Reference Base for Soil Resources of FAO (1998) and United State Department of Agriculture (USDA, 1998) soil classification system. At the end of the exercise, soil and soil suitability maps of the area were produced.

3.1.7 *Impacts Assessment*

The impact assessment was executed by a team of Form international consisting of Ms. Marthe Tollenaar (initial assessment in 2012-2013) and Mr. Tieme Wanders (update in 2015).

Anticipated impacts that may emanate from the plantation project were analyzed against the baseline conditions as established during the fieldwork and with information obtained from the documentary reviews. Effects of the project on the environment were evaluated on vegetation cover, land and soil, environmental pollution, health and safety, social well-being, cultural integration and benefits to the residents and country.

Upon identification of the positive and negative impacts from the project, their magnitude was analyzed in order to be able to classify them as major, moderate, minor or negligible impact. The format of the assessment and the ranking of the activities are according to Martin Fecteau's checklist (Table 4 and 5). This method combines three criteria: duration, extension, and magnitude of the impact. The matrix was chosen to have an objective measure of importance of the impact.

Extent, duration and intensity of the impact are rated according to the descriptions in table 4. The magnitude of the impact is as high as the highest of these three factors (negligible, low, medium or high). After that, the likelihood of the impact is determined. The magnitude and likelihood are used as input for table 5, which gives the final rating of the importance of the impact. The analysis is elaborated in a text under each table.

To evaluate the relative importance of the impact, other criteria are taken into account as well, the so-called weighting criteria: reversibility, probability of occurrence, and legal and social values. Then, the cumulative character of each impact on other impacts is associated. The environmental measures are envisaged with respect to the relative importance of the impact. Finally, the importance of the residual impact was evaluated (CAFECO 2009). The contents are based on the plantation management plan, flora and fauna inventories, interviews with local stakeholders and socio-economic survey data. FSC and EPA standards for Environmental Impact Assessments have been taken into account, with regard to the aim of Form Ghana to obtain an FSC certificate for the plantation.

Table 4. Explanation of terms

Magnitude	
Extent	Local – impacts that affect the project area.
	Regional – impacts that affect the region as determined by administrative boundaries (here the Ashanti region of Northwest Ghana).
	National – impacts that affect nationally important environmental resources.
	International – impacts that affect internationally important resources such as areas protected by international conventions.
Duration	Temporary – impacts are predicted to be of short duration and occasional.
	Short-term – impacts that are predicted to last only for the duration of the construction period.
	Long-term – impacts that will continue for the life of the Project, but ceases when the Project stops operating.
	Permanent – impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.
Intensity	Negligible – the impact on the environment is not detectable or there is no perceptible change to people’s way of life.
	Low – the impact affects the environment in such a way that natural functions and processes are not affected or the communities are able to adapt.
	Medium – where the affected environment is altered but natural functions and processes continue, albeit in a modified way or the communities are able to adapt with some difficulties.
	High – where natural functions or processes are altered to the extent that it will temporarily or permanently cease or the communities affected will not be able to adapt to changes.

Table 5. Rating of the matrix.

	Likelihood		
Magnitude	Unlikely	Likely	Definite
Negligible	Negligible	Negligible	Minor
Low	Negligible	Minor	Minor
Medium	Minor	Moderate	Moderate
High	Moderate	Major	Major

Appropriate mitigation measures were formulated to avoid or minimize any negative effects that may result from plantation establishment and enhancement measures were proposed to maximize the positive impacts arising from the project. The recommendations of mitigation and enhancement measures were integrated in Form Ghana’s Management Plan which includes management of environmental and social aspects. Form Ghana’s monitoring plan, besides monitoring the condition of the forest plantations, will serve as a supervisory schedule with respect to the environmental aspects, the effectiveness of the management and any unforeseen impacts resulting from the project.

4. POLICY AND LEGAL FRAMEWORK

This chapter outlines the Ghanaian administrative framework and describes relevant Ghanaian legislation, international treaties and industry standards including International Finance Corporation (IFC) and African Development Bank (AfDB) standards that Form Ghana will comply with.

4.1 National policies

Ghana Forest Policy of 1995 provides a solid basis to develop a national forest estate and a timber industry that provides the full range of benefits required by society in a manner that is ecologically sustainable and that conserves Ghana's environmental and cultural heritage. Among others, the policy promotes public participation in the share of benefits and responsibilities in forest management and encourages integrated coordinated research in forest-related issues. It also provides for conservation of all valuable wildlife habitats and communities.

Climate Investment Funds: Forest Investment Program of 2012 (Version 3.5) summarizes Ghana's forest investment plan and other related issues.

Forest and Wildlife Policy, 1994, Ministry of Lands and Forestry, aims at conservation and sustainable development of the nation's forest and wildlife resources for maintenance of environmental quality and perpetual flow of optimum benefits to all segments of society.

Forest Development Master Plan (FDMP) of 1996 was prepared for the period 1996-2020, basing on the guidelines from the National Medium Term Development Plan Ghana Vision 2020. Ghana's FDMP aims to achieve sustainable development of forest and wildlife resources (it contains also a comprehensive Wildlife Development Plan 1998-2003), modernization of the timber industry and conservation of biodiversity and the environment. The program is intended to be driven by the private sector, mainly through the reforestation plans required by the new concessions system (see below). The master plan also contains other specific commitments regarding: the introduction of a forest management certification system; the merging of the Timber Export Development Board and the Forest Products Inspection Bureau into the Timber Industry Development Board; the implementation of 1988 Timber Resources Management Act provisions and regulations (Act No. 547/88) designed to introduce social responsibility, local participation and replanting into timber concession management.

National Land Policy of 1999, seeking to address some of the fundamental problems associated with land management in the country. The document includes important sections covering wetlands, national parks and reserves. The Ministry of Lands and Forestry, in collaboration with other three Ministries launched a comprehensive three-phased, multi-donor assisted, ten-year sector investment program, the Natural Resource Management Program. Its purpose is to secure sufficient resources to implement the Forestry Development Master Plan (1996 - 2020). It focuses on protection, rehabilitation and sus-

tainable management of national land, forest and wildlife resources through collaborative management and aims at increasing the incomes of rural communities owning these resources.

National Forestry Development Program of 2001 with an ambitious annual planting target of 20,000 hectares. This relies on private sector involvement, particularly through agroforestry 'taungya' practices by local farmers on areas of degraded forest reserves.

National Environmental Action Plan (NEAP) (1990-2000) provides the basic policy framework for environmental and land management in Ghana. The NEAP covers some of the key issues for the country's economy and environmental sustainability, including land management, forestry, wildlife, water management, marine and coastal systems, mining, manufacturing, hazardous chemicals and human settlements. The NEAP defines a set of policy actions, related investments, institutional mandates and other supporting activities to ensure the environmental sustainability of Ghana's development approaches. The development of the NEAP led to the establishment of the Water Resources Commission and the Environmental Protection Agency (EPA), which is mandated with the regulation, establishment and enforcement of environmental standards.

4.2 Legal aspects

The **constitution of Ghana** was published in 1992. It is a framework document which stipulates the rights and duties of Ghanaian citizens, the functioning of government and democratic processes, ownership and management of lands and the functioning of traditional power structures (Chiefs).

The constitution applies to Form Ghana as a Ghanaian company. Of special interest are the parts on "land and natural resources" and on "chieftaincy", as Form Ghana rents Forest Reserve Land which is managed by the Forest Commission on behalf of the Chiefs.

Farm Lands (Protection) Act of 1962 (Act 107) describes the land ownership by farmers which is of specific interest regarding the admitted farms in Forest Reserves and when trying to purchase land.

State Lands Act (Act 125) of 1962, the **State Lands Regulations (L.I. 230) of 1962** and the **Lands (Miscellaneous Provisions) Act (Act 186) of 1963** are of interest to Form Ghana as it states that lands can be claimed by the state for natural interest.

Conveyancing Act (N.R.C.D 1750 of 1973) stipulates how land titles can be transferred.

Land Title Registration Act (P.D.C.L. 152) of 1986 describes how land titles should be registered.

Land Title Registration Regulations (L.I. 1341) of 1986 provides information of the transfer and registration of leases.

Forests Act (CAP 157) of 1927 provides a framework for the protection of forests and for the constitution and protection of forest reserves and creates forest offences and punishment regime.

Forest Protection Act (N.R.C.D 243) of 1974 provides for the functions of forest officers and offences relating to forest reserves and other related matters

Timber Resource Management Act (Act 547) of 1998 provides for the grant of timber rights in a manner that secures the sustainable management and utilization of the timber resources of Ghana and creates forest offences and punishment regime

Forestry Commission Act (Act 571) of 1999 re-establishes the Forestry Commission and brings under the Forestry Commission the main public bodies and agencies: implementing the functions of protection, development, management and regulation of forests and wildlife resources.

Forest Plantation Development Fund Act (Act 583) of 2000 establishes a Forest Plantation Development Fund to provide financial assistance for the development of forest plantations, to provide for the management and disbursement of the Fund.

Wild Animals Preservation Act (Act 43) of 1961 consolidates and amends the law relating to wild animals, birds and fish and to continue the observance of the international Convention for the preservation of wild animals signed at London on the nineteenth day of May, 1900.

Economic Plant and Protection Act (A.F.R.C.D. 47) of 1979 provides for the prohibition of the destruction of specified plants of economic value and for related matters.

Timber Resources Management Regulations (L.I. 1649) of 1998 were made pursuant to section 18 of the Timber Resources Management Act, 1997 (Act 547) to provide, among others; the procedure for grant of timber rights; the procedure in relation to lands other than public lands and existing forest resources; qualification for grant of timber utilization contract; and for related matters.

Timber Resource Management Act of 2002 (Act 617) is an act to amend the Timber Resources Management Act 1997 (Act 547) to exclude from its application land with private forest plantation; to provide for the maximum duration, and maximum limit of area, of timber rights; to provide for incentives and benefits applicable to investors in forestry and wildlife and to provide for matters related to these.

Water Resources Commission Act (Act 522) of 1996 establishes a Water Resources Commission, to provide for its composition and functions on the regulation and management of the utilization of water resources in Ghana.

Rivers Act (CAP. 226) of 1903 regulates the use of certain rivers and related matters.

Water Use Regulation (L.I. 1692) of 2001 regulates: (a) domestic water use, (b) commercial water use, (c) municipal water use, (d) industrial water use, (e) agricultural water use, (f) power generation water use, (g) water transportation water use, (h) fisheries (aquaculture) water use, (i) environmental water use, (j) recreational water use, (k) under water (wood) harvesting; and related matters.

Environmental Protection Agency Act (Act 490) of 1994 establishes the Environmental Protection Agency with functions to inter alia issue environmental permits and pollution abatement notices for controlling the volume, types, constituents and effects of pollutants and of substances which are hazardous or potentially dangerous to the quality of the environment or a segment of the environment.

Environment Assessment Regulations (L.L. 1652) 1999 regulates the assessment of all projects with potential environmental impacts. These regulations stipulate the need for Form Ghana to apply for an environmental Permit.

Control and Prevention of Bush Fires Act (P.N.D.C.L. 229) of 1990 ensures adequate prevention, control and monitoring of bushfires.

Plants and Fertilizer Act (Act 803) of 2010 provides for plant protection, seeds and fertilizer control and for related matters and provides for the regulatory framework for the importation of plants and plant materials. The Act also provides for the efficient conduct of plant protection, to prevent the introduction. The act regulates the import and facilitate the export of plants and plant materials and provide for related matters.

Internal Revenue Act (Act 592) of 2000 amends and consolidates the law relating to Income Tax, Capital Gains Tax and Gift Tax and to provide for related matters.

Export and Import Act (Act 503) of 1995 revised the laws relating to external trade and provides conditions for the optimum development and efficient conduct of Ghana's export and import trade.

Office of Administrator of Stool lands Act (Act 481) of 1994 describes that the Office of the Administrator of Stool Lands shall be responsible for (a) the establishment of a stool land account for each stool into which shall be paid rents, dues, royalties, revenue or other payments whether in the nature of income or capital from the stool lands; (b) the collection of all such rents, dues, royalties, revenues or other payments whether in the nature of income or capital and to account for them to the beneficiaries specified in section 9 of this Act; and (c) the disbursement of such revenues as may be determined in accordance with section 9 of this Act.

Alternative Dispute Resolution Act (Act 798) of 2010 seeks to provide for the settlement of disputes by arbitration, mediation and customary arbitration, to establish an Alternative Dispute Resolution Centre and to provide for related matters.

Social Security Law (P.N.D.C.L. 247) of 1991 seeks to provide social protection for the working population for various contingencies such as old age, invalidity, and such other contingencies as may be specified by law; to be responsible for the administration and investment of the Scheme within the framework of general directives issued by the Board referred to in section 4 of this Law and to carry out such other activities as may appear to the Trust to be incidental or conducive to the attainment of its objects under this Law.

Labor Act (Act 651) of 2003 applies to all workers and to all employers except the Armed Forces, the Police Service, the Prison Service and the Security and Intelligence Agencies specified under the Security and Intelligence Agencies Act 1996 (Act 526).

4.3 International conventions

United Nations Framework Convention on Climate Change of 1992 The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

United Nations Convention to combat Desertification 1992 The objective of this Convention is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas.

African Convention on the Conservation of Nature and Natural Resources 1969 Its objectives are "to encourage individual and joint action for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind, from an economic, nutritional, scientific, educational, cultural and aesthetic point of view." It commits the Parties to adopting "measures necessary to ensure conservation, utilization and development of soil, water, floral and faunal resources in accordance with scientific principles and with due regard to the best interests of the people." The Parties agree to use resources wisely, to manage populations and habitats, to control hunting, capture and fishing, and to prohibit the use of poisons, explosives and automatic weapons in hunting. They also agree to prevent and control water pollution, establish conservation areas and consider ecological fac-

tors in development plans. This Convention was ratified by Ghana on the 17/05/1969.

RAMSAR Convention on the Preservation of wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

ILO Convention 87,98, 29, 105, 111, 138,182, 97, 100, 131 on the Freedom of association and collective bargaining, Elimination of forced and compulsory labor, Elimination of discrimination in respect of employment and occupation, Abolition of child labor, Migration for Employment (Revised), Equal Remuneration and Minimum Wage Fixing.

CITES Convention on International Trade in Endangered Species: listing species not to be traded, or to be traded with special documentation. Appendix I lists 20 animals and 1 plant, Appendix II lists 161 animals and 40 plants, Appendix III lists 162 animals. Trade in these species is subject to regulations or prohibited.

Signed by 150 government leaders at the 1992 Rio Earth Summit, the **Convention on Biological Diversity** is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.

Convention on the conservation of migratory species of wild animals (CMS) aims to conserve terrestrial, aquatic and avian migratory species throughout their range.

Stockholm Convention is an international Convention on the ban of persistent organic pollutants

International plant protection convention is an international plant health agreement, established in 1952, that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. Relevant standards for Form Ghana are:

- ISPM 01 Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade
- ISPM 02 Framework for pest risk analysis
- ISPM 12 (as revised by CPM-9, 2014) Phytosanitary certificates
- ISPM 14 The use of integrated measures in a systems approach for pest risk management
- ISPM 15 (as revised by CPM-8, 2013) Regulation of wood packaging material in international trade
- ISPM 17 Pest reporting

The standards require actions mainly at government level. This means that Form Ghana needs to be aware but will not be required to undertake actions, except insisting on required permits and inspections when importing or exporting material and reporting pests when they occur. When identifying a pest or disease in the areas under management by Form Ghana the relevant authorities should be informed and relevant action taken to eradicate the pest or disease.

4.4 African Development Bank Safeguards

The information on the safeguards of the African Development Bank were taken from the African Development Bank Group's Integrated Safeguards System (2013)

Safeguards and Sustainability Series, Volume 1 - Issue 1 (Dec. 2013) addresses emerging environmental and social development challenges. The Integrated Safeguards System not only promotes best practices in these areas but also encourages greater transparency and accountability. It upholds the voices of people who are affected by Bank-funded operations, especially the most vulnerable communities, by providing, for example, project-level grievance and redress mechanisms – a structured, systematic and managed way of allowing the voices and concerns of affected people to be heard and addressed during project planning and implementation.

1. The Integrated Safeguards Policy Statement – Describes common objectives of the Bank's safeguards and lays out policy principles. It is designed to be applied to current and future lending modalities, and it takes into account the various capacities and needs of regional member countries in both the public and private sectors.

2. Operational Safeguards (OSs) – These are a set of five safeguard requirements that Bank clients are expected to meet when addressing social and environmental impacts and risks. Bank staff use due diligence, review and supervision to ensure that clients comply with these requirements during project preparation and implementation. Over time the Bank may adopt additional safeguard requirements or update existing requirements to enhance effectiveness, respond to changing needs, and reflect evolving best practices.

3. Environmental and Social Assessment Procedures (ESAPs) – These provide guidance on the specific procedures that the Bank and its borrowers or clients should follow to ensure that Bank operations meet the requirements of the OSs at each stage of the Bank's project cycle.

4. Integrated Environmental and Social Impact Assessment (IESIA) – Guidance Notes provide technical guidance to the Bank's borrowers or clients on standards on sector issues, such as roads and railways, hydropower, or fisheries, or on methodological approaches clients or borrowers are expected to adopt to meet OS standards.

- **Operational Safeguard 1: Environmental and social assessment** – This overarching safeguard governs the process of determining a project’s environmental and social category and the resulting environmental and social assessment requirements.

Form Ghana applies this safeguard with the current impact assessment.

- **Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation** – This safeguard consolidates the policy commitments and requirements set out in the Bank’s policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.

Form Ghana applies this safeguard with the resettlement action plan.

- **Operational Safeguard 3: Biodiversity and ecosystem services** – This safeguard aims to conserve biological diversity and to promote the sustainable use of natural resources. It also translates the commitments in the Bank’s policy on integrated water resources management into operational requirements.

Form Ghana applies this safeguard through its management as formalized in the Management Plan and the various Protocols .

- **Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency** – This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.

Form Ghana applies this safeguard through its management as formalized in the Management Plan and the various Protocols.

- **Operational Safeguard 5: Labor conditions, health and safety** – This safeguard establishes the Bank’s requirements for its borrowers or clients concerning workers’ conditions, rights and protection from abuse or exploitation. It also ensures greater harmonization with most other multilateral development.

Form Ghana applies this safeguard through its management as formalized in the Management Plan and the various Protocols.

4.5 Other important guiding documents

The **FSC National Standard for Ghana (FSC-STD-GHA-01-2012 Natural and Plantations)** is a guiding document for the management of the plantations by Form Ghana. This standard follows the requirements of FSC-STD-20-002 Structure and content of forest stewardship standards (November 2004)

to improve consistency and transparency in certification decisions between different certification bodies in Ghana and in different parts of the world, and thereby to enhance the credibility of the FSC certification scheme as a whole. This standard is guiding for the execution of the current impact assessment.

IFC's document on **Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets of 2007** on actively developing and sustaining relationships with affected communities and other stakeholders throughout the life of their project.

Form Ghana applies this guideline through its management, community development plan, stakeholder engagement plan and the resettlement action plan.

5. ENVIRONMENTAL SETTINGS

5.1 Topography

Tain II FR lies around a grid reference of 7N35, 2W30. The forest area is 409.2 km², with a perimeter of 269.43 km. 14,596 ha of this reserve is allocated to Form Ghana Ltd. for commercial forest plantation development.

The Tain II Forest Reserve is named after the Tain River and forms the border of the reserve to the north. The ground level elevation of the Tain sub-basin ranges from 240 to 300 m above sea level with some few areas either undulating or rugged (Dramani et al., 2014). The topography of the area is gentle undulating with moderately steep slopes between 5 – 12%. The summits are nearly flat and broad with slopes of 0 – 4%.

Roads in the reserve are all gravel roads in various states of repair. Most of the roads go from Berekum into the reserve from the south northwards. One road goes from Berekum to Seikwa through Oforikrom and Tainso. North of the reserve roads go from Seikwa southward but few of these roads actually enter the reserve.

Around and in the reserve (admitted farm) 18 villages can be found, with between 13 and 2000 households.

5.2 Soils

5.2.1 Soil survey

The information presented is taken from the soil study done by Scholten and Augustine in 2012. The soils of the area have been developed in weathered products of rocks of the geological formation of the Lower Birrimian, and in alluvial sediments of the river valleys and the floodplains of the Tain River. Other geologic components found in the area were found to have influenced soil development to a lesser extent. In addition to the role of the parent materials in soil development, the pedogenesis has been influenced by the warm-humid climate, tropical forest vegetation, variable topography and associated hydrologic regimes and, more recently, anthropogenic factors.

A soil association is a group of soils which usually occur together in a certain area. The soil association encountered in the study area is the Bekwai Association. The association members encountered during the investigations are Wenchi, Bekwai, Nzima, Kokofu and Oda.

Most soils in the study area are neutral to strongly acidic. Organic matter and nutrients are highest in the surface soil and their concentration rapidly decreases with depth in all the profiles. The cation exchange capacity of most soil profiles similarly decreases with depth, primarily due to the close relationship to soil organic matter. The low exchange capacity reflects the dominance of low activity clays in the soil profiles.

The dominant soil types of the concession are moderately suitable for Teak plantation. Food crops grown in the area are cocoa, citrus, oil palm, cocoyam, cassava, maize, legumes and vegetables.

The soil survey exposed five different soil series present in the area; Bekwai, Nzima, Kokofu, Oda and Wenchi, three of which are suitable for Teak cultivation, despite a relatively low nutrient content (Table 6). One soil series is unsuitable due to restrictions in drainage capacity (Oda series).

Table 6. Soil series found in Tain II Forest Reserve.

Soil series	Suitability	Constraints	Favorable	Ha
Bekwai series	High	Low nutrient content	Drainage and soil depth	718
Nzima series	High	Low nutrient content	Drainage and soil depth	1,883
Kokofu series	Moderate	Internal drainage	Deep topsoil with humus up to 35 cm depth.	9,639
Oda series	Low	Drainage	Topsoil rich in humus	2,203
Wenchi series	Marginal	Shallow soil	Topsoil rich in humus	135

The Bekwai and Nzima series, located on summits and upper to middle slope sites were found to be moderately deep to deep, well drained, stony and gravels brown to red in color, well developed in-situ. They have well developed alluvial clay accumulated subsoil horizons. The soils were classified as Ferric Acrisols (WRB) and Typic Paleudult (USDA). The two soils were assessed as Moderately Suitable for rain fed agriculture.

Kokofu series, occurring on lower slope sites and developed over colluvial sediments from upslope, were found to be very deep, moderately well drained, yellowish in color, devoid of stones and gravels, with weakly developed subsoil structure and with plinthic materials at the base of the profiles. They were classified as Plinthic Acrisol (WRB) and Typic Plinthudult (USDA). They were evaluated as Moderately Suitable for rain fed agricultural production with low fertility status as the main limitation for use.

Oda series were mapped within the wide, flat valleys and were found to be hydromorphic, poorly drained with clay and silty clay textures. The soils are very deep but may have shallow groundwater table. They are liable to flooding and waterlogging during the rainy periods. They were evaluated as Marginally Suitable for rain fed agricultural production due to their poor moisture relationship, plastic nature and their liability to flooding and waterlogging. They have been classified as Eutric Gleysol (WRB) and Aquic Udifluent.

The Wenchi series is comprised of very shallow or exposed concretionary and gravelly soil with iron pan (petroplinthite) present within 30cm of the soil surface. They occur on summit to middle slope sites where plinthite naturally occur near the soil surface. The root-limiting layer and high coarse fragment content of this soil significantly reduce the water holding capacity. They were assessed as permanent not suitable for rain fed agriculture, but with variations in the soil depth could be suitable for crop production.

The soil series Bekwai, Nzima and Kokofu are considered suitable for cultivation of Teak. Therefore, a total of 12,240 ha, or 84% of the total soil surface is suitable for planting Teak (Appendix I and J).

The rainfall and temperature regimes are favorable for the establishment of the plantation. The major upland soils encountered in the compartment namely Bekwai, Nzima and Kokofu series are soils with no physical restriction to the root movement. However, they are susceptible to erosion and therefore will require effective soil conservation and management practices such as contour ploughing, strip cropping, mulching leaving of vegetal strips between fields and the establishing of cover crops at the initial stages of planting.

There are streams and drainage grooves all over the area which drains northwards into the Tain River. Drainage conditions range from well drained in the summits and upper slope sites to moderately to imperfectly drained on middle to lower slopes and poorly drained in the valley bottoms. The soils are of medium to low in plant fertility levels and are liable to mostly moderate sheet erosion.

5.2.2 Discussion soil survey

The soils in most of the area are suitable for planting Teak (84%). This is slightly less than necessary to realize the goal of Form Ghana to plant 90% of the area with Teak. The risk of sheet erosion is moderate. This means that care should be taken not to cause soil erosion or to increase this risk. The remaining 16% of the soil area is not suitable for planting Teak.

The soils that are permanently not suitable for growing Teak are the soils of the Wenchi series. These areas can be used for natural forest regeneration and wildlife conservation. When soil depth is more than 30cm, crops can be grown as well. Soils of the Oda series are classified as marginally suitable but considered as part of the area not suitable for Teak cultivation. Although fertility of these soils is relatively high, the ground water table is high and there is a risk of slight sheet erosion, flooding and waterlogging.

5.3 Mineral resources

No information is available on mineral finds in the area. No mining is actually taking place.

5.4 Water resources

Generally, the area is well drained. The Tain River marks the northern boundary of the reserve. It is a tributary river to the Black Volta. The Tain River dries up in the dry season except for some pools. Ground water potential in the area is highly variable. Much depends on the nature of the underlying rock formations and rainfall. The present combination of the lack of water storage in the wet season, heavy run-off, high evaporation and low infiltration rates to charge aquifers in some areas contribute to water deficiencies hampering ag-

ricultural production. In the Tain II Forest Reserve there are a few streams (see appendix A), such as Fete, Dwumoaso, and Woro. The only permanent open water is the Tain River, but this holds water in some pools throughout the year only.

5.4.1 Hydrological survey

The analysis of the hydrological samples shows that water in Tain II Forest Reserve is not suitable for drinking. Although turbidity per se does not have to be a risk for people's health, it is an indicator for possible presence of contaminants that do threaten health. Also, it interferes with disinfection of water. For effective disinfection, turbidity should be lower than 1 NTU, and definitely not exceed 5 NTU. Turbidity in these samples ranges from 11.77 to 54.47 NTU. No health-based guideline value is proposed for color in drinking-water. But commonly values below 15 PtCo are acceptable to consumers. In the Tain II samples, apparent color ranges from 82 PtCo to 388 PtCo.

Ph lies well within the range of 6.5 – 8.5 recommended by the World Health Organization (WHO). Calcium, magnesium, nitrate and chloride do not exceed recommended maximum levels. Hardness, conductivity and alkalinity are also within acceptable range.

Copper and iron levels however are high. No health-based guideline value is proposed for iron by the WHO, but it is recommended to maintain levels below 0.3 mg/l, because iron promotes the growth of "iron bacteria" which derive their energy from the oxidation of ferrous iron to ferric iron and in the process deposit a slimy coating on the piping. At levels above 0.3 mg/l, iron stains laundry and plumbing fixtures. Iron levels in these samples reach up to 5.5 mg/l. The health-based guideline for copper is set at 2 mg/l by the WHO. Overall high concentrations can interfere with the intended domestic uses of the water. Staining of sanitary ware and laundry may occur at copper concentrations above 1 mg/l. At levels above 5 mg/l, copper also imparts a color and an undesirable bitter taste to water. This level is exceeded in one of the samples (2.4 mg/l), located in the Kankama River, south of Dadease. In the other samples levels are generally low (0-0.63mg/l).

The data from the water analyses can be found in Appendix L.

5.4.2 Discussion hydrological survey

Water quality is generally not unsafe for drinking, based on the parameters measured in this study, except for one site where the WHO guideline value for copper has been exceeded. However, the turbidity level is very high and the PtCo value for apparent color exceeds the WHO recommended value by ten-fold. The WHO guidelines warn that water purification may fail at these levels of turbidity.

Water quality can benefit considerably from Teak plantation establishment. Both the reduction of cattle watering and the conservation of buffer zones are likely to contribute to the decrease of erosion and sedimentation, decreasing

turbidity levels. This is of great importance to the inhabitants of the area bordering the Tain River, as they are still largely dependent on Tain River as a water source. According to WHO guidelines, purification of water from any source within the forest reserve cannot be done sufficiently with the current turbidity levels without filtration. At this moment, no filtration or purification efforts are undertaken, so drinking water is generally unsafe and might lead to health problems associated with this problem. Another point of concern is the fact that some inhabitants of communities with boreholes still prefer to use the water from the river because of traditional values attributed to this water.

5.5 Climatic conditions

Tain II Forest Reserve has a bi-modal rainfall pattern with a major and minor peak in June and October respectively. The main dry season is from November to March and there is a second dry spell in August. The mean annual rainfall is 1200mm and the maximum and minimum annual temperature for 26 years were 23.6°C and 26°C (Orgle, 1994). Relative humidity in the dry season ranges from 100% at night to 30% near midday when the Harmattan is strongest.

5.6 Air quality

Air quality in the area is generally unaffected by industry and heavy traffic and can be called good. During the peak of the dry season dust particles in the air can be irritating to the respiratory system.

5.7 Ecological features

The Tain II Tributaries Forest Reserve falls in the Dry Semi Deciduous Forest Zone (Hawthorne and Abu-Juam, 1995). They also indicate it is in the fire zone. Originally, the main vegetation type in the reserve was the dry semi-deciduous forest, which generally contains valuable timber trees such as Wawa (*Triplochiton scleroxylon*), Odum (*Milicia excelsa*), Sapele (*Entandrophragma cylindricum*) and Kokrodua (*Pericopsis elata*) (Amponso-kwatiah, 1993). Today however, large areas of the reserve are covered by savannah, resulting from human induced land degradation. Due to intensive farming and re-reported annual fires very little of the original forest remains and what is left is secondary forest and grassland. In the past, farmers protected the large trees on their farms but most of them have been logged eventually so that very few still remain today.

5.7.1 Flora study

Four main vegetation types were identified and classified as forest, Teak plantation, farmlands and degraded areas (Table 7).

Table 7. Main vegetation types surveyed

Vegetation type	Characteristics
Forest	Natural forest fragments riverine/gallery forests, secondary forests
Teak plantation	Teak monocultures at various stages of development and management
Farmland	Actively cultivated areas (maize, cassava, vegetables, etc.) including fallowed areas
Degraded areas	Severely disturbed areas, grasslands, <i>Chromolaena</i> stands, bare soil, etc.

Forest vegetation represented natural forests with little human disturbance. Tree basal area (Hédli *et al.*, 2009; DBH>10cm) ranged from 30 - 20 m²/ha in slightly disturbed areas to 19 – 10 m²/ha in moderately disturbed areas. Teak plantation represented areas with monocultures of Teak whilst farmlands were actively cultivated areas including fallowed areas used for the production of a variety of food crops including maize and cassava. Degraded areas represented highly disturbed forests and grasslands with thickets of *Chromolaena odorata* and isolated trees (basal area of less than 10 m²/ha). These areas also served as active Fulani cattle grasslands and were constantly razed by fires in the dry season. (Figure).

**Figure 8.** Cattle grazing at the project site.

Figure shows the pooled percent habitat data on vegetation type for the study area. Degraded areas (73%) constituted the major vegetation type followed by Teak plantation (13%) and farmlands (9%). Forest was the least encountered vegetation type (5%).

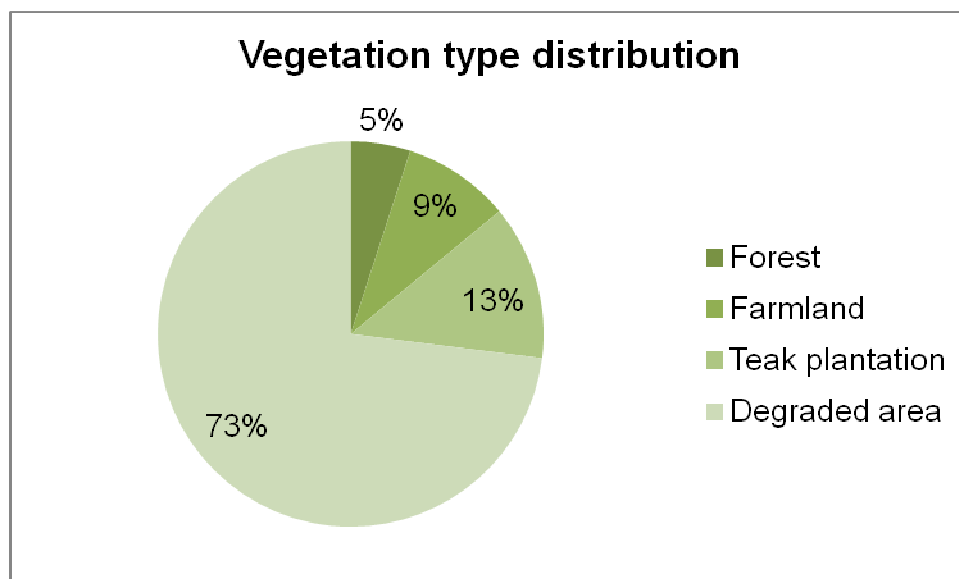


Figure 9. Percent vegetation types found on transects in the study area

Table 8. Vegetation type per plots

Vegetation type	Number of plots	Percentage of plots
Degraded area	64	53%
Farm	12	10%
Forest	13	11%
Teak	31	26%

Generally, forest patches were prevalent along the main water bodies, especially along the Tain River and its tributaries. These forests generally existed as riverine forests and occurred along the northern and western fringes of the reserve. There were also smaller forest fragments dotted within the central portions of the reserve. There was no clear pattern in the distribution of degraded areas and Teak plantation however; farmland was recorded mostly towards the fringes of the reserve. Although the percentage of actively farmed land for food crops varied across the study area, fallowed areas (farm bush) was more or less evenly distributed.

Indigenous trees representing 22 Families and 56 Species were confirmed in the study area during the survey (Appendix F). *Tectona grandis* (Teak) was concentrated in isolated local plantations but ranked highest in abundance with relative density of 59.60%. This was followed by *Ficus exasperata* with relative density of 5.67, then *Albizia adianthifolia* (3.61), *Cola gigantea* (2.28), *Antiaris toxicaria* (1.47), *Holarrhena floribunda* (1.18), *Newbouldia leavis* (1.10) and then 1.03 each for *Aningeria altissima*, *Trema orientalis*, *Morus mesozygia* and *Albizia ferruginea*. Very rare species included *Mareya micrantha*, *Piptadeniastrum africanum* and *Mucana pruriensis* with relative abundance lower than 0.10.

There are fewer young individuals than mature trees in the population and the relation of DBH classes to number of individuals does not follow an exponen-

tial model closely (Figure). There are very few trees bigger than 40 cm Dbh and none over 60 cm Dbh.

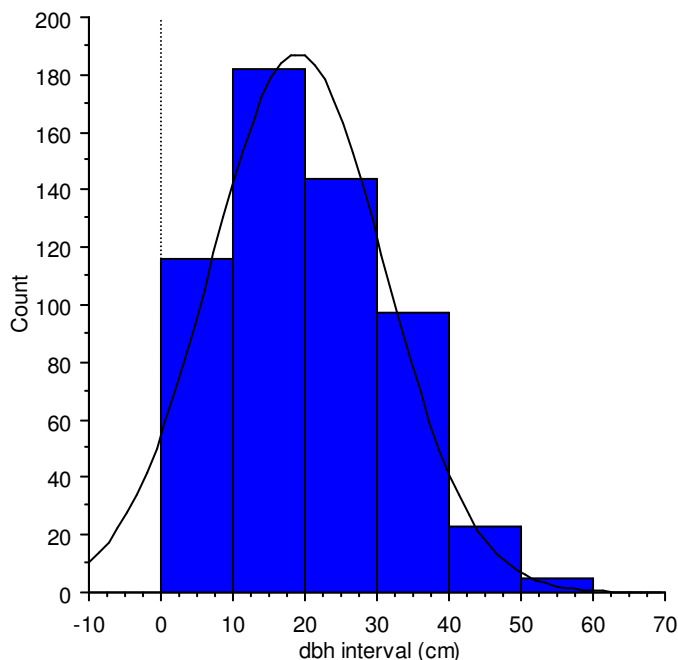


Figure 10. DBH class distribution of trees recorded in sample plots.

The mean height class distributions of the four main vegetation types recorded in the various plots are shown in Figure .

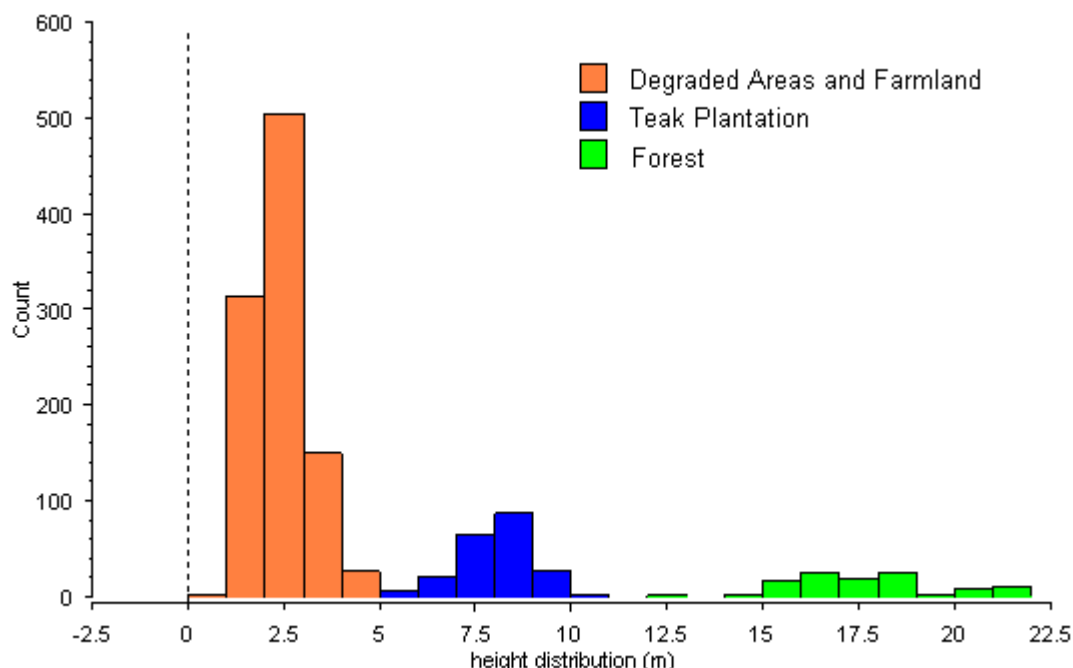


Figure 11. Vegetation height class distribution recorded in sample plots.

There seems to be some similarity between the height class distributions recorded in degraded areas and farmland, Teak plantation and forest. Generally, the younger and older individuals in all vegetation types were few and the size

classes did not have the "normal" logarithmic representation (Richards 1998). No tree exceeded a height class of (>22.50m). In addition, forest trees had species of which individuals of less than 12.50m were almost absent. In comparison, most Teak trees ranged in height of between 7m to 9m. In the case of degraded areas and farmland, there were few bare areas of vegetation height (<1.0m) and virtually no areas with vegetation higher than 5.0m. The height class range of (1.0m - 5.0m) represented most grassland, thickets and farms.

5.7.2 Fauna study

Small mammals

In total, individuals of four species of terrestrial small mammals were captured (Table 9). Due to the small numbers of captures, it was impossible to make realistic comparison between sites. Nevertheless, most rodent species seemed to favor forest vegetation.

Table 9. Small mammal signs per km recorded in the various vegetation types

Taxa	Species	Forest	Teak plantation	Farmland	Degraded areas
Soricomorpha	<i>Crocidura grandiceps</i>	1	0	0	1
Rodentia	<i>Proamys tullbergi</i>	4	0	2	0
	<i>Mastomys natalensis</i>	5	1	3	0
	<i>Lophuromys sikapusi</i>	2	1	2	0
Total specimens		12	2	7	1
Total species		4	2	3	1

Both Tullberg's soft furred mouse (*Proamys tullbergi*) and the shrew *Crocidura grandiceps* are endemic to West Africa. The latter is ranked on the red list as Near Threatened (IUCN, 2010).

Medium-sized to large mammals

Four taxonomic groups, representing 13 Families, 17 Genera, and 18 Species were confirmed in the study area during the survey (Appendix G). Forest vegetation ranked highest with a record of 18 species, followed by farmland (11), Teak plantation (9) and degraded areas (9).

Our sampling effort was more than the optimum sampling effort of about 100 transects required to determine the entire range of species in the study area. The species accumulation curve flattens out approximately from the 100th transect onwards, suggesting that most species had been confirmed at that sampling intensity and that continuing sampling possibly resulted in no new species.

Forest vegetation was found to be richest and most diverse in terms of species when various richness and diversity indices were applied to the data (Ta-

ble 10). Comparably, these indices were low in the farmland, degraded areas and Teak plantation.

Table 10. Richness and diversity indices generated for vegetation types

Vegetation type	Bootstrap mean	Bootstrap SD*	Shannon mean	Shannon SD*	Simpson mean	Simpson SD*
Forest	104.23	3.78	4.21	0.11	88.10	1.28
Teak plantation	33.46	7.18	3.14	0.22	47.92	3.80
Farmland	85.77	22.30	4.08	0.24	73.72	17.46
Degraded areas	53.32	12.44	3.72	0.26	68.89	10.23

*SD = Standard Deviation

Rodents were widespread in the study area with grass cutters and brush-tailed porcupines representing the most abundant species (Appendix E). Giant rats and ground squirrels were however restricted in abundance and distribution.

Common carnivores were mongooses, civets and genets. Although these species occurred in lower densities, they were largely restricted to forest vegetation with highest densities occurring in the riverine vegetation. Bushbucks were the most abundant ungulates followed by Maxwell's duiker whilst red river hogs and royal antelopes were comparably restricted to just a handful of sites. Apart from the forest cobra and green mamba, the activities of reptiles including the Nile monitor were among the least recorded (< 0.50 signs per km) animal signs.

No direct recordings of primate activity were made throughout the study. Nevertheless, a few hunters interviewed confirmed the presence of Demidoff's galago and Bossman's potto in a few sites, particularly in some of the forested vegetation.

In total, 847 animal signs were recorded on 120 km transects (average encounter rate = 7.1 animal signs per km): 509 in forest vegetation, then farmland (148), degraded areas (132) and then Teak plantation (58) (Table 11). Animal densities were significantly different (Kruskal-Wallis Test: $H=31.335$, d.f. = 3, $P<0.01$) between vegetation types.

Table 11. Animal sightings per vegetation type.

Species	Teak	Degraded	Farmland	Forest
Brush-tailed Porcupine	7	7	14	98
Bushbuck	9	44	9	72
Civet	1		1	20
Cobra	10	17	20	17
Cusimanse Mongoose				54
Genet	2			35
Giant Rat		3	7	
Grass cutter	19	39	71	2

Green Mamba	5	8	15	9
Ground Squirrel	1		3	
Marsh Mongoose	2	3		33
Maxwell duiker		10		108
Monitor Lizard			1	10
Puff Adder			4	1
Red River Hog				37
Rock Python	2	1	1	
Royal Antelope				9
Royal Python	1	2	1	1
Total	59	134	147	506

The majority of animal signs (60%) consisting mostly of ungulates (73%), carnivores (21%) and reptiles (6%) were spotted in forest vegetation type (Jacobs' Preference Index: 0.83) (Figure 12) where canopy foliage gaps and density in the understory stratum were lowest. In contrast, fewer (38%) animal signs were recorded in the remaining three vegetation types (Jacobs' Preference Index: 0.40) where canopy openness and understory foliage density was greatest. Comparative analysis confirmed little overlap in species composition between the two land-use categories (Jaccard Similarity Index: 0.37).

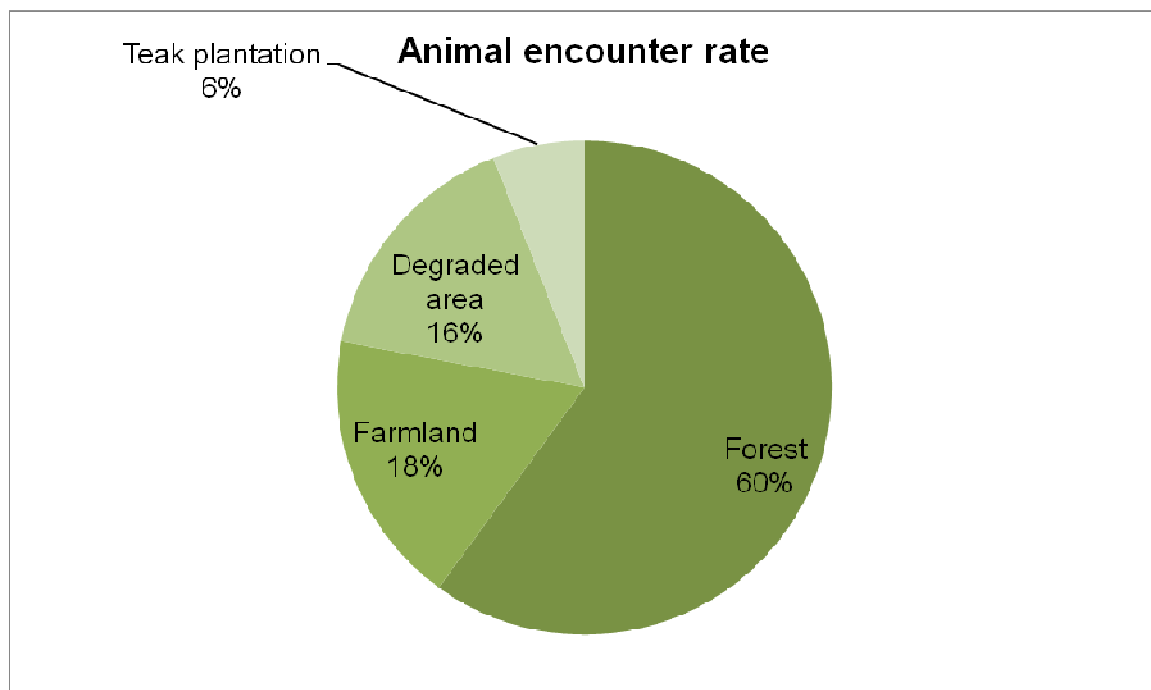


Figure 12. Encounter rate of animal signs in relation to vegetation types found on transects in the study area (%).

Forests provided the highest encounter rates for most species; however, the activities of cane rats (commonly called grass cutters) were particularly recorded in farmlands and degraded areas compared to Teak plantations. There was no significant difference in sign abundance between farmlands and degraded areas (Kruskal-Wallis Test: $H=1.203$, d.f. = 2, $P>0.05$). Ungulates and

carnivores showed marked differences ($H=31.054$, d.f. = 5, $P<0.01$) in sign densities between forest sites and other vegetation types whilst there were no significant difference ($H=9.137$, d.f. = 5, $P>0.05$) for reptiles and rodents.

Factors affecting mammal distribution

The distance to water sources, number of hunting signs, length of forest and distance to roads had the most significant effect on the density of mammals in the study area (Table 12). Length of forest is classified as the length of the transect that has been determined as 'forest vegetation type'. Length of farmland, degraded area and Teak plantation did not appear to influence animal density.

Table 12. Spearman rank correlation coefficients (r_s) between animal sign density (pooled data) and a suite of human/ecological variables recorded on transects. Sample size is 120 transects.

Variable	r_s	p
Distance from roads	0.673	<0.01
Length of forest	0.963	< 0.01
Distance to water source	-0.844	> 0.01
Number of hunting signs	-0.835	> 0.01
Length of farmland	-0.213	> 0.05 NS
Length of degraded areas	-0.125	> 0.05 NS
Length of Teak plantation	-0.075	> 0.05 NS

Each potential predictive variable (Table 12) was regressed against the individual species sign densities. However, there were no significant relationships at that level. Hence, the data was further analyzed by pooling the sign data for all the mammal species recorded. For this level of analysis, all the mammal signs were combined per transect and related to each of the potential predictive variables.

The length of forest was the strongest predictor of mammal density ($r^2=0.931$, $p<0.01$) when expressed as a polynomial (Figure 13). The regression model indicated that mammal density generally increased steadily with increasing length of forests.

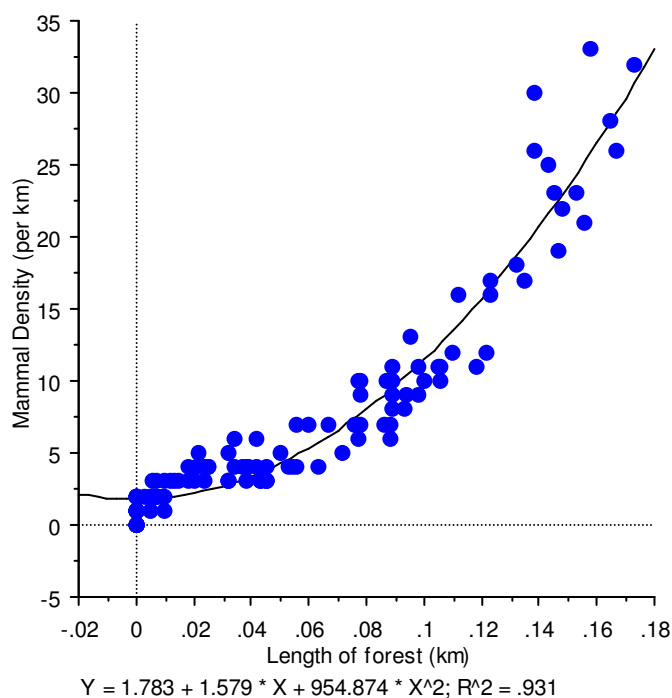


Figure 13. Relationship between pooled sign density and length of forest

Highest numbers of fauna species are found at maximum intensities of forest vegetation where tree cover is abundant. This positive relationship between mammal density and changing forest cover is consistent with the productivity hypothesis (Gaston, 2005).

The second step was to regress each of the other potential predictive variables in turn against the pooled sign data. The number of hunting signs in an area emerged as the second most important variable ($r^2=0.806$, $P<0.01$) determining mammal density in polynomial model (Figure 14).

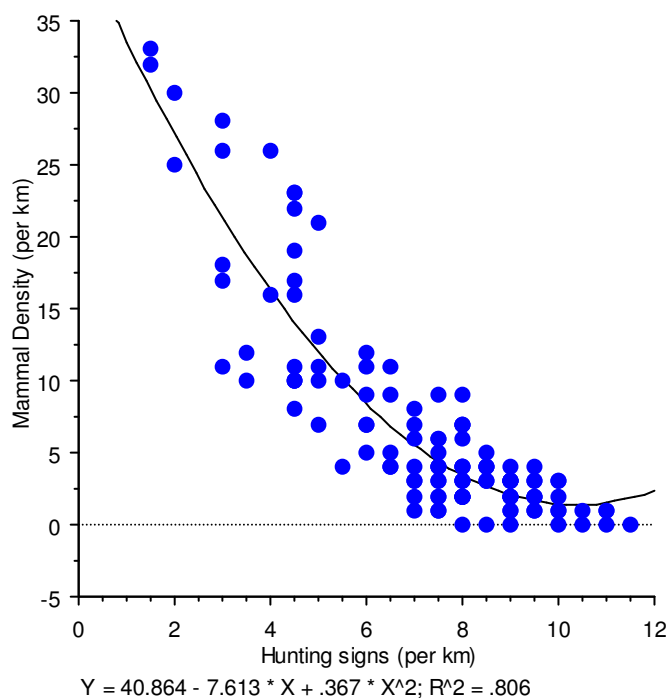


Figure 14. Relationship between pooled sign density and hunting signs per km

The regression model generally showed decreasing mammal density with increasing hunting activity. Lowest numbers of mammals are found at maximum intensities of hunting activity where wildlife persecution is highest. This negative relationship between mammal abundance and increasing human influence is consistent with the ecosystem-stress hypothesis (Lepczyk, 2008).

Signs of hunting were relatively low in the study area surveyed. One hundred and eighty (178) indices of hunting activity were encountered on 120 km of transects combined (average of 1.5 signs per transect). These consisted mostly of rat hunting activities (50%) (Figure 15). Other indices were; wire snares (27%) and empty cartridges cases (23%). No gunshots were heard throughout the survey. Most of the hunting signs were found in degraded area (57%) and Teak plantation (29%). The rest were found in farmland (13%) and forest (1%).

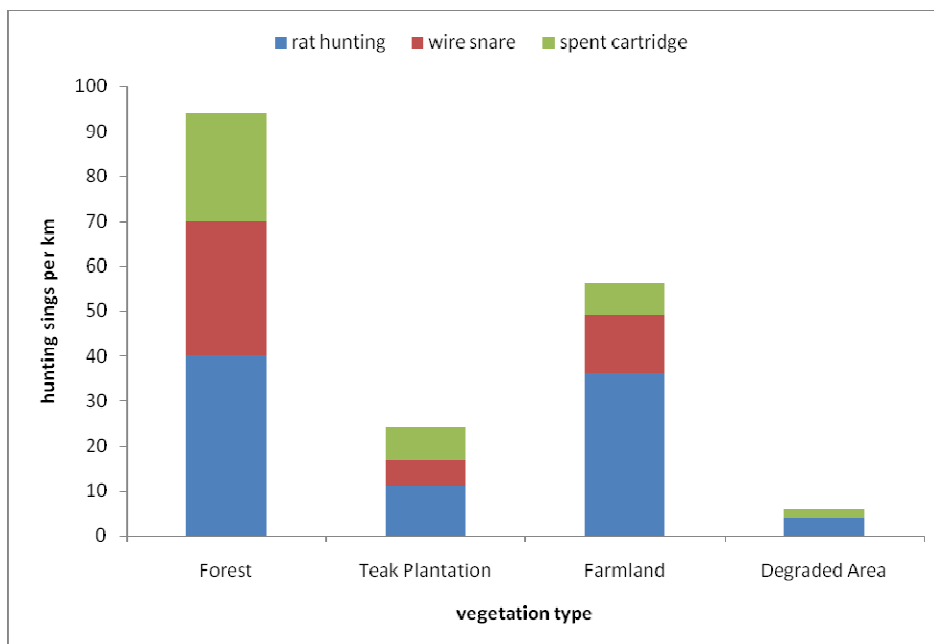


Figure 15. Abundance of hunting signs recorded in the four main vegetation types

Proximity to roads emerged as the third most important variable ($r^2=0.723$, $P<0.01$) influencing mammal density, again in polynomial model (Figure 29). The regression model indicated that mammal density generally increased steadily with increasing distance from forest roads.

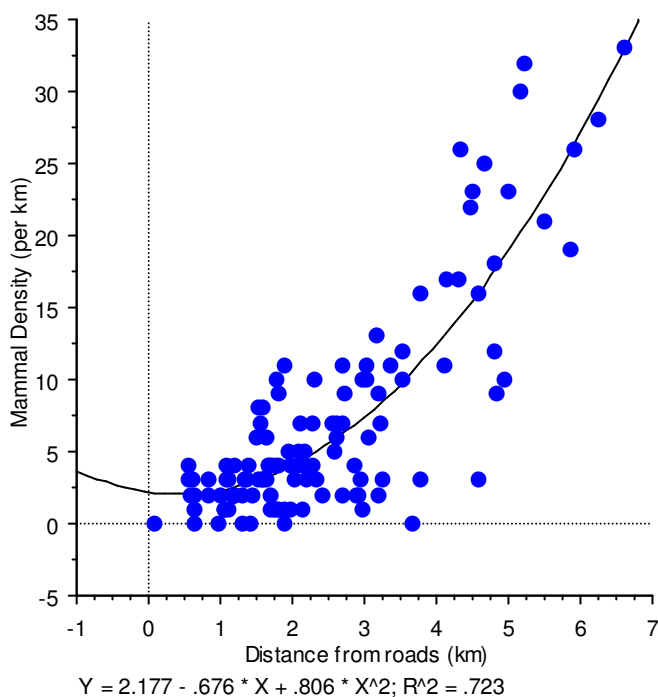


Figure 16. Relationship between pooled sign density and distance to roads

The highest density of mammals was found at maximum distance from forest roads where vehicular noise and human disturbance were lowest. This positive relationship between mammal density and distance from forest roads is consistent with the productivity hypothesis (Gaston, 2005).

Proximity to water bodies emerged as the fourth most important variable ($r^2=0.699$, $P<0.01$) influencing mammal density, again in polynomial model (Figure 30). The regression model generally showed decreasing mammal density with increasing distance to waterbodies. Lowest numbers of mammals are found at maximum distance from waterbodies where habitat condition may be unsuitable. This negative relationship between mammal abundance and increasing unsuitable influence is consistent with the ecosystem-stress hypothesis (Lepczyk, 2008).

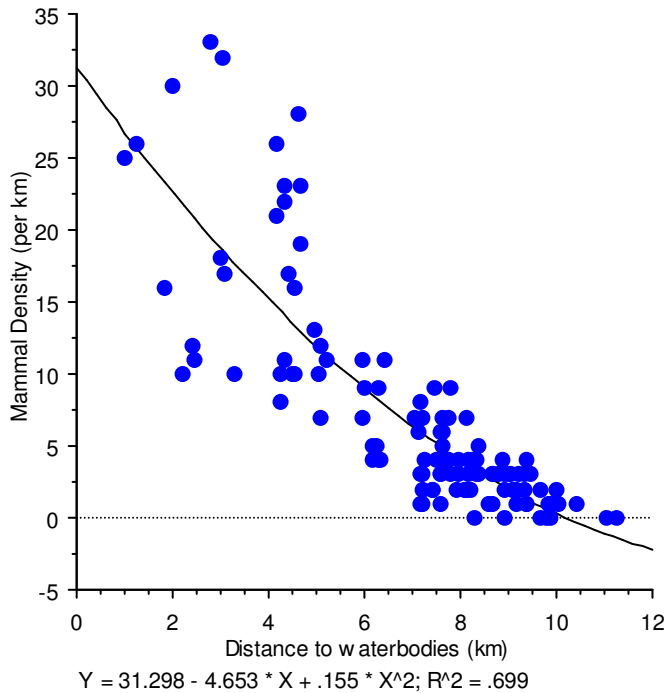


Figure 17. Relationship between pooled sign density and distance to water sources

Roads had significant negative impacts on mammal species, presumably as a result of increased hunting activity near roads ($r^2=0.488$, $P<0.01$) (Figure 18). The highest levels of hunting activity occurred close (less than 3 km) to roads.

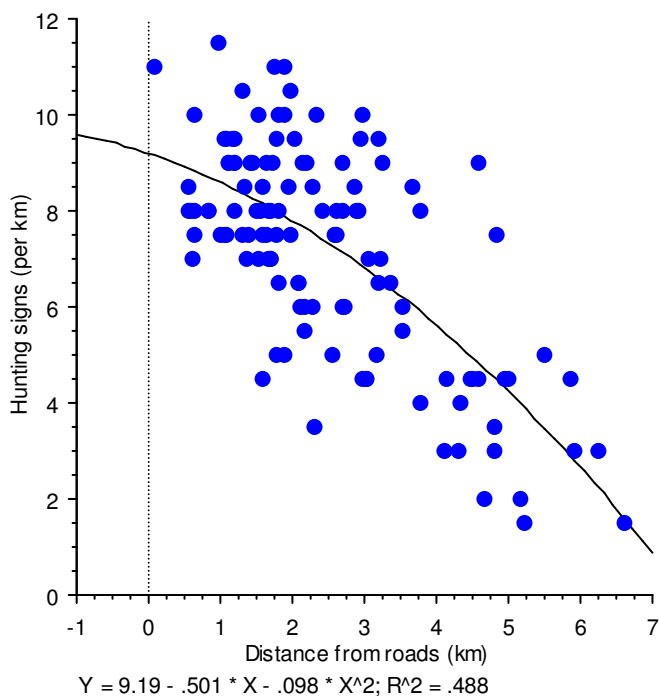


Figure 18. Relationship between hunting activity and distance from roads

These models allow us to predict the density of mammal signs in an area given the number of available variables recorded in a particular area. Such changes in mammal community structure can have potentially broad effects on forest ecosystems via alterations in predation, herbivory, and seed dispersal.

Amphibians

Fourteen frog species consisting of 62 individuals were found during the study in Tain II FR. Amphibians were generally difficult to encounter in the study area and individuals encountered represented a variety of habitats including savannah, forest, or grassland vegetation types. It is expected that when the canopy in the Teak plantation closes with time, a shift in species will occur. Closed canopy species will thrive as Teak stands mature.

Avifauna

Sixty (60) species, belonging to 23 families were recorded on transects (Table 13 and Appendix H). More than 10% of the species recorded belongs to the Weavers and Malimbos family (Ploceidae). Other families included Flycatchers (Muscicapidae), Bulbuls and Greenbulbs (Pycnonotidae) and Pigeons and doves (Columbidae) with a record of 8% of the species each. The White-throated Bee-eater (relative abundance of 13.861), Black-winged Bishop (7.129), Red-eyed Dove (5.743), Common Bulbul (4.752), Zitting Cisticola (4.752), Vieillot's black Weaver (3.960) and Grey-backed Cameroptera (3.960), were the most recorded and widespread bird species. The Families Alcedinidae and Accipitridae accounted for about less than 1% of the specimen recorded and also produced the least number of species. Most bird species were recorded in the forest vegetation (38), followed by degraded areas (33), Teak plantations (21) and then farmlands (19) (Appendix E).

The white-throated bee-eater recorded the highest number of individuals in the survey but was not recorded in Teak plantation possibly because of the low diversity of insects compared to the other vegetation types (Larsen, 2005). The activity of the family *Accipitridae* known to be birds of prey was much recorded on the degraded areas more than the forest interior. They presumably make frequent flights to the open areas due to improved visibility and as carnivores recorded their highest numbers in the grasslands.

The mist net sampling protocol yielded four species that were not recorded on transects: the Red-collared Widowbird, Grey-headed Sparrow, Black headed Weaver and Collared Sunbird. It is worth mentioning that the transect and mist net sampling protocols recorded a different species on each sampling day. This is a good indication that the Tain II Forest Reserve may still hold an impressive number of birds.

Table 13. Bird sightings per vegetation type.

Family	Forest	Teak Plantation	Farmland	Degraded Areas	Total
Weavers and malimbés	44	96	72	132	344
Bee-eaters	104	0	120	56	280
Pigeons and doves	84	32	8	68	192
Bulbuls and greenbuls	76	24	12	44	156
Warblers	72	52	8	24	156
Hornbills	56	8	16	28	108
Cisticolids	0	16	0	80	96
Waxbills and finches	22	0	8	56	86
Rollers	0	0	8	64	72
Flycatchers	56	8	4	0	68
Sunbirds	48	0	16	4	68
Wood-hoopoes	56	0	0	8	64
Woodpeckers	32	12	0	8	52
Cuckoos and coucals	28	4	8	12	52
Francolins	24	0	4	4	32
Drongos	20	0	0	0	20
Turacos/plantain-eaters	12	0	0	8	20
Barbets and tinkerbirds	12	0	0	8	20
Swifts	0	0	0	20	20
Birds of prey	0	0	4	12	16
Falcons	0	4	0	12	16
Kingfishers	4	0	0	0	4
Total	750	256	288	648	

Hotspots

The hotspots for fauna sightings were calculated and displayed in maps of the forest reserve (Figures 19 and 20 and Appendix E). Animal sightings were most abundant in the western part of Tain II Forest Reserve, west of the road leading northwards from Kotaa. This reflects the analysis shown previously about factors affecting wildlife distribution; it is a remote area, far from villages and roads, where human presence is generally low. Carnivores, rodents and ungulates show a similar distribution pattern to the total animal sighting distribution but reptiles show a different pattern (Figure 19). Reptiles occur less often in the strip where mammals are most abundant, and more often in the centre part of the reserve, east of the road from Namasua to Seikwa.

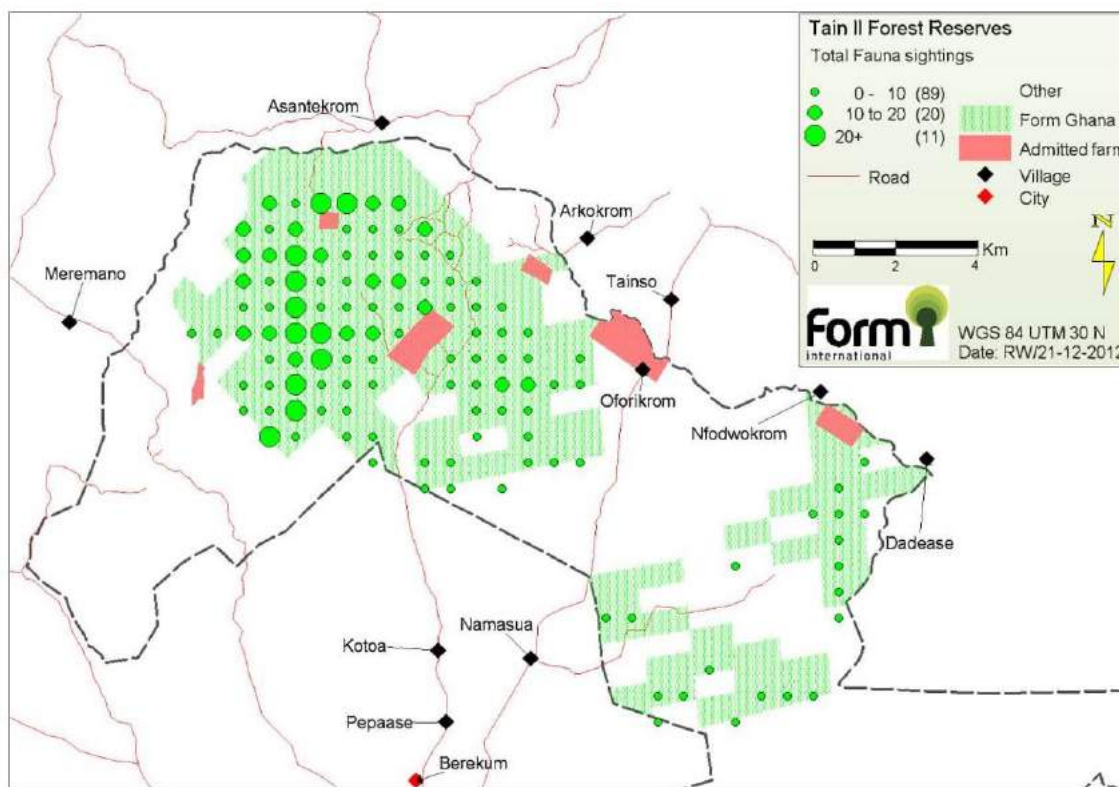


Figure 19. Distribution of hotspots for animal sightings

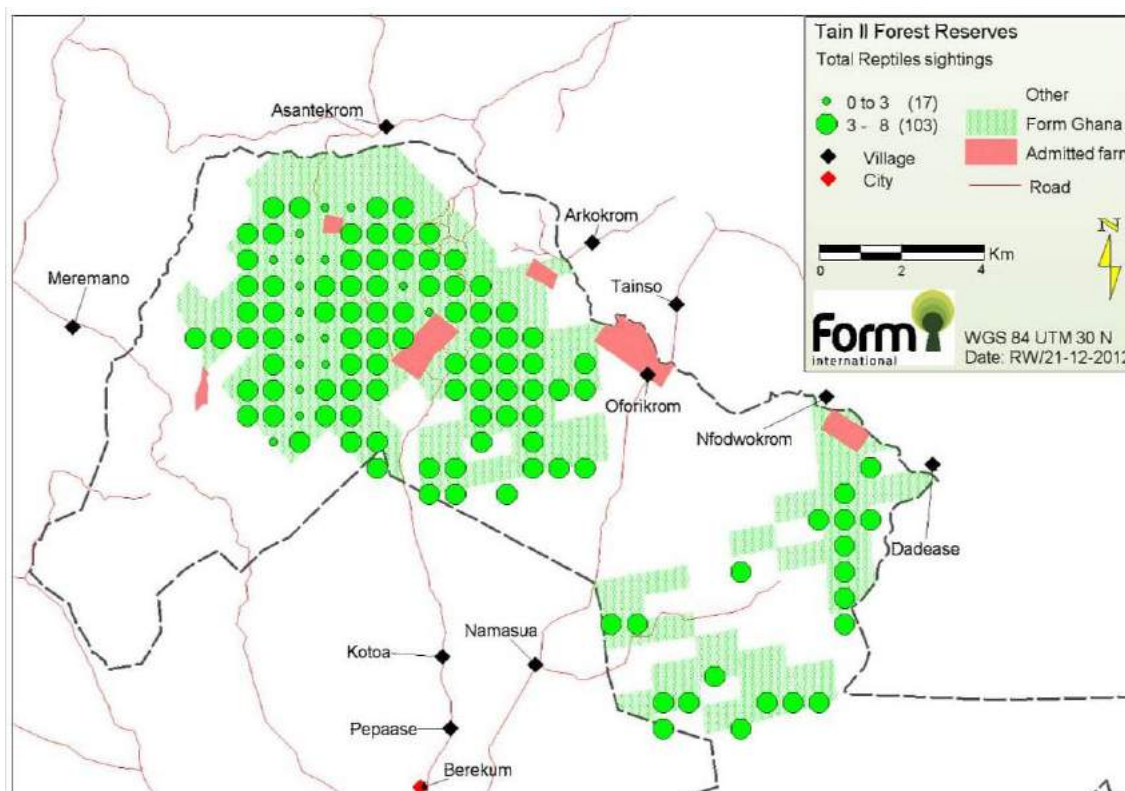


Figure 20. Distribution of hotspots for reptile sightings

5.7.3 *High Conservation value forests*

An analysis of the High Conservation Value Forests has been done separate to this impact assessment. This study is based on the findings from the preparatory studies. The study is published on the Form Ghana website.

At the time of this study, the status of the forest vegetation in Tain II Forest Reserve is highly degraded. The only forest that remains is distributed in small patches in riparian areas. Because of the current conditions, no High Conservation Value Forest has been identified in the Tain II Forest Reserve area managed by Form Ghana.

5.7.4 *Discussion ecological survey*

Although it is difficult to count animals accurately in the forest/farm bush mosaic that exist in the study area, the results of this survey indicate that censusing these species by sign counts can provide an indication of abundance for comparison of trends in future surveys. The use of sign counts for elusive species may be useful as an index of abundance (Koster and Hart, 1988) and a cheap and simple method for detecting trends in wildlife population numbers. Furthermore, the line transects method (Buckland et al., 1993) is very well suited for mammal sign surveys.

Ungulates including some antelope species are adapted to secondary or colonizing forests, thereby persisting or increasing (Struhsaker and Oates, 1995) and do not appear to have suffered to the same extent as primates or larger carnivores due to hunting and commercial logging activities. Most antelope populations are assessed as stable or increasing in Ghanaian forests (IUCN/SSC, 1996). Species such as bushbucks, Maxwell's duikers and royal antelopes may also be favored by the opening of mature forest and an increase in secondary growth. In addition, most antelopes, especially duikers, can probably withstand hunting pressure to a greater degree than the more susceptible primate species. Nevertheless, hunting activities might have reduced the large ungulate populations in comparison to past levels of abundance.

The generally low record of reptile signs and particularly of amphibians in the study area corresponds well to conditions that exist in degraded habitats that are often plagued by frequent raging forest fires and excessively high human pressure.

Factors affecting distribution of animals

Four variables emerged as determinants of mammal distribution in the study area. Analysis of mammal sign distribution indicated that water availability accounted for a large proportion of the variation in animal numbers. Danquah, (2007) has reported a positive correlation between mammal abundance and number of water sources in Bia and in most cases, scarcity of water in an area and animals' affinity to water becomes the central theme for such distribution. Water will have a seasonal effect on animals with a stronger influence in the dry season (Danquah, 2007).

The length of forest in an area is the most important variable in determining mammal distribution and densities. This implies that maintenance of adequate forest fragments within the study area may be a viable approach to improving biodiversity levels in a sustainable forest management that also brings economic value to Form Ghana. Holbech (2001), Wilkie & Finn (1990) and Wilkie (1989) have also shown the importance of secondary patches in forest habitat mosaics as good environments for maintaining high game production and diversity even under relatively high hunting pressures.

Mammal density was also significantly affected by hunting activity. Almost all the remaining forest patches which should have provided refuge for animals had comparably higher hunting intensity than the other vegetation types. Unfortunately, few sites in the study area still have reasonable forest cover to serve as animal habitat. Gradual loss of forest cover and wildlife due to increasing human activities may be an inevitable consequence for the area if an immediate conservation strategy is not implemented.

Though hunting activity in the study area seem relatively low, it is important to note that it is still high compared to 0.44 and 0.76 activities per km recorded within Ankasa and Bia respectively (Danquah, 2007) or in the Kakum Conservation Area (0.63 activities per km; ARG 2004). Form Ghana should endeavor to reduce hunting activity in the area because unlike in the other protected areas, Tain II FR is without wildlife guard posts, hence less patrolled to safeguard animal security.

Even in the sparsely populated study area, roads had a strong negative impact on the local abundance of fauna. Roads could be a far more formidable barrier to strictly arboreal species, including primates. Virtually none of the roads we encountered had overhead canopy connections that would permit road-crossing movements by the strictly arboreal species. Moreover, the inhibitory effects of roads on movements of larger animals will surely increase with increased human activity, local hunting pressure and road width (Peres, 2000; Fa *et al.*, 2005). Since the general impact of roads on fauna is linked to local hunting pressure, we expect the magnitude of road avoidance by animals to generally decrease with increase and effective regulation of illegal human activities in the study area by Form Ghana. We had expected that the length of farmlands and degraded areas would emerge as an important variable. Although, its effect was not significant on animal distribution, Barnes *et al.* (1995) showed a much greater influence.

6. SOCIAL AND ECONOMIC SETTING

This chapter presents the results of the diverse preparatory baseline studies which together form a description of the project environment. Based on the information gathered in the socio-economic and biodiversity study, an identification of any areas of special value is further elaborated in the High Conservation Value Forest analysis.

6.1.1 Socio-economic study

The information for these paragraphs was gathered from questionnaires filled out by household heads in the selected communities and group discussions held with a number of focal people and village representatives in each community. Also, meetings with service providers, government agencies and traditional authorities were incorporated. The minutes of these meetings are included in appendix E.

6.1.2 Village facilities

From the group discussions held in the fringing communities, the facilities in each village were deducted. Below is a short description of the facilities, as summarized in table 14.

Table 14. *Facilities per village*

Village	# of households	# of boreholes* - since (yr)	Electricity since (yr)	Churches (mosques)
Akrofo	200	2 (3) – 1983	2000	5
Ampenkrom	13	1	-	0
Arkokrom	120	1	2010	3
Asantekrom	150	0 (3) – 1983	-	4 (1)
Dadease	55	1 (1) – 2000	-	1
Domeabra	22	1	-	1
Kojoakokrom	223	1(1) – 1996	-	1
Kotaa	150	1 (1) – 1983	2000	3
Kutre 1	300-350	5	1992	10
Kutre 2	250	5 (1) – 1990	1994	10
Meremano	500	Pump – 1996	-	4 (1)
Mpatapo	1000-1200	3 (2) – 1993/2001	1998	8
Mpatasie**	1500-2000	6 – 1992	1992	6 (1)
Namasua	500	3 (2) – 1996	1998	9
Nfodwokrom	45	1 (1) – 2008	-	0
Oforikrom	19	0	-	0
Pepaase	100	1 – 1985	2005	2
Tainso	556	2 (1) – 1988	2007	2

* Numbers in brackets represent non-functional boreholes, **A pipeline runs from Berekum to Mpatasie, with 2 tap points in the village

Electricity

10 of the 18 villages are connected to the electricity network. The villages in the South are generally connected, with the exception of the small villages of Domeabra and Ampenkrom. In the North the only villages with electricity are Arkokrom and Tainso. Houses built after the connection was established are usually not connected. These households can pay to get connected as well, but generally this hasn't happened yet. In Meremano the electricity network has been established in 2006 (poles, wires), but it still doesn't work. The opinion leaders expect that they will get connected this year or the next.

Water

Most of the communities fringing Tain II Forest Reserve had access to a borehole. These have been established in the region since 1983. Water quality and quantity was generally perceived to be good. However, many of the boreholes were non-functional at the time of this assessment and has been left discarded for the past years. Mpatasie is the only village with tap water from Berekum. There are 2 tap points in the village and people can pay to be connected to these taps to have running water in their houses. However, the quality of this water was said to be less than the quality of the water from the boreholes so not many people were connected to the taps. In Meremano, a reservoir and pump system had been established with a network of pipes throughout the village. Asantekrom and Oforikrom still depended on the Tain River for their water, but people living in communities with boreholes often preferred the river water to the borehole water. Some people explained this water is more 'filling' than the water from the boreholes.

Churches

The churches included in this assessment were only those that had an actual building. Other Christian communities, housed in churches or school buildings, were discarded from this analysis. The most common Christian churches were Roman – Catholic, Presbyterian, Methodist and Anglican.

Table 15. Approximate distances (in miles) to nearest services.

Village	Tain II FR	River/stream	Hospital	Primary school	JHS	SHS	Paved road	Market
Akrofoa	5	0	0/3 ^B	0	0	3 ^B	2 ^M	3 ^B
Ampenkrom	6	0.5	2 ^A /4 ^B	1 ^K	1 ^K	4 ^B	2 ^M	4 ^B
Arkokrom	1	1	7 ^S	0	3 ^{Ky}	7 ^S	21 ^B	7 ^S
Asantekrom	1	1	5 ^{Asu}	0	0	8 ^G	20 ^{Se}	7 ^S /8 ^G
Dadease	1	1	16 ^S	0	16 ^S	16 ^S	30 ^{Su} /30 ^B	16 ^S
Domeabra	7	0.5	1 ^A /3 ^B	1 ^K	1 ^K	3 ^B	1 ^M	3 ^B
Ko-joakokrom	2	2	4 ^S	0	4 ^S	4 ^S	22 ^N	4 ^S
Kotaa	4	0	2 ^A /4 ^B	0	0	4 ^B	2 ^M	4 ^B
Kutre 1	6	0	3 ^B	0	0	3 ^B	0	3 ^B
Kutre 2	5	2	2 ^B	0	0	0	0	2 ^B
Meremano	1	0	1 ^J	0	0	5 ^D	5 ^D	5 ^D
Mpatapo	5	5	4 ^B	0	0	4 ^B	0	4 ^B
Mpatasie	7	0	0/2 ^B	0	0	0	0	2 ^B
Namasua	2	2	0/5 ^B	0	0	5 ^B	3	5 ^B
Nfodwokrom	1	1	12 ^S	3 ^{Asi}	12 ^S	12 ^S	17 ^K	12 ^S
Oforikrom	0	0.5	13 ^B	2 ^T	2 ^T	13 ^B	11 ^M	13 ^B
Pepaase	7	0	3 ^B	0	2 ^{K/M}	3 ^B	3 ^B	3 ^B
Tainso	2	1	8 ^S	0	0	8 ^S	15 ^B	8 ^S

A = Akrofoa, Asi = Asiaakrom, Asu = Asuokor, B = Berekum, D = Drobo, G = Goka, J = Jemberija, K = Kotaa, Ky = Kyekyewere, M = Mpatasie, N = Nsoko, S = Seikwa, Se = Seketia, Su = Sunyani, T = Tainso

Roads

A paved road runs from Berekum to Mpatapo, Kutre 1 and Kutre 2 and to Mpatasie. After this the roads are all unpaved and often in poor condition. Dadease, Arkokrom, Kojoakokrom and Asantekrom are especially inaccessible in the rainy season.

Hospital

The nearest hospital for most of the villages around Tain II Forest Reserve is the Berekum Holy Family Hospital (Table 15 and box). There are also small clinics in Akrofoa, Mpatasie and Namasua with 5, 5 and 2 nurses respectively as a permanent staff.

Holy Family Hospital of Berekum

Facilities

The Holy Family Hospital (HFH) of Berekum is a municipal 'Teaching Hospital' owned by the Archdiocese of Sunyani. It provides health training opportunities to students from various health training institutions. The departments of HFH are: Accident and Emergency, General in- & outpatient services, Physiotherapy, Eye care, Maternal and Child Health, Natural Family Planning, Assisted Reproductive Technology, CT-scans & Preventing Mother-to-Child Transmission, Pharmaceuticals and X-rays. The HFH also provides specialized services such as obstetrics, gynecology, pediatrics and surgery. Cases that cannot be treated by HFH are referred to the Konfo Anokye Teaching Hospital (KATH) in Kumasi. The capacity of the HFH is 400 out-

patients per day and 150 inpatient places. The medical facility is accessed by inhabitants of Berekum locality as well as national and even international visitors (e.g. Ivory Coast). Currently the hospital runs malaria and tuberculosis (TBC) programs and focuses on awareness raising for the consequences of teenage pregnancy. HFH cooperates with local- and community-based health clinics within the Berekum locality. The hospital provides training, skills building and upgrading for smaller clinics. Smaller hospitals are sensitized on the need to timely transfer difficult cases to the HFH for treatment. HFH collaborates with radio stations to educate the general public about critical health issues and to organize programs such as blood donations.

Social Welfare and Public Healthcare Departments (SWD and PHD)

The Social Welfare and Public Health Departments provide specific outreach programs for the benefit of surrounding communities. Education is provided through cooperation with churches, football clubs, District Assembly, Municipal, and Regional administration.

The SWD used to provide financial assistance to needy patients who could not afford their medical bills. Funds came from individuals and organizations from the USA. For the past 4 years no funding has been secured but they still encounter many patients that aren't covered by the National Health Insurance Scheme (NHIS) and cannot afford their bills. According to hospital statistics, 16% of the admitted patients is not insured. It also happens that insured patients are unable to feed themselves whilst on admission at the hospital. The current strategy of the SWD is focused on educating and assisting people to join the NHIS (costs: GH¢16 and GH¢5 per year for adults and youngsters (<19) respectively). The PHD provides ante-natal and post-natal services and runs a children clinic. Prevalent diseases amongst children are upper respiratory- and skin infections, but the main focus of the PHD lies on teenage pregnancy and unsafe abortion, as this is a major problem in the Berekum locality. The PHD coordinator runs education programs on the radio about the risks of unsafe abortions and people are educated on natural methods of family planning. Recently, a Sexually Transmitted Diseases clinic has been opened but this program is not well patronized because generally people find it difficult to talk openly about such issues.

Schools

All of the villages have a primary school within 3 miles radius. For Junior High School (JHS) though, some students have to travel up to 16 miles (Dadease) (Table 15).

Table 16. Schools and clinics present in villages.

Village	Public primary school	Private primary school	Public JHS	Private JHS
Akrofo	1	1	1	1
Arkokrom	1 (P1-4)			
Asantekrom	1		1	
Dadease	1			
Domeabra				
Kojoakokrom	1			
Kotaa	1		1	
Kutre 1	2		2	
Kutre 2	1	3 (being established)	1	
Meremano	2		1	
Mpatapo	1	2		
Mpatasie	1	5	1	5
Namasua	1		1	
Nfodwokrom				
Oforikrom				
Pepaase	1			
Tainso	1		1	

Most of the villages have at least one primary school (Table 16) and Junior High School (JHS). The only Senior High School in the area is located in Mpatasie (Star Business College). Other students travel to Berekum or even to Sunyani if they want to continue after JHS. They commonly stay with relatives in the town where they attend school and come back to their village in weekends or during holidays, depending on the distance. In the box below the school system is explained in more detail.

Education

School system

Kindergarten and crèche/nursery are optional schooling preceding formal education. The current basic education system is structured as follows:

- 6 years primary school (P1-6)
- 3 years Junior High School (JHS)
- 3 years Senior High School (SHS)

Pupils from JHS write the Basic Education Certificate Examination (BECE) with successful candidates admitted to Senior High School (SHS). The duration for SHS has been reduced from 4 to 3 years. Graduating students take the West African Secondary School Certificate Examination. Depending on your (aggregate) mark, successful completion of this exam allows you to enroll at the University or at Polytechnics or Teacher's Training College.

Previously, Junior High School was called 'Middle School'. After primary school, pupils proceeded to form 1 of the Middle School. From form 1 to form 3, pupils could take the common entrance examination and successful candidates proceeded to Senior Secondary Schools (SSS or SHS) right away. Unsuccessful candidates from form 3 went to form 4 and obtained the 'middle school leaving certificate'.

Enrolment

There is an increased enrolment in schools, which can be attributed to a number programs geared towards enrolment drive. School Management Committees (SMCs)

and Parent-Teacher's Associations (PTAs) have been established to improve communication between the schools, families and local governments. Capitation Grants, school feeding programs, free school uniforms and furniture. However some programs exist only on paper, as the government does not fulfill its part of the agreement. Capitation Grants, designed to take the burden of costs off the parents, will end because of this and at a recent meeting it was revealed that support from the Department for International Development (DFID) support will be discontinued as well.

Teachers posting

In order to have sufficient teachers in the rural areas, a new system of posting was initiated in the district in 2009. Generally, teachers apply to a region (and also a district within the region) of their choice. The GES decides which applicants to accept and also the town/village to be assigned. Now, all new teachers are posted in rural areas for a period of 3-4 years. Some exceptions were granted on the grounds of poor health and female teachers were not posted too far from Berekum in order to increase their chances of getting a proper husband. There are still problems with 'deprived communities' where there is shortage of trained teachers. Pupil's teachers (those without the formal qualification from teacher's training college) are employed in these villages.

Market

The main markets in the area are in Berekum and Seikwa, on Thursdays and Fridays respectively. Other markets are in Drobo and Goka (Table 4). Market trucks come to all villages to pick up people and their products, but during the rainy season the condition of the roads is sometimes too poor to cross, making the remote villages (Dadease, Nfodwokrom) inaccessible. This is a problem for the inhabitants of those communities that cannot sell their crops.

Fire service

Bushfires occur frequently in Tain II Forest Reserve. Last winter, 38 bushfires occurred in the period of December to March. This is a great pain for the farmers that risk losing their crops, but also poses a threat to the communities as they are often located close to the fire. Several villages have been struck by the fires in the past years; e.g. Kotaa and Pruso. In order to counteract these fires, the districts work together to locate hazards as quickly as possible and combat the hazards effectively. In addition to the banning of hazardous activities in and outside of the reserves, the district fire office developed systems to alarm communities and educates volunteers in fire extinguishing techniques (see box).

Berekum District Fire Office

Protocol

The Berekum District Fire Office operates through a system of trained Fire Volunteers. Since 1992, the Fire Service runs a volunteer program with Fire Volunteers in each village, 814 in total. The volunteers organize daily patrols during the dry season in which they check for fire hazard but also for people violating the law. They have the right to arrest offenders and take them to the fire office or directly to the police. Criminal offences are described in a by-law, drafted in 2011. Offences include smoking, carrying matches or guns, making fire for cooking and using smoke or fire for any purpose whatsoever between January and March. Farmers are allowed to burn their land only if they give advance notice to the fire volunteers. The volunteers then check if it is done safely and help out where necessary. Fire and smoke are also often used to chase rats out of their holes, tap honey or prepare palm wine. In case the patrol team encounters a fire outbreak, they notify the fire office. The location of the fire outbreak is determined by a zoning system (8 zones in the district) and by knowledge of the area. A fire squad is arranged to combat the fire with a fire truck and by creating fire belts. People in the surrounding communities are notified by the fire volunteers and by the NCCE (National Committee for Civic Education), alarming the people in the communities. The drums used in former times are still used occasionally but in many villages they have been replaced by a speaker system.

Revitalization

The volunteer program was revitalized 4 years ago because it didn't function well. According to the Fire Office representatives and the volunteers present at the meeting, the revision has had a positive effect on the reduction of bushfires. This can be attributed to the motivation of the volunteers that run patrols and fight fire despite the fact that they have to leave their farm unattended, receive no incentive and have no resources or safety equipment to help them in the field. The success is reflected by the fact that farmers have started cocoa plantations in the area. Cocoa-farming was very common in the area before the great fire of 1983, but was considered a too risky investment thereafter since frequency of bushfires increased dramatically.

6.1.3 Occupation and age

Approximately 14% of the respondents was a child before school attendance, ca. one third was student (Figure). Over half of the respondents was working (52%) or unemployed (2%). Of the working respondents, the vast majority was farmer (76%). The next most frequently occurring occupations were trader (5%) and mason (3%). Other professions included tailor, taxi driver, hair-dresser and teacher.

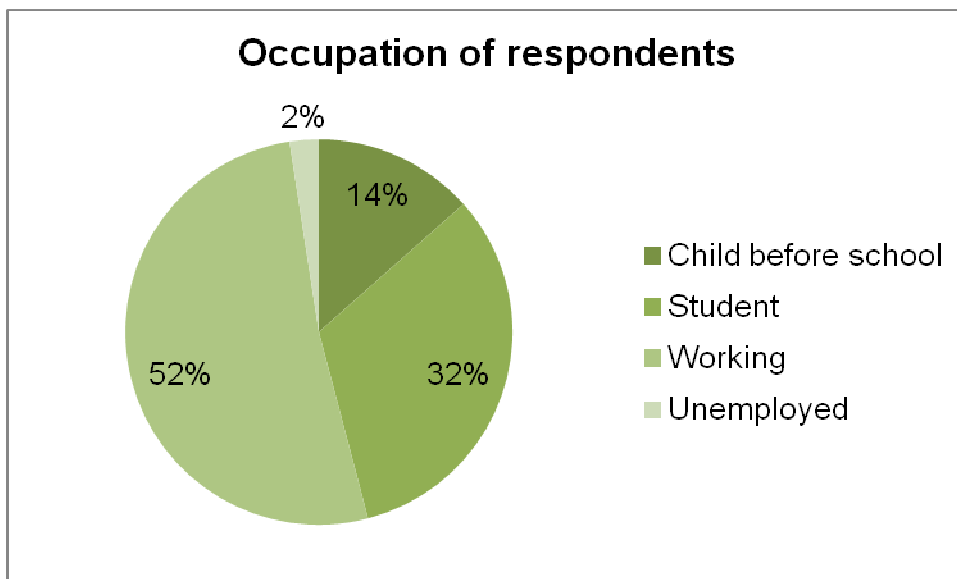


Figure 21. Occupation of the respondents.

The average age of the respondents was 22, but the most frequently occurring age was 4. It should be noted that most community members were not sure of their age or the age of their children. The numbers in Figure are based on respondents' estimates and the author's observations.

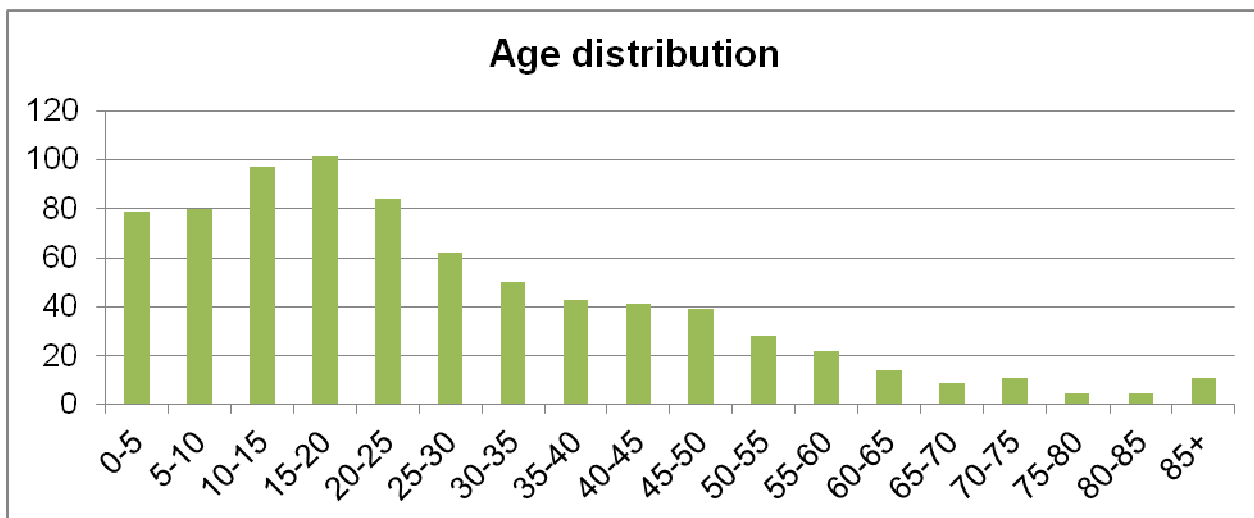


Figure 22. Age distribution of respondents in classes.

The distribution in age classes (Figure) shows a peak for ages 10 and 25 and a rapid decline above the age of 25 and again above 50. It is remarkable that the youngest age classes are less abundant than the teenagers. This may be explained by a decline in population growth or by migration of children into the communities after primary school (age 10-15).

6.1.4 Marital status and household size

Average household size is 8 people, usually consisting of the household head, his wife and their children. On average, a household had 4 children living in

the village. Most households were reduced in size because part of their children had moved out of the village, either temporarily or permanently. The largest household consisted of 17 people. There were often other relatives included in the household, such as parents of the household head, brother/sisters, uncles/aunts or family in law.

The respondents were equally distributed in men and women (390/391).

6.1.5 Literacy and level of education

Looking at the education status of the respondents at or above school-going age, we can distinguish three basic groups; those that never attended school, those that attended school in the past and those that attend school at the time of the assessment (Figure).

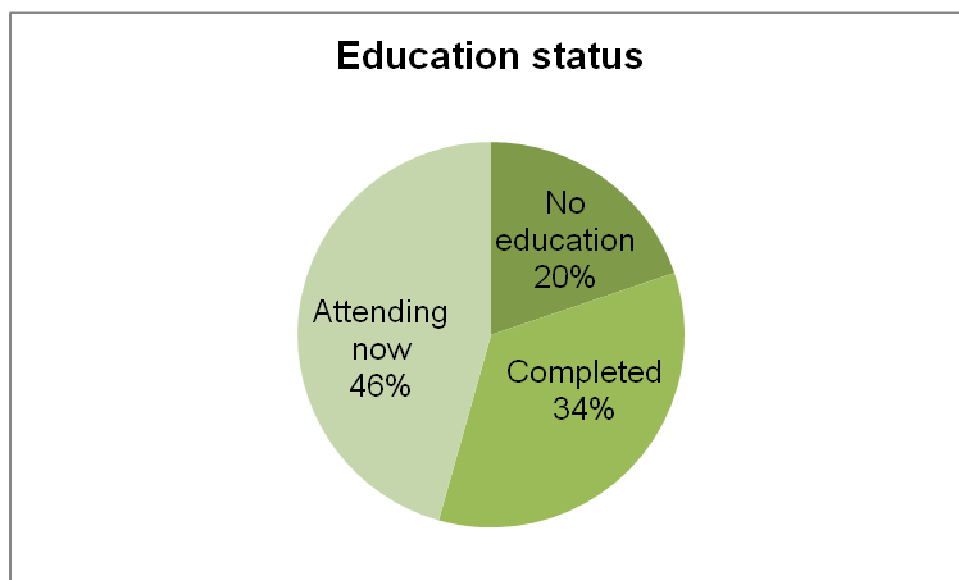


Figure 23. School attendance of respondents above school-going age

The people that never attended school are considered illiterate. Illiteracy amongst the population >11 years of age at the national level is 26%, according to the national census report of 2012. In Brong Ahafo region this percentage is higher: 30%. The 20% illiteracy amongst the respondents of this assessment is hence below the national as well as the regional average, possibly because a large part of the respondents in this study lived in the vicinity of Berekum. Literacy in urban areas is commonly higher than in rural areas. This trend is visible in the national census report as well as in this study.

Approximately one third had completed a level of education, primary school or higher, and 46% was attending school at the time of this assessment.

In the figure below, education type of respondents has been distributed over age classes (Figure). It is clear that school attendance below the age of 6 is very low. Most children attend primary school at age 6 to 11 and JHS between 12 and 17. Minimum age for attending university is 24.

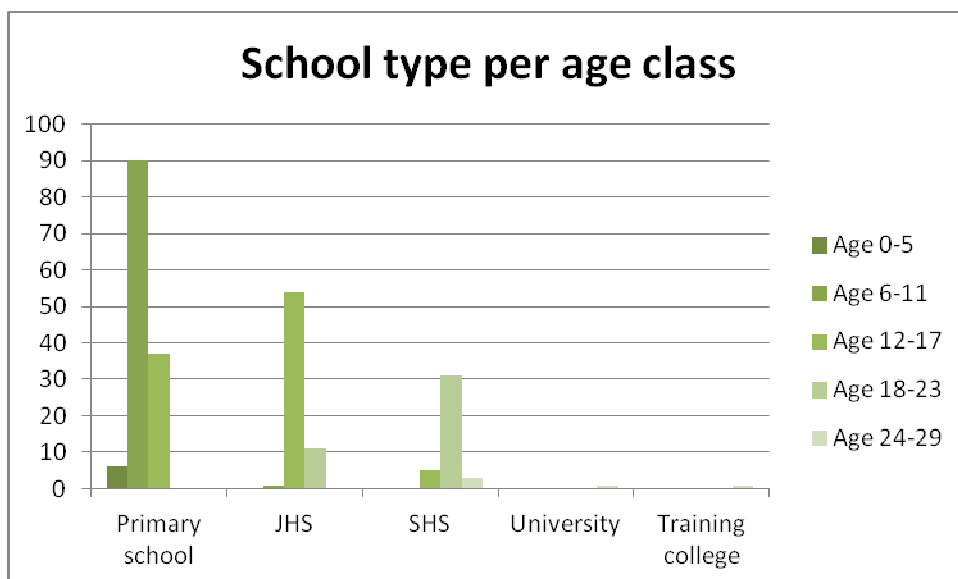


Figure 24. Level of school attended by respondents per age class

The different regions bordering Tain II FR have different levels of education. The communities in Seikwa district have been distributed in east and west because they are otherwise located too far apart. Dadease and Nfodwokrom are considered Seikwa East and Tainso and Arkokrom are part of Seikwa West.

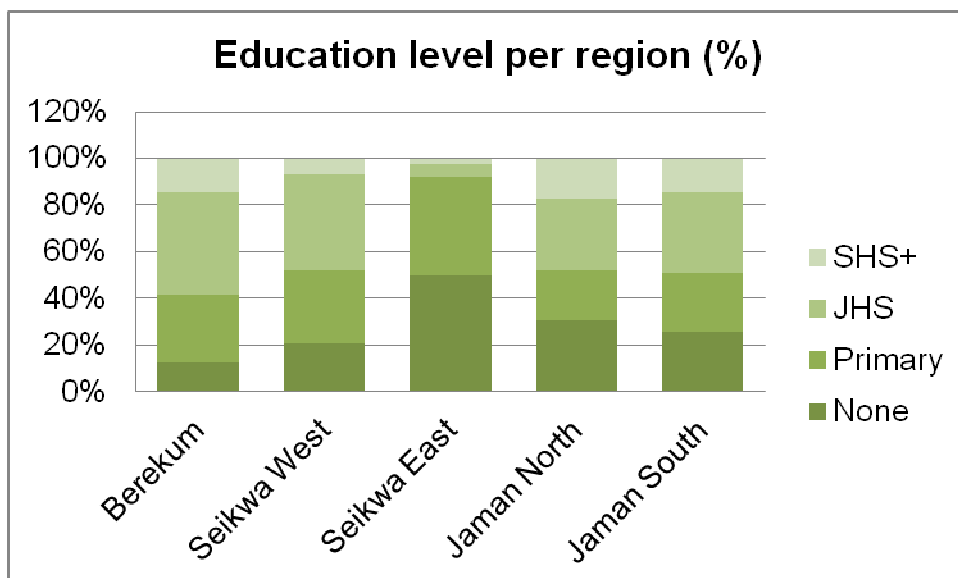


Figure 25. Education level of respondents per region

The communities located in Berekum district have the lowest level of people without education (13%) (Figure 25). Enrolment in this area is almost equal for boys and girls. In the rural communities, a small majority is boys (52%), while in the town of Berekum, the majority is girls (51%).

The highest level of people without education is in the communities in the east of Seikwa district (50%). Only 5% of the people in these communities went to JHS and 3% to SHS or higher level education. This coincides with the longest distance to the nearest JHS school for these communities; 12 and 16 miles for

Nfodwokrom and Dadease respectively. The level of highly educated people (SHS and higher) is relatively low throughout Seikwa, with 7% in Seikwa west compared to 15%-17% in the other districts.

The education level of people above school-going age above the age of 25 is different from the people aged 25 or younger (Figure 26 and 27). The percentage of people without education is considerably higher amongst the older generation (28%) compared to the younger generation (8%), and more children attend primary school in this generation; 41% against 16%. However, the amount of students that continue after primary school to do JHS or higher education is not that different, even a little bit higher for the older generation; 56% compared to 51%.

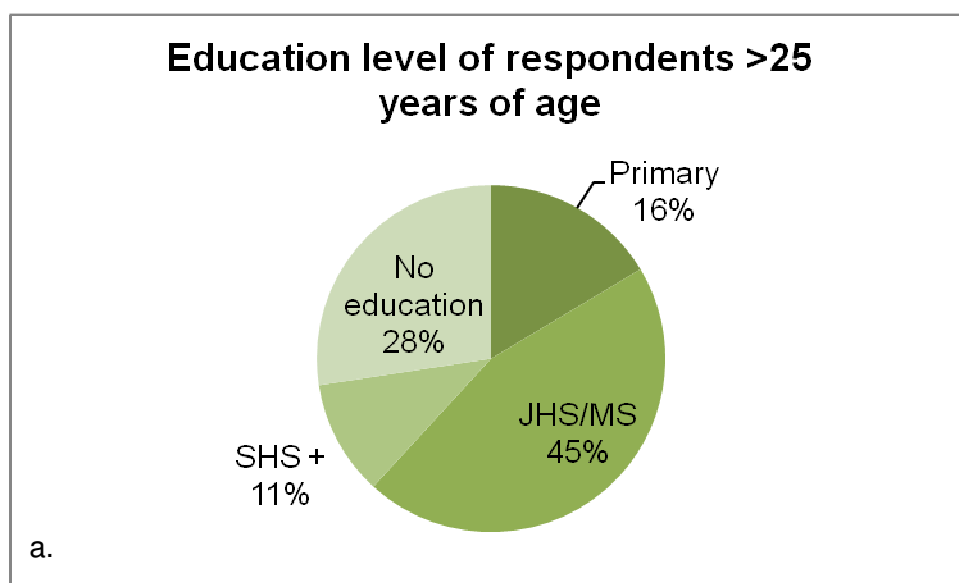


Figure 26. Education level of respondents over 25 years of age.

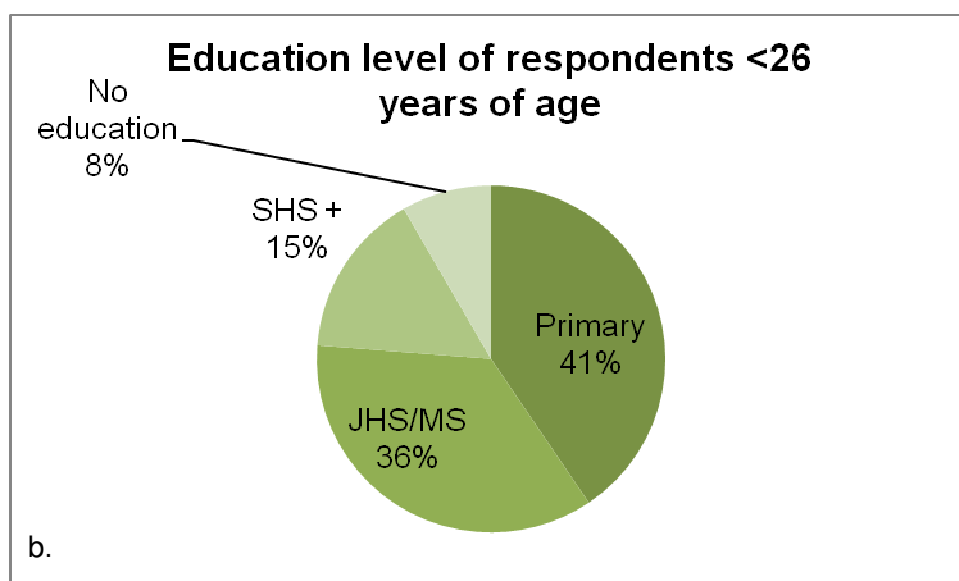


Figure 27. Education level of respondents below 26 years of age.

6.1.6 Ethnicity

Most of the migrants interviewed in this assessment migrated in the past decade (2000-2010) (Figure). It is remarkable that the national migration peak of the 1980's, following the great draught of 1983, is not reflected in this figure.

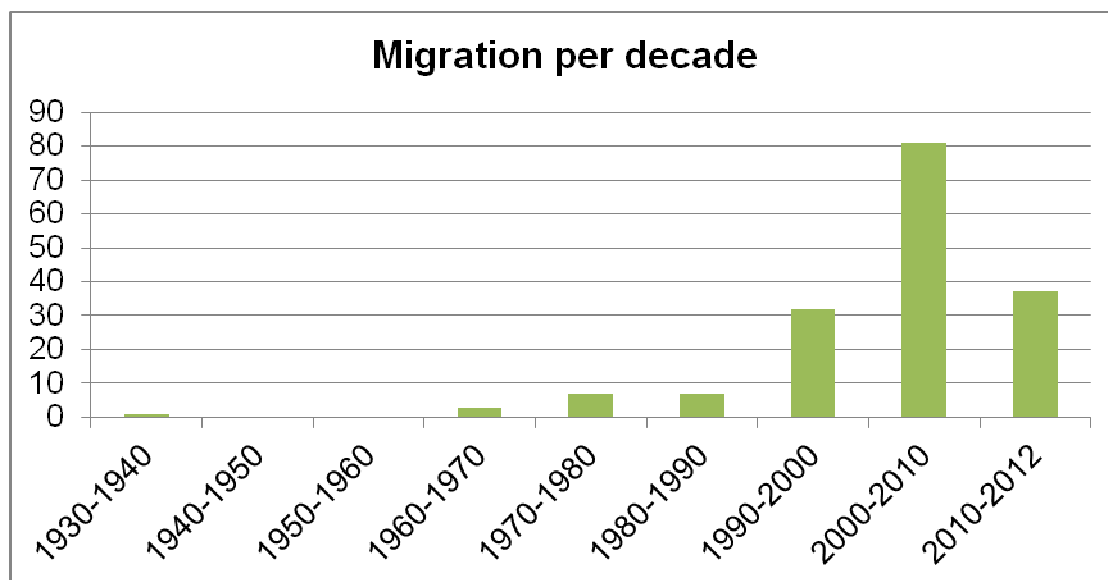


Figure 28. Year of migration of migrated respondents, per decade.

Overall, most respondents were born in the village that they currently lived in (23%). This percentage showed a large variation between the different communities. The highest migration rates were found in Ampenkrom (80%), Nfodwokrom (75%), Oforikrom (73%) and Dadease (55%) (Figure). These communities are bordering the forest reserve, which makes it easier for settlers to find a piece of farmland. The villages are also located at some of the most remote locations, with the largest distance to facilities like markets, school or hospitals. Ampenkrom is an exception to this but is the most remote community of the Berekum district included in this assessment. The original inhabitants of Ampenkrom have recently left the place because of this remoteness, leaving room for newcomers to access the village.

The communities with the least amount of migrants can be found in the villages closer to Berekum; Mpatapo, Kotaa, Namasua, Akrofoa, Pepaase, Kutre 1 and Mpatasie. Kutre 2 forms an exception with a relatively large number of migrants (43%).

Fulani herdsmen

It became clear during interviews with several parties and from field sightings that Fulani herdsmen herd cattle in the project area. The Fulani are a nomadic people that come from Northern regions in Ghana and Burkina Faso. It was difficult to arrange a meeting with the Fulani because their whereabouts were unclear. They did have a temporary settlement at the fringe of the reserve, close to the road. We met four young Fulani herdsmen there. The Fulani have their own language, but two of the four also knew how to speak in Twi, although they first pretended not to. We explained to them the purpose of our visit, and introduced the proposed project. After that, we asked if we could interview them. The interview is described below.

How many Fulani are there in this area? Where do they stay?

“There are four herds in the forest reserve. Most live in Berekum and travel to the forest reserve for herding the cows. One household lives in this settlement. There are no houses in the reserve. There are a few Dagarti (other people from the North) settlements close to the border of the forest reserve, more to the east.”

How long have you been here?

“We have lived in Ghana for a long time now, but we arrived in Tain Forest Reserve only 2-3 years ago.”

Do you want to stay here?

“We rent the land from the landowner. We have an agreement for one year. If the agreement gets extended, we will stay, if not, we will move.”

Who owns the cattle?

“The herds belong to Mr. Yakubu Morro, who is also the owner of Berekum Arsenal. This is a famous Ghanaian football team that trains young players and sells them to other teams. The cattle herdsmen can choose to receive one cow per year for their services or to get paid by or receive food from Mr. Morro.”

What are your means of transportation?

“Mr. Morro, our boss, owns a pickup. The herdsmen own a motorcycle.”

Do you have any questions for us?

“What is the size of the company? Will the cows be allowed on the plantation? We are worried that if we are not allowed to take the cattle on the plantation, we will not be able to reach the water from the Tain River in the dry season.”

Interview with household next to Fulani settlement

The household head explains how the Fulani came to be in Tain Forest Reserve in such great numbers: “Mr. Morro brought them in. He acquired a piece of land from the chief’s brother. At first, only a few cows came to the area. Then there was a conflict about the ownership of the land. Somebody sued the chief’s brother. Mr. Morro then went to the person who won the case and offered him 40 million GHS and 2 bulls for his land. After paying 20 million GHS, the landowner lend him the land, not knowing that Mr. Morro then sublet the land to cattle herders. He brings in the herds from a road far from the communities so they don’t notice how many herds he brings. Then all of a sudden the forest reserve is full of cows. The chiefs organized a task-force to drive out the herds but get only as far as Seikwa, so the herds come right back in again after a short while.”

Form Ghana has held several meetings with the Fulani herdsmen to formally inform them that they cannot enter the Form Ghana land since 2013. The Fulani indicated that they are aware of this, but that they need to enter the reserve to look for water in the dry season.

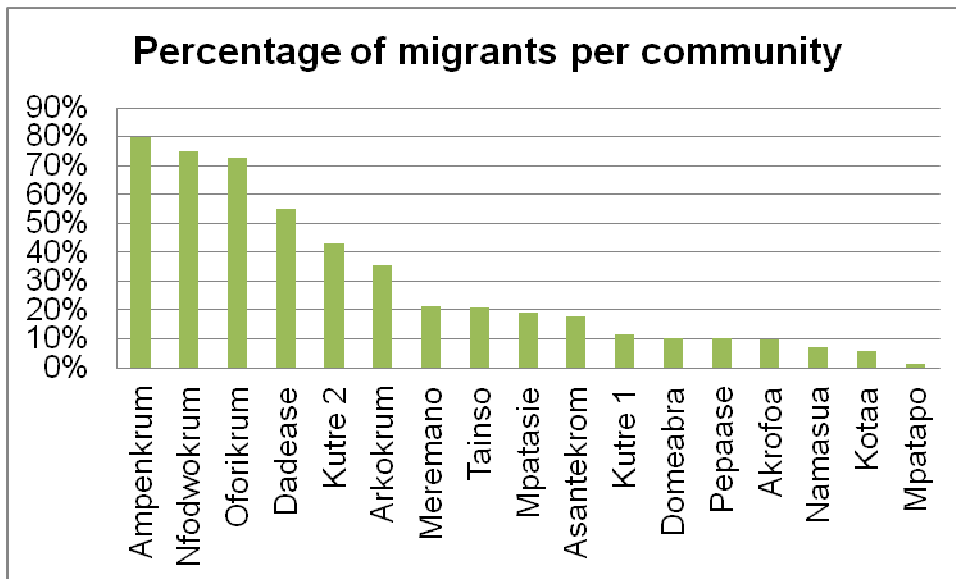


Figure 29. Percentage of migrants per community.

Most of the migrant respondents originated from another community within Brong Ahafo Region (35%). Most of the people from outside the region came in from the Northern Region (29%), followed by Upper West (15%) (Figure). Approximately 3% of the migrants came from foreign countries: Togo and Burkina Faso.

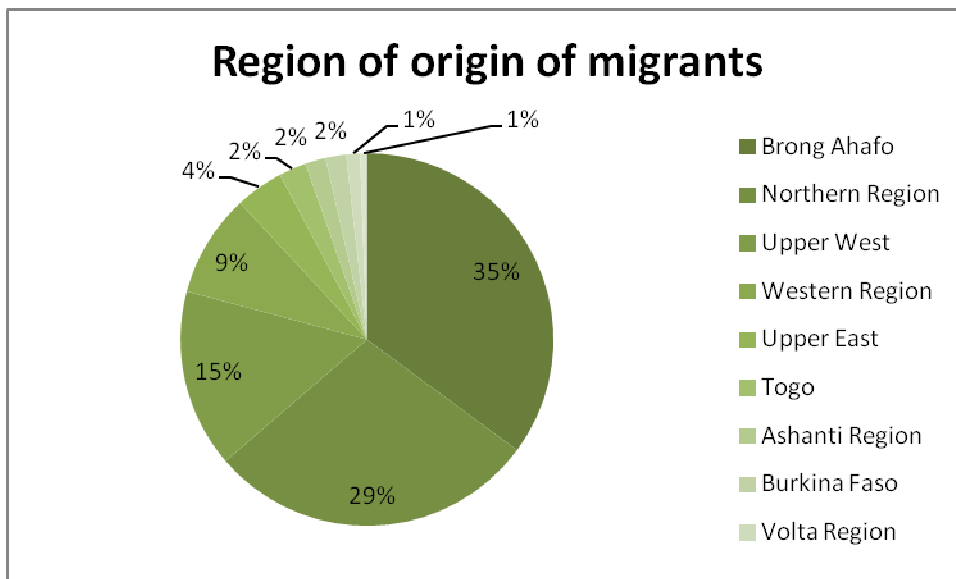


Figure 30. Respondents' region of origin.

In total, 11 different ethnicities were interviewed in this assessment. The largest ethnic group is the Bono (81%), the original inhabitants of Brong Ahafo Region. The largest ethnic minority are the Dagarti (12%). Dagarti (also spelled Dagaare or Dagari) actually refers to the language spoken by the Dagaaba, a people from the northwest of Ghana and southwest of Burkina Faso. Asante (2%), original people from Ashanti Region and Frafra (2%), people from Northern Ghana and Burkina Faso, are the next largest minorities. Other ethnic groups encountered in this assessment were Akan Nkwaman, Ewe, Sisala, Burkinabe, Krobo and Wala.

This ethnicity distribution reflects the national trend of Northerners traveling to the fertile south to start their farms.

Religion is mainly Christian, combined with traditional customs and worship. Only a small percentage indicated that they were Muslim (Figure).

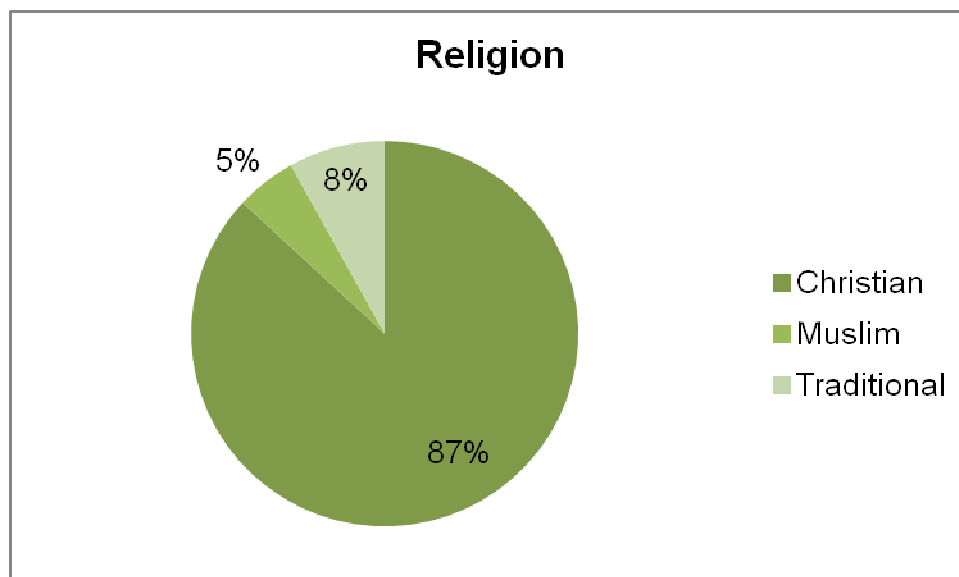


Figure 31. Religion of respondents

6.1.7 Main agricultural crops cultivated and farm location

Households commonly have some acres with their main bulk food crops (used for e.g. fufu and banku) and a small piece of land with vegetables. These crops are grown in a mixed cropping system. Based on rough indications from the farmers around Tain, the farms have an average size of 8 acres (1 acre = 0,4 hectares), excluding large-scale farmers with 100 acres or more. Part of the farms are fallow land, used for rotational purposes. Some households grow perennial crops like cocoa, cashew or palm nut on 4.3 (1,72 ha), 6.1 (2,44 ha) and 8.4 (3,36 ha) acre fields respectively. Indicated farm size is slightly smaller than in Asubima Forest Reserve; 2.5 ha of pure crop land and 1.54 ha fallow land (SEIA report Asubima).

The main bulk crops cultivated in the area, calculated by the frequency of cultivation by the households included in the social assessment, are cassava, maize and plantain, followed by cocoyam and yam (Figure). Most frequently cultivated vegetables are pepper, okra and garden eggs, followed by tomatoes, onions and green beans. Some households grow fruits like pineapple and watermelon but this is a small minority. The average yield for maize is 18 bags per farm per year.

Cocoa was the most frequently grown perennial crop, followed by cashew and palm nut.

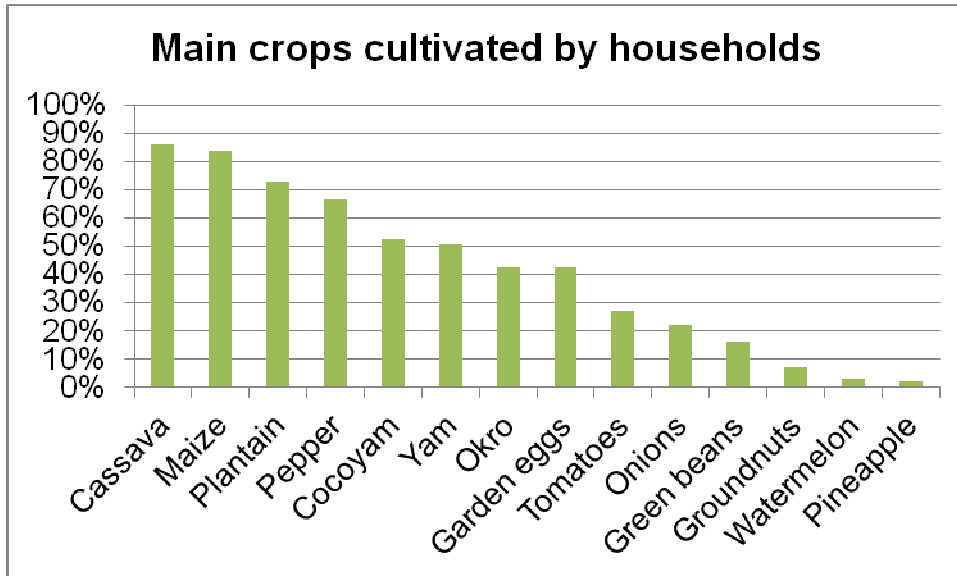


Figure 32. Main crops grown by households included in SEIA (%).

Most farmers farm on their own land or in the forest reserve. Only a few farmers reported to pay rent to or share their benefits with the land-owner. Most of the households were farming outside the forest reserve (74%) (Figure). Approximately half of the households with a farm inside the reserve also farmed on land outside the border. The households that farm inside the reserve were located in the communities closest to the forest reserve.

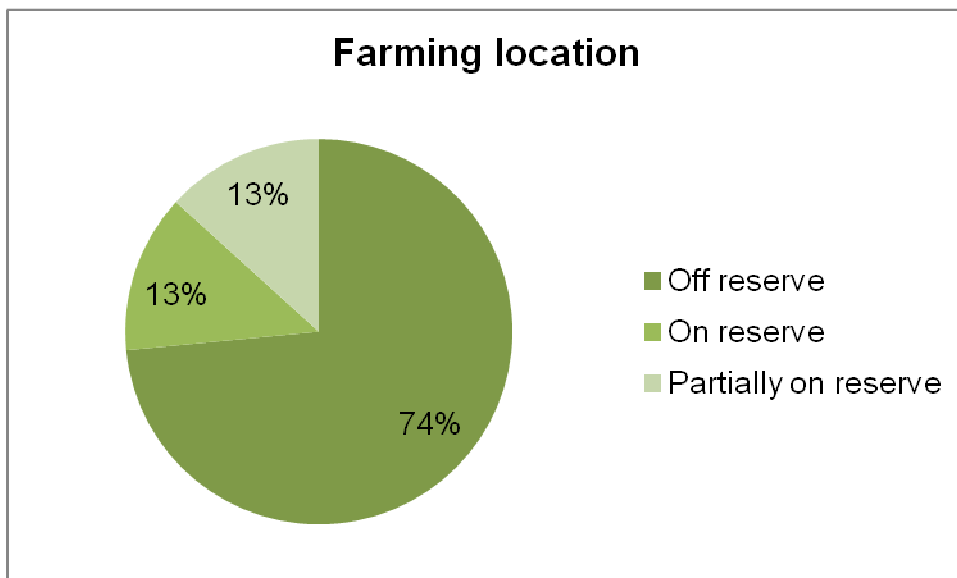


Figure 33. Location of farms in relation to Tain II Forest Reserve.

A large share of farmers used artificial ways to stimulate growth of their crops. Herbicides were used by over 90% of the households, and pesticides by nearly 70%. Fertilizers were used less frequently (30% of the households). Many farmers indicated that they would prefer to use them but couldn't afford them.

The farms located inside the forest reserve were on average twice as big as the farms located outside of the reserve; 6.8 acre and 3.1 acre respectively.

The production of maize per ha is much higher within the forest reserve than outside of the forest reserve: 2.8 bags/ha/year compared to 1.9 bags/ha/year. This can be explained by the conditions in the forest reserve or by the farmers that farm in the FR. It is likely that the soils within the reserve haven't been exhausted yet, and that abiotic conditions are more favorable to farming than outside the reserve. It can also be attributed to the efforts of the farmers farming inside the reserve. Farmers inside the reserve are mainly migrants from the northern parts of Ghana. They may be motivated to farm with a higher intensity compared to the native inhabitants.

6.1.8 Health

Malaria is the most frequently occurring disease in the area. More than 30% of all the hospital visits were for malaria treatment. This reflects the statistics of the Berekum Holy Family hospital, where malaria is the number one reason for admission (10% of all admissions). Other frequently encountered complaints in the interviewed communities are stomach ache, headache, injuries from accidents and skin rashes. The main cause of death in the Berekum Holy Family hospital is AIDS.

6.1.9 Housing and transportation

Approximately half of the houses was built from clay, some of them plastered, some of them uncovered. The other half was built with either blocks or bricks. Bricks and blocks are building materials shaped in a rectangular wooden or metallic box, either manually or mechanically. Bricks are made purely from clay, similar to the bricks used in modern buildings whereas blocks are made from a mixture of sand and cement. Traditional clay buildings are made solely from clay, not molded into rectangular shapes or dried before building. Most of the houses used corrugated steel for roofing but there was still 18% with thatched roofing, made from grass species found in the forest reserve; *Imperata cylindricum* and *Hyparrhenia spp.*

The interviewed households had 1 to 12 rooms at their disposal, with an average of 4 rooms, for an average of 9 residents.

Approximately 78% of the households owned at least one bicycle, 15% owned a motorcycle.



Figure 34. Interviews conducted in villages

6.1.10 Admitted farm areas

A distinction has to be made between farmers in admitted farms and farmers that have illegally settled in the forest reserve.

It is not allowed by law to farm in forest reserves. In spite of the law, farmers still makes use of the land and even settles within the reserve because the law is poorly enforced. The farmers are aware that they are illegal and know that they can be evicted at any time. The forestry law of Ghana list both farming and cattle grazing as illegal and punishable.

Some patches in the FR are labeled 'admitted farm area'. At the time that the FR was gazetted, some people were living inside the FR. These people received a permit to stay on the land and consider it their own. Until today, these admitted farm areas do not belong to the government, and are not part of the forest reserve, but to the traditional land owners. In Tain 2 FR the only village located in one of these admitted farm areas is Oforikrom, owned by the chief of the village. Other admitted farm areas are used for farming and storing crops. Akrofoa owns some admitted farm areas (they named it Wasutaka, after a neighboring stream), as well as Asantekrom. They don't seem to use the land intensively though, as the patches are located deep within the FR, far away from the villages that own them.

6.1.11 Festivals/events

Almost every community celebrates an annual festival. The most common festival is the yam harvesting festival, celebrated either in the village or in the

nearest town. None of the villages performs rites or rituals within the forest reserve.

Yam harvest festival

Krufie, Kwafie, Kwabena, Munufie, Fofie, Djobo and Fodjo are different names for the same festival in which the yam harvest is celebrated. The festival takes place annually between September and December. To calculate the exact date, the communities use the Akan calendar. The general tradition is to remember the ancestors on this day and to ask them for protection and guidance of the village. The opportunity is also used for settling disputes and pacifying the community, and to discuss the future strategy of the village. Some villages have additional ceremonies that they perform on this festival.

Mpatasie has a ceremony for the birth of Kontokori, the god of stones, on this day, for which a cooked meal and sheep or chickens are sacrificed. For Pepaase, the ceremony takes place in their sacred forest, close to the village, as the people from Pepaase believe that the spirits of the paramount chiefs live there. They sacrifice animals to pacify the ancestors and to support them in their work and provide safety etc. In Akrofo, the festival lasts for about 1 week. In Kotaa, they pacify their gods Tanyaw and Tanduomo and in Namasua they celebrate the god Benyade.

Rituals

The yam festival is often preceded by a worship ritual, in which an animal is sacrificed by a specific person, either the chief's priest or a substitute. In Kotaa, they perform rites to purify the community from sins, after celebrating Munufie. In Akrofo, women are not allowed to eat from the sacrificed meat, and women before their menopause are not allowed to join in the ceremony at all. Men are not allowed to have sex with a woman or else they will be denied to join eating the meat as well. If a man disobeys this rule, he will be possessed by the god Afofu, who will demand you to do things for him before he leaves you. In Meremano the community members pray for the welfare of the community on a selected day at the beginning of the year. This day of worship is called Joybene.

Marriage

In the old days the father would look out for a suitable girl to marry his son. If he found an appropriate party he would approach the girl's father to come to an agreement regarding the marriage. If an agreement is made between the fathers, they gather all of the village elders to assess whether or not everybody agrees with the arrangement. If everybody agrees the father of the boy brings 1 pound, 1 shilling and 2 bottles of drinks to the girl's father to symbolize the engagement. The girl's father then splits the gift in 2 and gives half to his wife's family and half to his own family to make all those concerned aware of the marriage. After this symbolical meeting an official meeting is arranged to give the girl's parents the agreed sum of money and Schnapps.

Nowadays the boy's father doesn't look out for a girl anymore but allows the boy to look out for one himself. When he found someone he likes he talks to her secretly and if she agrees he will discuss matters with his father. If he also

agrees the traditional rites are performed as described above, followed by the usual Christian or Muslim ceremonies.

Funerals

In case someone passes away, the person is brought to a morgue to be conserved until the funeral. The funeral takes place on the day of the burial and the person should be buried where the funeral is held.

All of the villages have their own cemetery. Most villages have a separate area on the cemetery where their own royals are buried. Some also separate the different religions. Pepaase has a cemetery where the royals of Berekum are buried. The cemetery is located in their 'sacred grove', a patch of forest close to the village. When a chief passes away, Berekum and Pepaase join together in his funeral ceremony. Representatives from Berekum bring animals and other food to be sacrificed and then leaves to celebrate the same ceremony within the town Berekum. The village people in Pepaase then sacrifice the animals from Berekum and drink water from a cup that is kept at the sacred forest.

6.1.12 Taboo days

Taboo days are days on which the communities pay respect to the local gods. Each community has their own traditions regarding the days they respect and rules that apply on these days. A taboo day generally involves restrictions on work/farming or entry to specific areas. If a taboo day is not respected, the forest god or god of the land will be displeased and a sacrifice has to be made by the priest in the form of a sheep/goat /chicken. Below is a description of the different taboo days that apply in the fringe communities of Tain II Forest Reserve and a table depicting the specific days that apply in each of the communities (Table 17).

Benada and Fiada

These are weekly taboo days that occur on Tuesdays (Benada) and Fridays (Fiada). On these days, community members are not allowed to work on their land and/or in the forest reserve in order to pay respect to the local gods. The extent to which the rules and regulations for taboo days are respected or not differs per community. Usually the days coincide with market days (Friday in Seikwa, Thursday in Berekum), which makes it easier for people not to farm on that day. Depending on the village either one or both of the weekly taboo days is/are respected. In case both days are respected, one day will apply to entering the forest reserve specifically and the other to the farmland. In some of the villages rites for the gods are performed on Fiada by pouring libation (Pepaase, Mpatapo).

Foda and Nchinda

These taboo days follow the Akan calendar, which means that they occur every 6 days, possibly coinciding with the weekly taboo days. Nchinda takes place 3 days after Foda and is respected in different parts of the district. On both Foda and Nchinda people from the village are not allowed to cross or

work near a specific river or tributary, depending on the village that you are from. For the fringe communities of the forest reserve this usually mean that they are prohibited to enter the reserve. This mainly and in some of the villages only (Pepaase, Mpatasie, Dadease) applies to women, mainly during their menstruation. Men are generally allowed to cross the river and in some cases have no restrictions to farming or working at all. In Nfodwokrom, women were not allowed to cross the river on Foda as they had to enter the water, but now that they built a bridge the restriction has been abolished.

Kuda-Pakuo and Kwabena

Apart from the weekly taboo days, some villages also adopt additional (two) monthly traditional days to respect the god of the land. Kuda-Pakuo takes place on a Wednesday if Foda falls on a Sunday, following the traditional Akan calendar. In effect this means that it is celebrated every 49 days of our Western calendar. Kwabena follows the same schedule but takes place on Tuesdays when Foda falls on a Friday.

Table 17. Taboo days per village

Village	Benada	Fiada	Foda	Nchinda	Kuda-Pakuo	Kwabena
Akrofo		X	X		X	
Arkokrom		X	X			
Asantekrom		X				
Dadease		X	X	X		
Domeabra/ Ampenkrom	X	X	X		X	
Kojoakokrom		X	X			
Kotaa	X		X		X	
Kutre 1		X	X	X		
Kutre 2						
Meremano				X		
Mpatapo		X				
Mpatasie	X		X			
Namasua		X	X		X	
Nfodwokrom	X	X	X		X	X
Oforikrom	X					
Pepaase		X	X			
Tainso	X	X	X			

6.1.13 Concerns and expectations

During group discussions, community members were asked to express their expectations and concerns about the proposed project of Form Ghana coming to Tain 2 Forest Reserve. The overall impression of their reaction was positive. Most communities expressed their excitement about the employment opportunities and were understanding when it came to the restrictions on farming in the plantation. As the people from Domeabra said it; the government allocated the land to Form Ghana, so all the company could do is to inform the

village about this agreement, and so they did. The village can only hope that the company will be forthcoming in their relation with them.

Concerns

The main concerns expressed by the communities can be divided into four categories; skepticism regarding the promises, deprivation from employment, people coming to settle in the area and loss of income to farmers. A general remark that describes the historical skepticism surrounding 'white man's' projects is that they often come and destroy the land without compensating the local inhabitants.

More often though, the skepticism originated from recent experience with other projects. The Highly Indebted Poor Countries (HIPC) program initiated a reforestation project in Tain II Forest Reserve that has caused some suspicion regarding new initiatives. Many people employed by as part of the HIPC Teak reforestation project have never received their payments and the program ended after a couple of months only. Another cause of suspicion is the Modified Taungya System implemented by the Forestry Commission. Farmers that join this system plant and maintain Teak seedlings in the degraded parts of the forest reserve. In exchange for their services the farmers are allowed to plant their crops between the rows of seedling, so within FR boundaries, and they are promised to receive a share in the revenues from the logged trees. Many farmers engaged in this system, but they found that Forestry failed to keep their promises, like handing out cutlasses and Wellington boots. The share in the revenues was often never paid to them. This makes them worried about the Teak trees they planted recently (5-10 years ago) as part of MTS. What will happen to these tree; can they expect any revenues from their efforts?

Other skepticism concerns the company itself. People wondered if the contract between Form Ghana and Forestry would be affected by the upcoming elections, and if the company had anything to do with the current and previous deforestation of the area, facilitating plantation establishment. Others were afraid that the company would not be able to provide any work after closure of the canopy. Generally there was some concern that the issues raised in the group discussion would never reach the company's management.

All communities were positive about the employment generated by the company. People were very anxious to be included in the recruitment and afraid to be overlooked or discarded for any reason. Main reasons they could think of that would cause exclusion were the remote location of their village, the lack of proper roads or bridges to access the reserve. As we explained that the company would be based in the Berekum area, communities located far away from Berekum worried that the company would employ people from Berekum only, and that by the time they reached the other side of the reserve the company wouldn't need employees anymore. Many people were also concerned that the company would bring in their own workers instead of hiring people locally. Other concerns included that only educated laborers would be hired, that physically disabled people would not be able to work in the field, that employment would be based on political preference and that the villages not in-

cluded in the impact assessment would not be included in the recruitment. School going youth worried that they would not be able to combine their school with a job at the plantation. Women asked how they could work in the forest when they weren't allowed to cross the river (either because of Foda or because they were having their period).

A widespread concern throughout the fringe communities was that the company will attract people from other places to come and settle in their villages. This would cause a number of problems, including a shortage of water, and outbreaks of foreign diseases. The workers are also likely to make the girls in the village pregnant without taking their responsibility afterwards.

The general perception is that the coming of Form Ghana will mean a loss of income to the farmers farming on plantation grounds. Farmers fear that they will have to abandon their farms either immediately or eventually. Immediate eviction would mean that they lose their current harvest, eventual eviction means that their land is lost and they will have no means to feed their families. Even if the farmers are allowed to stay they will still encounter a great number of problems because of the restrictions posed by the company. Farming in the reserve without chemicals (fertilizer, herbicides, and pesticides) is considered devastating for their yields. Farmers are afraid that the company will not weed properly and that the company's workers will disturb their farms. Farmers outside the reserve worry about the Fulani cattle coming to their lands when they are pushed out of the reserve. Other concerns are the destruction of cocoa plantations within the reserve boundaries, restrictions for entering the reserve, eviction of all Northerners living around the reserve and destruction of the roads due to heavy use by plantation traffic. An illegal chainsaw operator expressed his concern that he would lose his job.

Expectations

Farmers expect that the company will provide certain goods (weedicides, cutlasses, and Wellington boots) or rewards in exchange for their services to maintain the Teak seedlings, as they were used to with the Modified Taungya System in the 1970's. They also expect the land to be cleared for them before they start planting their crops. Communities also expect to benefit from the company through royalties, establishment of boreholes, assistance with educational and medical facilities, establishment of 'white man's toilet facilities' (Kumasi Ventilated Improved Pit locally known as a KVIP), electricity, entertainment for children (toys, footballs) and improved infrastructure (roads, bridges). The company is expected to care for the communities once workers from these communities are employed by them. Social programs will be designed based on Form Ghana's experience in Akumadan. Some even expected the company to be more aware of the villages' needs than the villagers themselves, drawing from this experience. The social and economic situation is likely to change as employment generated by the company will attract people from outside to live in the villages surrounding the FR, bringing more business to the villages. Women see business opportunities preparing meals for the workers. The community members expect the company to come to the villages and explain about the employment opportunities.

Based on a previous visit of Form Ghana representatives, the Oforikrom chief expects that the company intends to establish their nursery in his village. He expects that this means that the company will be based in Oforikrom, constructing their office buildings there as well.

The opinion leaders in Meremano are under the impression that the Forest Reserve would be reallocated to the traditional owners after 99 years of ownership by forestry. They wonder how forestry will fulfill this promise now that the company will plant trees there.

Questions raised in group discussions

Many questions are raised in the group discussion about the detailed working conditions the company will provide; health insurance, food, pension, benefit sharing, policy concerning female employees, working hours, holidays. Farmers are interested to know how many acres they can get to farm on, what will happen to the admitted farm areas and whether they will be allowed to burn their land as long as the company is not operational in their area yet. The most frequently posed question was: when will the company start?

Experience with other companies operational in Tain II FR

Some negative aspects were mentioned regarding the experience with companies that are/have been operational in the forest reserve previously (Table 6). Some of the villages reported that they received no benefits at all from any of the companies, and the smaller communities never even interacted with them. These villages complain that they never received any benefits in return for the destruction of the forest reserve and the access roads by the logging companies. Others have been visited by companies but complain that the companies were never clear about details on land ownership, benefit sharing and duration of their stay. Companies that brought their own workers to the site caused problems with their employees impregnating the girls in the village without taking their responsibility. These villages now have many bastard children to care for.

Some companies drew specific negative attention of the communities. OTI Yeboah Complex Ltd. was observed to log illegally. Anthony Sawmills Ltd. (SAC) did not cooperate with the road construction and was reported logging outside of the reserve, destroying people's farmland. In response, the farmers shot their catapults at the chainsaw operators. The major complaint of the inhabitants of Kotaa concerned the former chief. He resided in Berekum and was suspected of secretly taking a share of the benefits that companies provided for the village. It was assumed that only 25% of the benefits ever reached the community.

Positive experiences came mostly from Asuo Bosoma Timber and Sawmills (ABTS), providing street lights and electricity poles, grading roads and constructing a chief's palace and a primary school. Other benefits from non-specified companies include financial help to communities, provision of plywood, cement, iron sheets and other materials. The Japan International Cooperation Agency (JICA) employed farmers to plant Teak.

Table 18. Companies and organizations previously and/or currently active within Tain II Forest Reserve.

Logging companies	Anthony Sawmills Ltd. (SAC)
	Asuo Bosoma Timber and Sawmills (ABTS)
	Bondplex Company
	John Bitar Company Ltd. (JCM)
	Logs & Lumber Ltd.
	OTI Yeboah Complex Ltd.
	Scanstyle Ghana Ltd.
Organizations	Sunstex Company Ltd.
	Japan International Cooperation Agency (JICA)
	Highly Indebted Poor Countries (HIPC)

6.1.14 Discussion socio-economic study

The results show a few interesting aspects of the socio-economic situation around Tain II Forest Reserve. The overall picture is that the villages in the Berekum area are more developed than those located close to the Forest Reserve with electricity, paved roads, bore holes and town facilities like hospital and schooling close by. The villages located close to the Forest Reserve are more remote and attract migrants from the north of Ghana, because they can find farmland available within the reserve. Education level in these villages is lower and the villages are less developed. Houses in these communities are often constructed from clay with thatched roofing instead of the brick or block buildings found close to the town of Berekum. Despite this less wealthy appearance, the size of the farmland of farmers within the forest reserve is considerably larger than the average farmland outside the reserve and the production in the reserve is higher. This may be explained by the uncertainties regarding the illegal farmland, which makes it likely that the farmers aim at a high production at the short term, taking into account the risk of eviction.

In general, migration seems to be a peaceful matter. The migrants are often separated from the native population within the village, both spatially and socially (language, religion) and there was little contact between the different ethnic groups but their settling is accepted by most of the inhabitants. For the social survey team it was difficult to approach the migrants; they were generally more suspicious about the questionnaires than the native inhabitants and their Twi was not always sufficient.

The migrant nomadic tribes were a different story. The Fulani herdsmen, herding cattle for a powerful private investor in Berekum, caused a lot of problems and conflicts in the area. The most heard complaint of the farmers was that the cattle damaged their crops, but there are many more effects attributed to the cattle. The most severe consequence is the pollution of water sources. Many of the communities bordering the Tain River used this as their main source of drinking water. In the dry season, the river dries out except for some natural reservoirs where water can be collected. Both the communities and the cattle are dependent on this water for their survival, but the pollution caused by the cattle (feces, erosion, and sedimentation) affects the water quality, endangering the people's health. The community members find it difficult to approach the Fulani, saying that they are not willing to communicate or even react violently.

Another important observation in the region is the fact that people have recently started planting cocoa again. This was a common crop to cultivate some decennia ago, but due to the high frequency of wildfires it was not profitable anymore. The fact that people are confident enough to invest in a long-term crop like cocoa is attributed to a reduction in wildfires according to the fire service as well as many of the respondent farmers. This reduction is said to be the result of increased efforts of the fire volunteers in the fringing districts of Tain II Forest Reserve. So far, only very few cases have been reported in which farmers started a cocoa farm within the forest reserve.

7. THE TEAK PLANTATION PROJECT DESCRIPTION

7.1 Project location

The proposed project site is located in Tain Tributaries Block II Forest Reserve, further referred to as Tain II Forest Reserve (TFR) in Berekum District, Brong Ahafo region. Tain 2 FR lies around a grid reference of 7N35, 2W30. The forest area is 409.2 km², with a perimeter of 269.43 km.

7.1.1 *Design Concepts*

Plantation design is based on the experience of Form Ghana and Form international with the establishment of plantations.

Areas that still have sufficient stocking of the original forest vegetation (closed canopy) are protected by keeping out fires and planting indigenous trees around them. Also, around water bodies 30 m wide buffer zones are created by planting indigenous trees. On the remaining suitable locations, Teak will be planted. Teak can only be successfully established on good soils with adequate (1.5 to 2 m) rooting depth and sufficient chemical richness in areas with at least 1,200 mm of annual rainfall and a dry season of about 5 months.

Planting is done in compartments of 128 hectares which are subdivided in blocks of 64 hectares. Around the blocks, roads are constructed for transport of personnel, equipment and for evacuation of timber. Planting is done in April and May, at the beginning of the large rainy season.

Teak is best planted, after thorough terrain preparation, at 3 m distance between the trees resulting in about 1,111 trees per hectare. Thorough terrain preparation consists of weeding, where possible ploughing, demarcation and pegging. Planting is done with stumps, which are uprooted and trimmed seedlings of at least 8 months old. Indigenous trees are planted as potted seedlings at a spacing of 3 m by 3 m.

After planting, the terrain should be farmed by intercropping with beans, groundnuts, jams or maize. If intercropping is not possible, regular weeding (manual and chemical) has to take place to avoid, at all times, that weeds compete with the young Teak trees.

The resulting plantation will consist of blocks of Teak (90% of the area) with roads around the blocks and patches of indigenous forest with indigenous plantations around them (10% of the area).

7.1.2 *Compartments allocated for plantation development*

Plantation development will take place in the compartments indicated as Block A, B and C on the map in figure 2. The proposed works in these compartments will consist of:

1. delimitation of planting areas;
2. construction of plantation roads;

3. construction of a site (offices, workshops, training centre, power house, fuel station and dispensary as well as residential houses);
4. creation of dryland nurseries for the growing of Teak stumps;
5. clearing of grassy vegetation, removal of dangerous (risk of toppling) trees, removal of small individual trees;
6. staking out of the area for planting (pegging);
7. digging holes and planting stumps or seedlings;
8. weeding (manual and chemical) up to 7 times per year;
9. thinning of the Teak stands at ages 4, 8 and 12 years;
10. final felling of Teak stands at 20 years and removal of harvested logs to an off-site location for further processing.

Planting will take place at a speed of 1,500 to 2,000 hectares per year.

7.2 Availability of project inputs

7.2.1 Planting material

The main inputs for the project are Teak stumps and potted seedlings of indigenous trees. These are produced in the Form Ghana nursery at Akumadan and in a dryland nursery located at the Berekum site. The annual need is about 3,000,000 seedlings / stumps. These can be readily produced in the nurseries.

7.2.2 Water

In the Akumadan nursery water is used for irrigation purposes. This water is taken from a stream which flows past the Akumadan nursery. Annual intake of water is about 30,000 m³. The nursery of Tain is rain-fed and uses no additional water.

7.2.3 Equipment

Equipment for the project is either locally sourced or imported. The equipment to be used include but is not limited to the following:

- 5 ton trucks (6)
- Tractors (4)
- Pick-ups (5)
- Towed grader (1)
- Motor bikes (8)
- Bakkie sakkies (fire-fighting equipment) (4)
- Fire towers (5)
- Containers (6)
- Chain saws (20)
- Solar system
- Water drums
- Safety gear
- Small materials such as cutlasses, pruning shears, paper and pens
- Spares for equipment

7.2.4 Site establishment

The company will search for appropriate land and engage a contractor to set up the company site to house among others the following:

- Offices
- Workshops
- Stores
- Fuel storage
- Truck / tractor parking yards
- Nursery
- Management residential quarters

7.3 Project implementation schedule

To make clear what Teak plantation establishment will entail in the case of Form Ghana, a description is provided of the various activities and a planning is provided for the plantation establishment

The planning for the implementation of the project covers several years. Form Ghana is leasing an area of 14,596 hectares which will be planted at a speed of 1,500-2,000 hectares per year.

7.3.1 Project activities

Terrain preparation: Terrain preparation is done in several separate activities; land demarcation, land clearing, spraying, ploughing, road construction and pegging.

Land demarcation: This activity consists of the measuring and marking in the field of planting blocks. The work consist of tracing lines using compass and GPS. Along the lines pegs are planted and the vegetation is cut with cutlasses.

Land clearing: This work consist of manually cutting weeds and bushes as well as the removal of small trees with chainsaws. When needed the cut vegetation is burned to provide clean terrain for ploughing and subsequent work.

Spraying: This is the application of glyphosate on the weeds that sprout again after land clearing.

Ploughing: This activity consists of opening up and turning the soil with a tractor pulling a disc plough. Ploughing can only be done in areas with few tree stumps present, and where the soil is of a type allowing it. Some soil react to this activity by severe concretion forming.

Road construction: This work consists of the removal of the top layer of the soil in a straight line to a width of 6 meters. This work is done using a Bulldozer. The removed soil is pushed to the side of the road. The profile of the roads is rounded with a drainage ditch to either side. At regular intervals exit drains are created to allow water to drain of the surface into the vegetation on the

site. Drains are made in such a way that drainage of water directly into streams is avoided.

Plant production: Plant production takes place in the nursery. The nursery at the site is a rain fed nursery, which means no irrigation takes place. Each year the terrain for the nursery is cleared of weeds, plowed and beds are created by creating footpaths every 1 by 5 meters. The seeds are then positioned in rows 10 centimeters apart and 15 centimeters apart in the row. Weeding is done every month. Spraying is only foreseen when insects or fungi attack the plants.

Pegging: This activity entails the placement of sticks at intervals of 3 by 3 meters in the terrain. It is done to provide a regular grid based on straight lines on which to plant trees. The sticks for this work are collected in the surroundings and are often made of Bamboo or Raphia.

Planting stumps: Stump planting consists of digging a small hole of 20 centimeters diameter and 25 centimeters depth. In this hole a stump is placed in an upright position, and the soil is filled back into the hole around it. After filling the soil is compacted by the workers using their heel.

Planting polybags: Indigenous trees in polybags are planted in a fashion similar to the planting of stumps. It is done by digging a small hole of 20 centimeters diameter and 25 centimeters depth. In this hole the polybag is placed in an upright position. The polybags is removed from the root ball of the plant, and the soil is filled back into the hole around it. After filling the soil is compacted by the workers using their heel. Polybags need to be collected from the field and be disposed of in an environmentally acceptable way.

Weeding: weeding consists of the removal of vegetation growing up around the Teak or indigenous trees. This needs to be removed in order to avoid competition. A few different techniques will be used, such as bush knife weeding (done by teams wielding bush knives), chemical weeding with glyphosate (done by teams using droplet applicators) and circle weeding (done by teams using hoes to scrape the soil in a circle around the young plants).

Pruning: the branches that the tree produces have to be removed at regular two year interval. Trees can be removed to a height of about one third of total tree height. Taking of more branches reduces the growth speed of trees. Work is done manually using telescopic hand saws.

Thinning: When the trees grow they start competing with each other for space and resources such as nutrients, water and light. In order to assure continued growth part of the trees will need to be removed. These trees are sawn down using chainsaws or harvester machines. The first thinnings have no commercial value and are left to decompose and enrich the soil. In subsequent thinnings the stems are taken to the road side for loading on trucks.

Final felling: At the end of the rotation the trees will be harvested. This activity consists of the felling and cross-cutting of the trees. This activity will be done using harvesters.

Monitoring: The project activities and intended results are monitored according to a pre-defined plan (see monitoring plan) to see how effective project implementation is and whether the intended results (growth, biodiversity development etc.) are achieved. Monitoring can consist of measurements in plots (in Teak or indigenous planting for instance), inventories (biodiversity studies) or regular checks (cleanliness of the site, waste disposal etc.).

Waste disposal: Waste produced during all processes of the company is sorted and disposed of in a way depending on the nature of the waste. Waste like paper and plastics are burned and the ashes burned. Used oils are stored and sold, old tires can be sold or stored (see waste disposal protocol).

7.3.2 *Project planning*

In 2012 the work in the field will consist mainly of doing surveys to get information for the planning of the work. Surveys will also be done for the Environmental and Social Impact assessment. These are flora and fauna surveys and socio-economic surveys. Terrain is selected for planting in 2013. Works start to set up an office, workshop, a nursery and to bring the roads into a motorable condition.

In 2013, the logistics are further improved by road construction and maintenance. The terrain is prepared for the first planting. Plants for this planting exercise are produced at the Akumadan nursery. A first area of about 650 hectares will be planted with Teak and indigenous trees. A temporary office will be created in the village of Kotaa by renovating the chief's palace and by placing a water pump. A plot of land will be looked for to create a permanent site. The site will be disclosed to the public to make sure all people having claims to the land are found and negotiations with them can be started and completed. A temporary dryland nursery will be created and sown. Terrain preparation will start in the area to be planted in 2014.

In 2014, an area of 2,000 hectares will be planted. The places that were planted in 2013, where success is low will be replanted (beating up). Weeding will be done in the areas planted in 2013 and 2014. A permanent site including offices, residential buildings, dispensary, storerooms, fuel tanks and workshops will be constructed. Roads will be constructed in the areas to be planted. A temporary nursery for the planting of 2015 will be created and sown.

Table 19. Implementation schedule for forest plantation project.

Activity	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Terrain reconnaissance	█																						
Environmental and Social Impact Assessment	█	█																					
Creation temporary office and workshop in Kotaa	█																						
Building of permanent site			█																				
Terrain selection for planting	█	█	█	█	█	█	█																
Terrain preparation for planting		█	█	█	█	█	█																
Road construction & maintenance	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Planting		█	█	█	█	█	█																
Beating up			█	█	█	█	█																
Weeding		█	█	█	█	█	█	█	█														
1st uncommercial Thinning						█	█	█	█	█													
2 nd commercial thinning										█	█	█	█	█	█								
3 rd commercial thinning													█	█	█	█	█	█	█				
Final harvest																						█	

Table 20. *Planning of planting.*

Planting year	Area Teak to be planted (ha)	Area indigenous to be planted / managed
2013	650	70
2014	2,000	200
2015	2,000	200
2016	2,000	200
2016	2,000	200
2017	2,000	200
2018	2,000	200
2019	614	61.4
Total	13,264	1,331.4
Grand total		14,595

8. Project alternatives

To properly evaluate the impacts of the proposed activities they have to be weighed against alternative scenarios such as not implementing the project or implementing the project on another site or with different tree species. The following alternative scenarios are described in this chapter: indigenous tree plantation, other project site and no project.

8.1.1 Indigenous tree scenario

Form Ghana has investigated the possibilities of plantation establishment in Ghana in depth. Experience gained through projects executed by Form international in Cameroon and Ivory Coast has shown that the establishment of plantations with indigenous species is feasible. The growth of indigenous species in Ghana is unfortunately mostly unknown. Very little literature is available on the growth of species such as Ofram (*Terminalia superba*), Emeri (*Terminalia ivorensis*), Wawa (*Triplochiton scleroxylon*) and Papao (*Azelia africana*). Experience in Ivory Coast and Cameroon has shown that growth is slower than that of Teak. When looking at market prices for logs another problem manifests itself. The price of Teak is about €300/m³ for saw logs. For plantation saw logs of Wawa (*Triplochiton scleroxylon*) or Ofram (*Terminalia superba*), this price is ca. €50/m³. Prices are derived from the quarterly ITTO Market Information System report of March 2008. With the lack of information on one hand and the lower prices for the produce on the other hand it is impossible to produce a bankable proposition for reforestation with indigenous trees. This is why the option of planting indigenous trees solely is not viable.

From the ecological perspective there are both advantages and disadvantages to planting indigenous trees on a large scale. Indigenous trees represent components of the original ecosystem in an area and as such can potentially play an important role in the preservation of the local genetic variety of these specific tree species. Also many species of both flora and fauna may be linked to the indigenous species and planting them on a larger scale may help in their preservation. As none of the cited species are important fruit trees for larger fauna such as mammals, their role in the preservation of these species is probably very limited, but smaller mammals may make use of them for shelter or eat the leaves. Species such as insects pollinating the trees or living of the foliage will probably benefit from the planting of indigenous trees.

Risks associated with the planting of indigenous species include outbreaks of pests and diseases. Pests that occur incidentally in the natural habitat of the planted trees may develop into large-scale pest outbreaks in monocultures. Experience from Ivory Coast has shown that large scale plantations of Emeri and Ofram (*Terminalia ivorensis* and *Terminalia superba*) suffered from defoliating insect attacks. Chemical interventions were needed to avoid losing the plantations (Kanga & Fediereb, 1991). As an exotic tree, Teak suffers from very few pests. Experience from the same area has shown that the susceptibility of many indigenous species to fire is a major risk. The large-scale forest fires that occurred during the 1983 to 1985 destroyed large tracts of indige-

nous plantation (Zobi et al, 2012). Mature Teak is fire-resistant. In Ivory Coast this was a reason for the large scale development of Teak in plantations.

The long rotation cycle of most of the indigenous trees species increases the risks associated with indigenous tree plantations.

From a social perspective no difference is expected between a plantation of Teak or indigenous trees, unless species are selected that provide fruits or other services to the people living close to the plantation. For instance, the bark of Mahogany (*Khaya ivorensis*, *K. anthotheca* or *K. grandifoliola*) has a medicinal value and can be used as a dye (Aku Diame, 2010). This species can however not be planted in monocultures due to the shoot borer *Hypsiphila sp.*

8.1.2 Other site scenario

Form international has conducted extensive research into alternative sites for planting. With the objective of planting Teak in mind, several Forest Reserves were assessed for suitability. The area should be a Forest Reserves because the legal status and ownership status of Forest Reserves is clear. The development of plantations in private land is possible but there is a large risk of problems with land ownership and conflicts over land. Private land is typically in the hands of many land owners and even with all caution and good conduct it is difficult to avoid conflicts over land ownership. Some land owners can be absent for longer periods of time which makes it extremely difficult to assure all landowners are heard before a land transaction is made. Form Ghana therefore chooses to work on Forest Reserves only.

The following criteria were used to assess for suitability:

- The site should have a rainfall of between 1200-1500 mm per year with a dry season of at least five months.
- The soil should be deep and fertile.
- The soil should ideally consist of a mixture of clay, loam and sand be of neutral pH.
- The area should allow work for several years and therefore not be smaller than 1500 hectares, though with the development of the company the minimum size is now at least 5000 hectares.

Several pieces of land have been investigated for the suitability for planting Teak before selecting the current areas. For instance, extensive research has gone into the Bandai Hills Forest Reserves in 1998-1999. The Pru Shelterbelt Forest Reserves has been studied in 2010-2011. The studies consisted of site visits by experts (soil specialists, plantation specialists) who produced reports concluding the sites were not suitable for planting Teak. FORIG has also studied the Forest Reserves that are in need of regeneration to see which are the most suitable for planting Teak. Both of these Forest Reserves did not meet the criteria established by Form. The reserves currently planted by Form have undergone similar scrutiny and were found to be suitable for planting.

8.1.3 No project scenario

Before Form Ghana became active in the Forest Reserves, it was severely degraded due to several factors: illegal farming, illegal chainsaw operations and overexploitation by logging companies. Despite the illegal nature of these activities, they continued unhampered due to lack of law enforcement. In a no-project scenario we have no reason to assume that this situation would change. If Form Ghana were not to plant the Forest Reserves, but left them as they were, forest cover would not be restored. Bush fires and agriculture would maintain the land in a savannah condition. Farmers could continue to farm there illegally with a constant risk of eviction when the law gets enforced. Degradation of the site would continue unhampered as chainsaw loggers are likely to continue to harvest the remaining trees that can be sawn into boards. The annual fires would continue to blaze through the area, reducing the vegetation and impoverishing the soils by degrading the soil moisture content and the destruction of the soil organic matter. Water quality would continue to degrade as a consequence of bush fires and farming practices. Some of the smaller streams may even cease to exist. Concerning wildlife, only animals that thrive in open agricultural land / savannah vegetation can continue to thrive in such an environment, though the hunting pressure would keep the numbers of the larger species down. Rare plants and animals that were living on the remnants of the original vegetation would disappear as these woods are cut for creating new agricultural land.

9. Social and environmental impact assessment

This chapter lists the various (potential) impacts of the proposed reforestation project on the various environmental components: the ecology, hydrology, soil and socio-economic situation of the project-affected area. For every component, the negative and positive impacts are summarized in a table and the importance of the impact is analyzed. Further explanation of the impact and importance is given in a description below the table. A distinction is made between the impacts originating from the forest plantation establishment and the impacts that entail the construction of the support facilities (buildings, roads, etc.).

9.1 Impact analyses

9.1.1 Impacts from forest plantation establishment and management

Ecology

Table 21. Negative impact of plantation establishment on the ecology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Loss of habitat	Local	Short term	Low	Low	Definite	Minor
	Biodiversity reduction	Local	Temporary	Low	Low	Likely	Minor
Road construction	Habitat fragmentation	Local	Long term	Low	Medium	Unlikely	Minor
	Improved access to natural resources, leading to illegal activities in the forest reserve	Local	Long term	Low	Medium	Unlikely	Minor
Planting <i>Tectona grandis</i>	Disturbance of balance in local ecosystem	Local	Short term	Low	Low	Definite	Minor
	Introduction of exotic pests and diseases	Regional	Permanent	Medium	High	Unlikely	Moderate
	Landscape disturbance	Regional	Short term	Medium	Medium	Definite	Moderate
Silvicultural interventions	Habitat disturbance	Local	Short term	Low	Low	Likely	Minor

(i.e. thinning, pruning, weeding, use of Roundup)	Environmental damage	Local	Long term	Low	Medium	Unlikely	Minor
	Cumulative effect of Roundup	Regional	Long term	Medium	Medium	Unlikely	Minor

The negative impact of most of the project activities on the ecology does not exceed project boundaries. However, planting can have effects on a regional level as it may introduce new pests and diseases, which will not be contained within the project boundaries. The current savannah landscape will be disturbed upon project establishment, which must be seen at a regional level, since part of the region will be transformed from savannah to plantation forest.

The only permanent risk is the introduction and/or spreading of pests and diseases, which will not cease after project closure. This is however unlikely because Teak is already a common plantation species in Ghana before project establishment. The impact is therefore rated as moderate.

The project will definitely cause disturbance in the landscape in the balance of the local ecosystem, as well as a loss of (savannah) habitat because the degraded land will be transferred into plantation forest. However, a new balance will be established after plantation establishment, with a closer resemblance of the original forest ecosystem, so the disturbance is short term. Also, land conversion will be gradual, allowing time for fauna species to find alternative habitats and for people to slowly get used to the forest plantation landscape. Both impacts are therefore classified as moderate.

It is likely that the disturbances of the project area will lead to a temporary loss of biodiversity. It is expected that after the establishment phase, wildlife will return and new flora and fauna species will get the chance to colonize the project area. The establishment and improvement of roads may lead to a better access to natural resources within the reserve. This could lead to an increase in illegal activities like logging or poaching. However, the project arranges for a security system that will control the access road and the activities within the reserve. It is therefore unlikely that illegal activities will increase with project establishment.

Chemical weeding with Roundup is allowed according to the guidelines of FSC. However, the cumulative effect of repeated use of Roundup may still cause environmental damage. Many studies have been done on the properties of Roundup, the way it remains in the environment and the negative side effects. For the acceptance of Glyphosate on the European Union market, these studies

have been reviewed¹. The product has been accepted for use in the European Union. The studies cited in the admittance file have shown that Roundup is immobilized in the soil, and is not easily mobilized again. As a consequence it is unlikely that the active component moves to water bodies. As an active component in the soil or in water bodies, Roundup can have a negative effect on soil and aquatic organisms respectively. How long Roundup continues to exist as an active component varies per soil type and climate. In hot climates it may degrade relatively fast. In the study for the acceptance of round-up in the European Union, different persistence periods in the soil were found ranging from 1 day (Texas, 7 days Ohio to 130 days in Iowa. It can be assumed that in a tropical climate, a similar or even shorter degradation time would apply. Considering the low leachability and the time it takes to degrade as well as the limited time glyphosate will be used for weeding (during three years per planting year) it is unlikely the chemical builds up in the soil.

Form Ghana makes use of droplet applicators. This has two major advantages: 1) the product is applied on the leaves of plants, not on the soil and 2) the product is used in a very effective way, so the used quantity is minimized.

The relatively short degradation time combined with the droplet applicator make it unlikely that cumulative effects of Roundup should affect the environment.

¹ see http://ec.europa.eu/food/plant/protection/evaluation/existactive/list1_glyphosate_en.pdf

Table 22. Positive impact of plantation establishment on the ecology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Planting <i>Tectona grandis</i>	Reduction of wind erosion	Local	Permanent	Low	High	Unlikely	Moderate
	Reduction of pressure on natural forest for timber	International	Permanent	Medium	High	Unlikely	Moderate
	Carbon sequestration	Local	Short term	Low	Low	Definite	Minor
	Improvement of micro-climate	Local	Long term	Low	Medium	Unlikely	Minor
Planting indigenous trees in plantation	Increased conservation value	Local	Permanent	High	High	Likely	Major
	Increased biodiversity	Local	Long term	Medium	Medium	Likely	Moderate
Buffer zone restoration	Provide refugia for wildlife population	Local	Long term	Medium	High	Definite	Major
Wild-fire control	Decrease fire hazard	Regional	Long term	High	High	Definite	Major
Monitoring and patrolling in the area	Reduced hunting/poaching activities	Local	Short term	Low	Low	Likely	Minor
	Protection of natural ecosystem	Local	Long term	High	High	Definite	Major
Intercropping	Weed control	Local	Short term	Low	Low	Definite	Minor

Cattle grazing control	Reduction of damage to vegetation	Local	Long term	Medium	Medium	Likely	Moderate
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As part of the project, buffer zones will be enriched and protected, indigenous trees will be planted and the project area will be patrolled to control hunting and poaching. It is likely that this will cause reduced hunting and poaching and increase the biodiversity and conservation value of the area. Protection of the existing natural ecosystems and providing wildlife refugia are definite.

Trees will definitely decrease fire hazard when compared to the current savannah vegetation, which is also expected to have a major impact in the region.

Planting trees guarantees sequestration of carbon. The long rotation cycle will ensure that the carbon is sequestered for a long period of time. And the durable product that is produced with final harvest is likely to be a sustainable source of carbon sequestration. Also, the soil organic carbon is expected to increase. This has been studied for the VCS certification of Asubima and Afrensu Brohuma, the forest reserves previously reforested by Form Ghana.

Reduction of wind erosion may occur when planting on fallow land but considering the dense savannah vegetation on most of the terrain, this reduction is considered unlikely.

Hydrology

Table 23. Negative impact of plantation establishment on the hydrology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Flood incidents downstream	Local	Short term	Low	Low	Unlikely	Negligible
	Increased turbidity	Regional	Short term	Medium	Medium	Unlikely	Minor
	Increase in surface runoff due to the reduction of infiltration and soil erosion	Local	Short term	Medium	Medium	Unlikely	Minor
Usage of Roundup	High levels of chemicals can affect the quality of water, the aquatic life and even the supply of freshwater.	Regional	Long term	Medium	Medium	Unlikely	Minor
	Leaching of chemicals into groundwater and ultimately into streams	Local	Short term	low	low	unlikely	negligible

The negative impacts on the hydrology are all considered unlikely to happen because the buffer zones protecting the water courses are conserved and enhanced. Clearing is done mainly manually, not with heavy machinery. This will not cause the soil to be bare at any moment, which makes erosion unlikely to increase. Cumulative effects are therefore not expected.

Chemicals are used in limited quantities and applied with a drop-applicator, reducing the risk of water contamination. Chemicals used in weeding may leach into the groundwater and could in that way ultimately end up in streams. Round-up is bound to soil particles however and broken down quickly in hot climates. It is unlikely leaching and subsequent pollution of streams will occur.

Form Ghana does not use water from Tain River or any of the side branches for their project activities. The water courses will be actively protected by buffer zones (30m on each side of the water). Farming, cattle herding and other illegal activities that take place within the project area may cause soil erosion. Form Ghana aims at stopping these illegal activities through an extensive security system, with patrols and look-out towers. This may reduce erosion, which will have a positive effect on the transparency of the rivers and streams and may have a positive effect on water quantity over time. It is therefore not expected that turbidity or surface run-off would increase.

Table 24. Positive impact of plantation establishment on the hydrology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Planting in degraded areas	Increase in soil water storage capacity	Regional	Long term	Medium	Medium	Likely	Moderate
	Reduced evaporation	Local	Long term	Medium	Medium	Likely	Moderate
	Moderation of water temperature	Local	Short term	Low	Low	Unlikely	Negligible
	Enhancing aquatic biodiversity	Local	Long term	Medium	Medium	Likely	Moderate
Buffer zone restoration and protection	Protection of water bodies from farming and other human disturbance	Local	Long term	High	High	Definite	Major
Control watering of cattle	Reduction of pollution of water bodies	Regional	Long term	High	High	Likely	Major

A number of positive impacts is expected on hydrology. Major impacts are the reduction of pollution and human disturbance of water bodies, as the project area will restore and protect the buffer zones. This has a large effect, not only on the project site but also further downstream as many communities are dependent on the rivers for their drinking water. They expressed complaints about the decrease in water quality from cattle drinking in the remaining pools in the dry season. This is likely to reduce when the cattle no longer has access to the water due to plantation establishment. If water quality improves due to buffer zone restoration, aquatic life is likely to be enhanced.

Soil

Table 25. Negative impact of plantation establishment on the soil

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Soil compaction	Local	Long term	Low	Medium	Unlikely	Minor
	Soil erosion	Local	Long term	Low	Medium	Unlikely	Minor
	Soil fertility reduction	Local	Temporary	Medium	Medium	Unlikely	Minor
Waste production	Soil pollution by empty containers, agrochemicals, hydrocarbon substances such as oil, grease, lubricant, etc.	Local	Long term	Medium	Medium	Definite	Moderate
Harvesting	Soil fertility reduction	Local	Long term	Medium	Medium	Likely	Moderate

Most negative impacts on the soil are unlikely to happen because site clearance is done manually, not with heavy machinery. This makes soil compaction highly unlikely. The soil will not be bare at any moment so erosion is not likely to increase.

After harvesting and replanting, soil fertility is likely to decrease as nutrients are taken out of the system. This poses a local risk with a long term effect, rated as a moderate risk.

The company will make use of pollutants such as fuel, grease, and chemicals. Compared to the low-intensity land use of farmers now, waste production will therefore increase upon plantation establishment. However, waste production in the area is now uncontrolled. Upon plantation establishment, waste management will become a major point of attention, in order to meet sustainability objectives and FSC requirements.

Extraction of trees is likely to cause exhaustion of soil nutrients over time. However, the first thinning will not be commercial, meaning that the stems will be left in the field. This contributes to soil fertility.

Table 26. Positive impact of plantation establishment on the soil

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Planting in degraded areas	Erosion reduction	Local	Long term	Low	Medium	Likely	Moderate
	Surface runoff reduction	Local	Long term	Low	Medium	Unlikely	Minor
	Increased soil infiltration	Local	Long term	Low	Medium	Unlikely	Minor
	Increase of soil organic matter content	Local	Long term	Low	Medium	Unlikely	Minor
Adoption of Reduced Impact Logging (RIL) techniques (incl. building erosion channels and respecting buffer zones)	Soil erosion control	Local	Long term	Medium	Medium	Likely	Moderate

Tree coverage is likely to decrease erosion at the project site compared to the current situation with savannah and fallow land. Implementation of Reduced Impact Logging practices will likely decrease the risk of soil erosion during harvest. Other impacts, such as reduced surface run-off and increased soil infiltration are less likely to happen.

Socio-economic environment

Table 27. Negative impact on the socio-economic situation

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Land conversion to plantation forest	Loss of farmland	Regional	Long term	Medium	Medium	Likely	Moderate
	Increased risk of poaching	Local	Long term	Low	Medium	Unlikely	Minor
	Crop damage of fringing farmers due to new pests introduced by forest environment	Regional	Long term	Medium	Medium	Unlikely	Minor
Implementing FSC rules & regulations; prohibition of the use of fertilizer, herbicides, pesticides	Reduced production potential for farmers	Local	Long term	Medium	Medium	Likely	Moderate
	No farm produce storage capacity	Local	Long term	Low	Medium	Unlikely	Minor
Commercial exploitation of forest reserve	Perceived inequity; foreigners gain from local land	National	Long term	Medium	High	Unlikely	Moderate
Employment of local people	Exposure to health and safety risks	Local	Long term	Low	Medium	Unlikely	Minor
Increased pressure on road network	Increased risk of road accidents	Local	Short term	Low	Low	Likely	Negligible

	Increased air and noise pollution	Local	Short term	Medium	Medium	Likely	Moderate
Enforcement of the law	Limited access to the forest reserve for Fulani cattle	Regional	Long term	Medium	Medium	Definite	Moderate
	Limited access to water sources for Fulani cattle	Regional	Long term	Medium	Medium	Likely	Moderate
Work related injuries	Work with power tools, sharp tools, chemicals and in snake rich environments can cause injury to people	Local	Long term	Medium	Low	Likely	Moderate

The project will cause loss of farmland of farmers that are currently farming inside the forest reserve. Even though farming inside the reserve is illegal and farmers are aware of this, it is still likely to have a negative impact on the socio-economic situation in the region. According to the social survey conducted for this report, 13% of the interviewed farmers farmed on the reserve. Another 13% farmed partially on the reserve. Out of the 781 respondents, 52% was working (406 respondents). Out of these 406 working respondents, 76% was farmer (309 farmers). That means that a total of 40 respondents was farming in the reserve and another 40 farmed partially in the reserve.

The option of temporary intercropping offers the farmers the opportunity to farm legally within the reserve, but there are some limitations and rules set by the company. Farmers will not be allowed to use chemicals so their production potential may be reduced compared to their current farms, and they are restricted in the choice of their crop and they can no longer farm after canopy closure.

On a regional level, people might regard the company as a 'white-man's' operation, bringing wealth to foreigners and not to local people. This is however unlikely because the employees will all be locally sourced.

The company will improve existing roads and construct new roads to access the plantation. This will lead to a higher pressure on the road network, which may lead to more accidents and will definitely cause noise and air pollution.

The Fulani herdsmen expressed their concern that they would not be permitted to cross the project area to reach the water of the Tain River in the dry season. The Fulani will be banned from the project area, which is in line with the applicable forest laws, but it can be questioned whether this affects their access to the river, since the main part of the forest reserve is not part of the project. However, the grazing grounds for their cattle will be reduced.

The company has made an analysis of the different jobs that create risk to the employee (risk assessment). Based on this risk assessment an identification was made of the necessary personal protection equipment and training to ensure safe working conditions (protocols 5, 10 and 11).

Table 28. Positive impact on the socio-economic situation

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Employment of plantation workers	Secured income	Regional	Long term	High	High	Definite	Major
	Reduced dependency on farm produce	Local	Long term	Medium	Medium	Likely	Moderate
	Workers are provided with healthcare	Local	Long term	Medium	Medium	Definite	Moderate
Establish inter-cropping system on the plantation	Reduce illegal farming activities within project boundaries	Local	Short term	Low	Low	Definite	Minor
	Offer security of land to farmers	Local	Temporary	Low	Low	Definite	Minor
	Offer 'free' farmland; no rent, no benefit sharing	Local	Short term	Low	Low	Definite	Minor
Training of plantation workers	Increase local knowledge level	Regional	Long term	Medium	Medium	Likely	Moderate
	Increase chances on labor market	Regional	Long term	Medium	Medium	Likely	Moderate
	Increase security after learning about fire protection	Regional	Long term	Medium	Medium	Likely	Moderate
Land conversion to	Provision of forest	Regional	Long term	Low	Medium	Unlikely	Minor

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
plantation forest	services to local people; game, fire wood, fodder etc.						
	Improved yield of farmland because of improved microclimate; increased humidity etc.	Regional	Long term	Low	Medium	Unlikely	Minor
Infrastructural development	Improved road network, improved connectivity town services	Regional	Long term	Medium	Medium	Definite	Moderate
Reduce activity of Fulani herdsmen	Reduced damage to crops, increased farmers' yield	Local	Short term	Low	Low	Likely	Minor
	Reduced risk of conflict situation	Local	Short term	Low	Low	Likely	Minor

Employment of local people is one of the most important social benefits of this project. The impact of secured income has a high intensity and will have a long term effect, giving an economic boost to the region. Side effects of this impact are a decreased dependency on farm produce and access to health care. Workers are also trained on the job which increases the level of knowledge in the region and increases chances on the labor market for these workers.

The intercropping system has a number of impacts that will definitely happen but have a relatively low magnitude because they are only noticeable locally, have an effect that doesn't exceed project duration and have a relatively low intensity.

The road construction and improvement is likely to improve connectivity between villages and will affect the region on the long term when it comes to transportation of produce, access to schools and health care etc.

The Fulani herdsmen are the subject of a number of complaints expressed by the local communities, causing conflicts on crop damage in the region. Their activity in the project area will be reduced by patrolling and stronger law enforcement, which is likely to lead to a reduction in conflicts and crop damage. However, if the project stops, the impact will no longer be visible.

The plantation forest is unlikely to largely increase the supply of fire wood, game and other forest-related benefits, especially in the beginning. It will take a long time before the plantation ecosystem will have matured enough to provide benefits like an improved microclimate.

9.1.2 Impacts of site construction

Site construction covers the clearing of the land, the building of the offices, residential area, power station, fuel station and stores (see chapter 7).

Ecology

Table 29. Negative impact of site construction on ecology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Loss of habitat	Local	Long term	High	Low	Definite	Minor
	Biodiversity reduction	Local	Long term	Medium	Low	Definite	Minor
Road maintenance	Habitat fragmentation	Local	Long term	Low	Low	Definite	Minor
Building	Creation of building waste	Local	Short term	Low	Low	Definite	Minor
Use of site	Waste generation	Local	Long term	Low	Low	Definite	Minor
	Spillage of chemical	Local	Long term	Low	Low	Likely	Minor

During construction of the site an area will be cleared to make room for the buildings and roads. The total site is about 35.76 hectares. Not all of this will be used for construction. Part will be used as a dryland nursery and parts of the original vegetation will remain and will be actively restored.

A waste management system will be put in place to manage the waste that is created on site. Protocols are put in place to assure safe working with chemicals (phytosanitary products, fuels, oils and greases) to reduce chemical spills to a minimum and assure proper clean up if they do occur.

Table 30. Positive impacts of site construction on ecology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Proper infrastructure for managing chemicals	Reduced spills	Local	Long term	High	Low	Definite	Minor
Proper infrastructure for managing waste	Reduced waste spilling into environment	Local	Long term	High	Low	Definite	Minor
Use of solar power	Reduced emission of greenhouse gas	Local	Long term	Low	Low	Definite	Minor

The construction of a site has the advantage that potential problems can be tackled before they arise. The site has proper facilities for handling chemicals, oils and fuels. The same goes for the waste that is produced by the workers and that result of work (packaging, used oil, batteries etc.).

The site is completely reliant on solar power. It is not connected to the national grid, nor is a generator needed for normal daily use of power. Especially not using a generator in a remote location has positive impact on the carbon footprint of the company.

Hydrology

Table 31. Negative impact of site construction on hydrology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Flood incidents downstream	Local	Long term	Low	Low	Unlikely	Negligible
	Increased turbidity	Local	Long term	Medium	Medium	Unlikely	Minor
	Increase in surface runoff due to the reduction of infiltration and soil erosion	Local	Long term	Medium	Medium	Unlikely	Minor
Handling of chemicals	High levels of chemicals can affect the quality of water, the aquatic life and even the supply of freshwater.	Regional	Long term	Medium	Medium	Unlikely	Minor
	Leaching of chemicals into groundwater and ultimately into streams	Local	Long term	Low	Low	Unlikely	Negligible

The drainage patterns are kept similar to the original, pre-project situation. There is not much difference in the risk of erosion and surface run-off between the pre-project farmland and the site once fully installed, with the exception of drainage water of additional roads and the roofs of buildings collecting water that lands on the soil in a concentrated way. Drainage is designed in such a way that this water will not create erosion on the site.

The site will have the proper infrastructure to deal with chemicals in order to avoid spilling and clean up effectively after a spill occurs.

Table 32. Positive impacts of site construction on hydrology

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Proper infrastructure for managing chemicals	Reduced spills	Local	Long term	Low	Low	Likely	Negligible
Planting of trees and lawns	Reduction of surface run-off	Regional	Long term	Medium	Medium	Unlikely	Minor
	Increased infiltration in the soil	Local	Long term	Low	Low	Unlikely	Negligible

The site will have the proper infrastructure to avoid spilling of waste and chemicals and to avoid spills getting into the hydrological system.

Trees and other vegetation will be planted which can help in reducing surface run-off and help increase infiltration.

Table 33. Negative impacts of site construction on soils

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Site clearing	Soil compaction	Local	Long term	Low	Low	Likely	Minor
	Soil erosion	Local	Long term	Low	Low	Likely	Minor
Road construction / maintenance	Soil compaction	Local	Long term	Low	Low	Definite	Minor
	Soil erosion	Local	Long term	Low	Low	Likely	Minor
Waste production	Soil pollution by empty containers, agrochemicals, hydrocarbon substances such as oil, grease, lubricant, etc.	Local	Long term	Low	Medium	Unlikely	Minor

The spots where roads and buildings are placed will have compacted soil. This is also expected during road construction and building. The whole site will not be subject to compaction as parts are also planted, used as nursery or kept with forest.

The site will have proper infrastructure for waste and chemical management which will reduce the risk of it impacting the soil. Specific protocols are used to structure the handling of chemicals and waste.

Socio-economic environment

Table 34. Negative impacts of site construction on socio-economic situation

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Land conversion to site	Loss of farmland	Local	Long term	Low	Low	Definite	Minor

The location of the site has long been advertised by the placement of sign boards. Active work has gone into finding each owner of land within the location. Each of these has voluntarily sold the land to Form Ghana.

Table 35. Positive impacts of site construction on socio-economic situation

Activity/source of impact	Effects of the impact	Evaluation of the importance of the impact					
		Extent	Duration	Intensity	Magnitude	Likelihood	Importance
Provision of a safe working environment	Reduced accidents	Local	Long term	Low	Low	Definite	Minor
	Increase work appreciation	Local	Long term	Low	Low	Definite	Minor
	Workers are provided with healthcare	Local	Long term	Medium	Low	Definite	Minor
Creation of employment	Jobs related to site maintenance (including housekeeping)	Local	Long term	Low	Low	Definite	Minor
	Jobs related to building	Local	Temporary	Low	low	Definite	Minor

A site creates additional employment both temporary (builders) and permanent (maintenance staff). Also the set-up of a new site allows for careful consideration of safety on the work floor, taking these consideration into account when designing the lay-out of the buildings and the workplace.

9.2 Cumulative impacts

Cumulative impacts can arise when in addition to the proposed project, the presence of other projects or activities in the area creates additional unforeseen negative or positive impacts, for instance by competing for the same land, labor force or water sources or by creating opportunities for, for instance, marketing that a single project could not create.

9.2.1 *Other reforestation projects*

Projects that have similar objectives as the Form Ghana Reforestation activities are:

- The restoration project in Pamu Berekum with a planting target of 800 ha/year for HIPC (Heavily Indebted Poor Countries) funded plantations. As this project focused on a different forest reserve the cumulative impacts between the Form Ghana and the Pamu project are limited.
- A planting target of 1,000 ha/year has been set under the Forest Services Division led modified Taungya system.
- An annual planting target of 20 ha for farmers involved in the IT-TO/FORIG community collaborative restoration project was set. It is not certain what the status of this project is at the moment.
- ABTS is a timber company that planted trees in the Tain II Forest Reserve as well. The company is currently not planting anymore.

9.2.2 *Positive cumulative impacts*

Positive cumulative impacts of other projects in the region can be:

- Additional reforestation activities can contribute to climate stabilization in the area and create opportunities for the timber sector by increasing the production of logs for local use. Then populations of forest animals may also benefit positively from more projects at different locations.
- More reforestation projects in the same area allow more of the students of natural resources management education of the KNUST in Sunyani to find employment in the region thus reducing the “brain drain” of educated people to larger cities.

9.2.3 *Negative cumulative impacts*

Negative cumulative impacts of the proposed reforestation project may be:

- A competition for land may increase the prices for plantation establishment by increasing the prices for land rent.
- It may become more difficult to find sufficient labor when more projects are active in the region.
- The available land for agriculture will reduce in the region when more projects are establishing plantations at the same time.

9.3 Residual Impact

No residual effects of significance is expected after mitigation measures have been properly implemented.

9.4 SWOT analysis

The SWOT matrix below describes the concept of project strengths, weaknesses, opportunities and threats. With respect to the proposed project if any inherent or internal item, issue, plan, strategy, policy or regulation is determined to be a positive component or inclusion to the project then it is described as a strength of the project. If the identified item is determined to be negative and likely to create difficulties for the project then it is an inherent weakness. On the other hand if external provisions (e.g. government policy of reforestation), issue or entity such as traditional authority's concern for the forests, and other regulatory issues or some wider consideration reinforces the proposed project then that is described as positive. Otherwise this situation would be a threat if found to be a negative one (e.g. hostile communities or government legal provision that is against certain or all objectives of the proposed project) and not in the interest of the effective implementation of project strategies or plans. Findings from the SEIA and other wider considerations are considered for this analysis.

Table 36. SWOT matrix used for opportunity analysis

	Positive	Negative
Internal	Strength	Weakness
External	Opportunity	Threat

Strengths

The vision of Form Ghana is to ensure sustainability in ecological, social and economic sense. Strong aspects of the proposed project, in support of the local ecology, are the planting of indigenous tree species in the plantation, restoration and reforestation of the riparian buffer zones, which serve as wildlife refugia, adopting the RIL strategy and avoiding the use of fertilizer and chemical pesticides or herbicides. These measures are likely to result in increased biodiversity and increased conservation value of the project area. The aspired FSC certificate will contribute to the compliance with these objectives.

Social sustainability is incorporated in the proposed project in several ways. The project offers long-term employment to local people (Ogoe et al. 2011). Employees will be provided with proper working conditions, considering health, safety, and sound wages. This provides alternative income for farming, making communities less dependent on their crop yields. Job creation and income security are therefore two of the major positive impacts created by the proposed project. In general, the communities were very positive about the company coming to the area. Many people expressed their interest in employment by the company and emphasized that their village should not be left out when the company was recruiting.

Other benefits to the local socio-economic situation are improvements to the road network and improved knowledge regarding fire combating and other safety regulations. Farmers that illegally exploit the forest reserve will be offered an agreement with Form Ghana to intercrop their own food crops with the freshly planted Teak seedlings. This will reduce illegality and provide security for the farmers within forest reserve boundaries until canopy closure.

The economical sustainability of the reforestation project is guaranteed by a well-designed, low risk business plan that has proved its functionality in already functional projects sites managed by Form Ghana: Asubima and Afrensu Brohuma Forest Reserve.

The creation of a new site has strong advantages on the social level. A new site provides a safe and well organized working space, with due considerations for the environment.

Globally, the project will have a positive effect on the pressure on natural forests for timber production. The natural forest cover decreases rapidly, amplifying the importance of forest plantations.

Weaknesses

The use of chemicals for eliminating weeds is inevitable in the first years of seedling establishment. This causes damage to the environment although the used chemical, Round-up, is allowed by FSC.

The largest part of the plantation (ca. 90%) will consist of a monoculture of *Tectona grandis*, an exotic tree species, creating a landscape that does not reflect the local ecology. This can be considered a decrease in landscape value. However, the natural forest that occurred originally in the project site has been severely damaged or removed completely. The forest that is still present will be conserved and the buffer zones will be reinforced with new seedlings of indigenous tree species to create a mosaic of semi-natural buffer zones, indigenous tree stands and profitable Teak stands. This will mitigate the landscape alteration.

The total area used as farmland in the region will be reduced by project implementation. Although illegal, large part of the project site have been used as farmland for many years. This farmland will be converted to forest plantation when the project is established. Farmers are given the opportunity to do inter-

cropping within plantation boundaries until canopy closure, mitigating the effect of the land conversion. However, after 2 or 3 years, the farmers are still forced to find new farmland or choose to become a plantation worker.

The altered microclimate may attract different micro fauna and fungi, and the prohibition of pesticides can cause them to spread rapidly on the farmland of intercropping farmers, but also at the fringing farmlands. Farmers intercropping on the plantation further experience a reduction in production quantity because they cannot burn their land, are not allowed to use fertilizers or pesticides and cannot store their products in sheds on-site. However, it should not be forgotten that the farmers are currently farming within the reserve illegally. Given the uncertainty of their situation, the legal option of intercropping may still be preferred.

The company will make use of pollutants such as fuel, grease, and chemicals. Compared to the low-intensity land use of farmers now, waste production will therefore increase upon plantation establishment. However, waste production in the area is now uncontrolled. Upon plantation establishment, waste management will become a major point of attention, in order to meet sustainability objectives and FSC requirements.

Extraction of trees is likely to cause exhaustion of soil nutrients over time. However, the first thinning will not be commercial, meaning that the stems will be left in the field. This contributes to soil fertility.

The new site does not reduce the travel time for people from the surroundings coming to work and takes away part of the farm land available. On the whole however it creates additional employment.

Opportunities

The reforestation project has been designed so that it can be repeated in other, similarly degraded areas. This provides opportunities for up-scaling to more degraded forest reserves in the area. Also, local farmers have been inspired to copy the concept on their own land. These initiatives contribute to meeting the increasing global timber demand.

The forest that is still present will be conserved and the buffer zones will be reinforced with new seedlings of indigenous tree species to create a mosaic of semi-natural buffer zones, indigenous tree stands and profitable Teak stands. This will mitigate the landscape alteration and provide a diversified habitat.

Intercropping of local farmers between the Teak trees poses an opportunity for both the farmers and the company. The farmers are ensured of free legal farmland, until canopy closure. The company benefits from the weeding and maintenance of the farmers on their farmland.

Threats

The threat of wild-fires is continuously present, especially in the adjacent farmland and open grassland; the fires are likely to spread rapidly. This could cause unexpected loss of revenues. In addition, the project largely depends

on the political stability of the country. The land-lease construction works only as long as the agreement of all parties lasts.

The balance between sound ecological and social management, and business focus is delicate. It can easily be disturbed if communication between the stakeholders is not sufficient. Furthermore, stakeholders have high expectations of the company. When these expectations exceed reality, this could lead to a lack of trust in the company.

Timber plantations require long-term investments. It takes a relatively long time before returns can be expected, increasing the risk of any situation to occur that can cause damage to the plantation.

Monocultures hold the risk of quick spreading of diseases. The risk of ecological damage is mitigated by the conservation of buffer zones within the plantation and the 10% indigenous trees planted within plantation boundaries.

Increased population pressure and decreased soil fertility cause shortage of farmland, increasing pressure on forest reserves and other protected areas. This increased pressure on land is likely to become an important risk factor in the future.



Figure 35. Example of a Teak plantation in poor condition.

10. CONCLUSIONS & RECOMMENDATIONS

10.1 General conclusions

In general, findings in this report are positive towards the continuation of the proposed project of Form Ghana for the reforestation of Tain II Forest Reserve.

The project is expected to have an overall positive impact on the environment and on the society in the project area. The environment benefits from the reforestation of the area with Teak since it can reduce many of the negative impacts caused by land degradation of Tain II Forest Reserve. Economically, commercial Teak planting offers a respectable and readily profitable market worldwide. In potential, this provides a sustainable basis for the responsible management of Tain II Forest Reserve.

Although threats to the project have been identified in this report, most of them can be prevented or mitigated with appropriate management solutions. Based on the outcomes of this report, benefits seem to outweigh the negative effects of this project.

10.2 Recommendations & Mitigation measures

The following sections contain short- and long-term management strategies to mitigate any negative impacts and enhance positive impacts.

Ecology

Further investigation

The duration of the study was short. Hence, some aspects of seasonality on habitat usage in the study area as well as the phenomenon of habitat factors need further investigation, which can be done through long term monitoring.

Regulating Human Activities

The long-term viability of Tain II FR will depend on earning the goodwill of all community members. Form Ghana may need to be creative in its attempt to control human activities in the study area because some community members have come to rely upon such reserves for economic activities especially farming and Non-Timber Forest Product (NTFP) gathering. Full government backing at the local and national level for this type of effort would ensure its success.

Intensively Managed Refuges

There is the need to establish intensively managed wildlife refuges within the study area, where no human activity occurs. Riverine vegetation, swamps and habitat around ponds and rivers should be given precedence because of the high biodiversity that exist in those places. Such refuges, when identified, need to be expanded and linked-up in order to safeguard their integrity and

should be priority in tree planting exercises. Creating and subsequently expanding intensively managed refuges within the study area may be an effective way of curtailing unregulated hunting and forest clearing activities whilst improving habitat to allow wildlife numbers to increase.

Enrichment planting of trees

Whilst focusing on the rehabilitation of riverine forests, further research should consider the species composition, structure and functions of the trees to be considered for enrichment planting. The trees should serve as a source of attraction of fauna. Hence, it is also important to have detailed information on the diet of the major fauna in the study area.

Wildlife density and distribution

It is strongly recommended to conduct the same kind of research in both seasons. This will allow seasonal comparison of wildlife distribution to give an insight into their habitat usage. Again, habitat factors that affect them seasonally will be known. This information is vital for their complete conservation and management.

Wildlife monitoring

Monitoring animal densities and distribution should be done regularly to assess the impact of Form Ghana plantation activities on animal populations. One design will consist of a number of trails that could be systematically established to cover both high and low animal density zones. Each trail could be sampled twice per year. Ideally, this kind of sampling should be done continuously and at the same time of day. It will be one way of ensuring that at least animals are monitored on a regular basis. Along each trail, counts would be made of the number of encounters with animals and their signs.

Minimize clear-felling area

Clear-felling has a strong impact on the ecology of the area, causing (temporary) loss of habitat and reduction of biodiversity. This negative impact can be minimized by keeping the size of contiguous areas for clear-felling to a minimum, keeping large patches of vegetation standing.

Spreading of pests and diseases

Monocultures hold the risk of quick spreading of diseases. To reduce risk of economic instability it is recommended to experiment with planting of other valuable tree species than Teak. In order to prevent the risk of pest and disease outbreaks, tree health should be monitored and an action plan should be ready in case of an outbreak (e.g. inform authorities).

Waste management

Specific systems for waste management will need to be designed and implemented.

Socio-economic

Outgrowing opportunities

It was recommended by several stakeholders that Form Ghana should explore the possibilities of outgrowing for Teak in the area. Many farmers and landowners already have a small stand of Teak that they can sell when matured. They would be interested to sell this to a company to increase security of income.

Recruiting workers

It is recommended that Form Ghana employs people locally, both unskilled and skilled. Recruitment should be divided over the fringing communities in order to maintain equality. In case new people come to the area, attracted by the job opportunities, Form Ghana could assist in the provision of activities like water, clinics or schools.

Fulani herdsmen

The farmers that work in or close to the reserve experience much hinder from the cattle herded by the Fulani as they feed on their crops. They warn the company that the cattle will also damage the seedlings and emphasize that the company should take this up with the local authorities to fix this problem.

Taboo days

Most communities respect their taboo days, on which community members are not allowed to cross the river or work in the forest. In some communities this tradition applies only to women, as women are prohibited to cross rivers when they are menstruating. This raised concerns amongst some women interested in working for the company. The communities and chiefs recommended that Form Ghana respects their taboo days and traditions and takes into account the special rules that apply to women. In Asubima and Afrensu Brohuma, Form Ghana has been able to get around the taboo days by making sacrifices to the gods to pacify them so they will allow people to work every day. This is likely to be a good option for Tain II as well, although some of the communities indicated that the taboo days cannot be avoided.

Cooperate with women

Many women indicated that they would like to provide food and other services for the company employees. They would be eager to start their own businesses and recommend Form Ghana to cooperate with them.

Chemical handling

Annual training of workers handling chemicals will reduce health risks and will result in effective application. The use of a droplet applicator is also recommended to this end.

Inform communities

There is a delicate balance between sound ecological and social management on one hand and business focus on the other. It can easily be disturbed if communication between the stakeholders is not sufficient. It is therefore essential to keep all parties informed on project progress and management decisions as well as benefit sharing arrangements.

Furthermore, stakeholders have high expectations of the company. When these expectations exceed reality, this could lead to a lack of trust in the com-

pany. Care should be taken that no false promises are made and expectations are not raised to unrealistic extends.

Hydrology

Stop cattle watering

It is recommended to stop illegal farming and cattle herding close to rivers and streams in order to prevent erosion. This can be achieved by buffer zone enhancement and conservation, combined with a security/patrolling system.

No reduction in water quantity/quality

The Tain River dries out in the dry season, which makes it unsuitable to serve as a fire wall. The water left in sinks in the dry season is used by people in the fringing communities for drinking/sanitation as well as irrigation purposes. It should be secured that the water quantity does not reduce as a consequence of plantation establishment.

Run-off management from roads and roofs

Water run off from roofs and roads much be led into vegetation where it can sink into the soil so as to avoid leading water with high silt content into streams.

Plant vegetation at the site to increase water infiltration

Trees and lawns should be planted at strategic locations to increase water infiltration and avoid run-off.

Soil

Conserve topsoil

Measures should be taken to prevent erosion in the area. It is recommended to keep the topsoil as much as possible undisturbed during operations of land preparation and clearing.

No burning

Whenever possible, burning should be avoided as it destroys organic matter and living organisms in the soils.

Maintain organic matter

Under plantation, fallen leaves and branches should be left behind on the soil as much as possible in order to replenish soil organic matter. However, care should be taken to prevent forest fires.

Replenish nutrients

It is recommended to estimate the quantity of nutrients which is removed by cutting the Teak trees and to replenish these nutrients to the soil as fertilizer during the life cycle of the Teak trees. As a positive side-effect, trees will have a better growth as no shortage of nutrients will occur.



Figure 36. Production of indigenous plants at Akumadan nursery.

11. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN AND MONITORING

11.1 Introduction

Form Ghana is committed to upholding high standards for social and environmental management. The management system is based on a continuous cycle of planning, executing, monitoring and adapting. This assures maintenance of high standards.

11.2 Environmental and Social Management System

Form Ghana has developed a system of separate protocols that describe the process of environmental and social management. Together with the Management Plan, these documents form the Environmental and Social Management Plan.

The management system is based on the FSC Principles and Criteria. The systematics between the various documents is described in the schedule below.

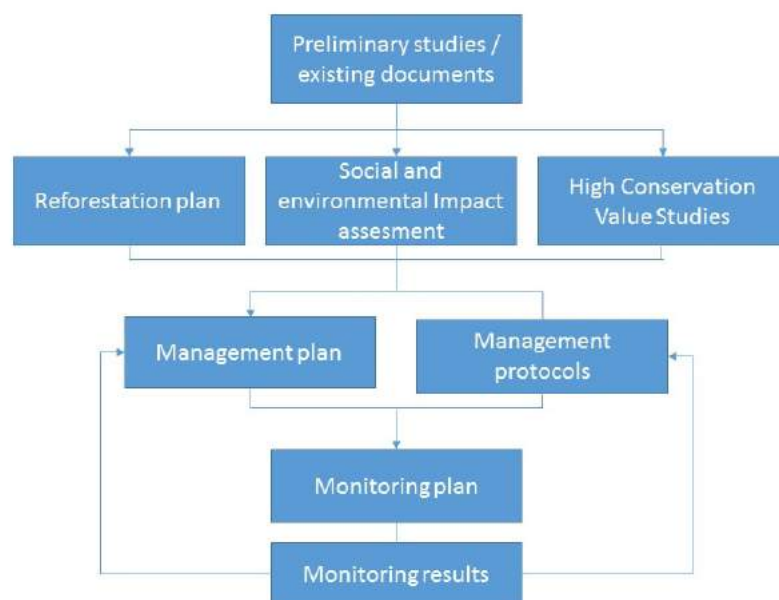


Figure 37. Links between various documents

The environmental and social management of Form Ghana has to address the recommendations and mitigation measures proposed in chapter 10.

11.3 Scope of the Environmental and Social Management Plan

The scope of the environmental and social management plan (ESMP) is the same as the scope for the Social and Environmental Impact Assessment. The goal is to give guidelines to all parties involved during establishment, maintenance and harvesting of the plantation in fulfillment of environmental and social requirements.

The environmental and social management plan has a long-term objective to ensure that:

- (i) Environmental management activities and requirements are implemented during the establishment, maintenance and harvesting of the plantation;
- (ii) The interests of the stakeholders are considered throughout the project;
- (iii) Damage to the environment, the biological diversity and sensitive habitats (where present) are avoided.

The ESMP addresses the recommendations and mitigation measures proposed by prescribing appropriate technologies and systems in protocols to be used during the execution of the work and by monitoring the effects of the measures. The environmental and social management plan is composed of plans and protocols that describe the techniques and methods to be used and the way work is monitored.

11.4 Description of the Environmental and Social Management Plan

The following protocols and plans have been developed to assist in managing the activities of Form Ghana:

11.4.1 ESMP – Forest management

- **Forest Management plan**

This management describes the company Form Ghana Ltd and the sustainability approach of the company. It presents the following:

- An overview of the physical environment (climate, water and soil condition, biodiversity, etc.) and social-economic environment (village facilities, occupation, level of education, housing and transportation etc.) of Tain II FR.
- The forest management objectives, elaborating on each of the three sustainability pillars (ecological, economic and social) and it describes the way land-use is impacted on the long-term
- The organization of the managed areas including the plantation infrastructure and field planting program
- The tree species selection and forest type allocation
- Tree nursery practices

- The various silvicultural practices that will be carried out during the entire plantation rotation cycle
- Risk management, including prevention of illegal activities, fire management and control of pests
- A social plan that covers the involvement of stake-holders, benefit sharing, employment and intercropping by local farmers
- Environmental management, concentrating on soil and water, biodiversity and High Conservation Value Forests
- The various monitoring activities

11.4.2 ESMP - Legislation and document management

- **P 01 Follow-up of legislation and conventions**
This document describes how Form Ghana follows up on new legal texts that appear in Ghana and new conventions that are signed internationally. It also describes how texts are evaluated for applicability to Form Ghana.
- **P 02 Prevention of illegal activities**
This document describes how Form Ghana avoid illegal activities on the lands it manages.
- **P 03 Periodical review of documentation**
This document describes the system of annual evaluation of all management documents to include new information and assure continued relevance and actuality.

11.4.3 ESMP - Waste management and environmental protection

- **P 04 Waste management**
This document describes how Form Ghana deals with waste produced on its various sites.
- **P 05 Responsible use of pesticides**
This document prescribes how pesticides need to be handled. It also describes the necessary safety measures.
- **P 16 Storage of fuel, lubricants and toxins**
This document prescribes how hazardous substances must be handled and stored.
- **P 18 Machine maintenance**
This document prescribes maintenance of machines to assure their continued functioning.

11.4.4 ESMP - Stakeholder engagement

- **P 06 Information policy personnel and local population**
This document describes how personnel and the local population are informed on Form Ghana activities, and how stakeholders can engage with Form Ghana
- **P 07 Conflict management**

This documents describes how grievances are dealt with and how grievances are redressed.

- **Stakeholder engagement plan**
This plan identifies the stakeholders of Form Ghana and describes how stakeholders are engaged.
- **Resettlement Action Plan**
This document describes the resettlement activities that Form Ghana undertakes for people that need as a consequence of Form Ghana activities.
- **Community Development Plan**
This plan describes the community development activities that Form Ghana undertakes

11.4.5 ESMP - Health and safety management

- **P 08 First Aid Procedures & Emergency Evacuation**
This document prescribes how to deal in cases of emergency.
- **P 09 Transport of personnel**
This documents prescribes how personnel can be transported.
- **P 10 Personal protection**
This documents assesses the risks related to the various work places and prescribes the safety gear people need for various jobs.
- **P 23 Envenomation by snakes and insects**
This documents describes the possible snakes and insects that may harm people and how to act in case of bites and stings.
- **P 27 information on contagious diseases**
This documents serves as a basis for sensitization on contagious diseases.

11.4.6 ESMP - Personnel management and training

- **P 11 Training of personnel**
This document presents the general recurrent planning for training
- **P 17 Management Requirements Responsibilities Senior Staff**
This documents describes the capacities need for senior functions
- **P 20 Meeting schedule**
This document describes the management meetings
- **Training register**
This document is an up to date list of training provided to all workers

11.4.7 ESMP – Certification management

- **P 12 Internal audits**
This document prescribes internal audits to be conducted at Form Ghana to assure the continued high level of performance at the company.
- **P 22 Chain of Custody procedures**

This documents describes the system of tracking and tracing of logs and timber at the company.

- **P 19 FSC logo usage**

This documents prescribes how the FSC logo can be used by the company.

11.4.8 ESMP - Technical work prescriptions:

- **P 14 Technical performance in the nursery**

This document describes all the activities in the nursery and presents quality standards

- **P 15 Technical performance in the plantation**

This document describes all the activities in the plantation and presents quality standards

- **P 21 Fire prevention and fire-fighting – Tain**

This document describes how fires will be prevented and when needed combatted.

- **P 24 Road construction and maintenance**

This document prescribes how roads are to be constructed and maintained.

- **P 25 Log extraction – Tain**

This document describes the system for extracting and preparing logs during forest harvesting.

11.4.9 ESMP - Monitoring

- **P 13 Monitoring**

This protocol describes the various monitoring activities

- **Monitoring plan**

This document describes the planning of the various monitoring activities

The effectiveness of management is checked annually through monitoring activities. Monitoring is done based on a matrix that identifies the fields of monitoring. This matrix is presented in the monitoring plan. Subjects covered during monitoring are:

- Mapping and map analysis;
- Fauna diversity;
- Buffer zone Permanent Sample Plots ;
- Timber plantation Permanent Sample Plots ;
- Water quality;
- Soil texture;
- Fire monitoring;
- Forest production;
- Section analysis of trees;
- Timber and carbon sales;
- Economic aspects;

- Social impact;
- Training and capacity building;
- Health and safety;
- Nursery development.

Findings from monitoring activities are fed back into the management system through the adaptation of protocols or management plans. A public monitoring report is produced for the general public. Reports on the specific monitoring activities are produced for Form Ghana management.

The cost of this monitoring system is 42 days by external consultants and 300 days by Form Ghana staff.

11.4.10 Responsibilities for the ESMP

The responsibility for implementing the ESMP lies with Form Ghana who delegates part of the responsibilities to Form international, regarding monitoring, training and document maintenance.

12. REFERENCES

- A Rocha, Ghana (ARG) (2004). CITES/MIKE Kakum National Park Elephant Survey 2004. Report submitted to CITES/MIKE Program, Nairobi, Kenya.
- African Development Bank, 2001, Handbook on Stakeholder Consultation and Participation in ADB operations
- African Development Bank Group, 2013, African Development Bank Group's Integrated Safeguards System: Policy statement and operational safeguards
- Aku Diame, G.L., 2010, Ethnobotany and ecological studies of plants used for reproductive health: a case study at Bia biosphere reserve in the western region of Ghana, Department of Environmental Science University of Cape Coast Ghana.
- Amponsah-Kwatiah, 1993, The effects of changes in rural land use patterns on agricultural development in Ghana: A case of Offinso district, Student dissertation, KNUST faculty of social sciences, Department of land economy and estate management.
- Barnes, R. F. W. and Lahm, S. A. (1997). An ecological perspective on human densities in the central African forests. *Journal of Applied Ecology*. 34: 245-260.
- Barnes, R.F.W.; Azika, S.; Asamoah-Boateng, B. (1995). Timber, cocoa, and crop-raiding elephants: A preliminary study from southern Ghana. *Pachyderm* 19: 33-38
- Blouin-Demers G., Weatherhead, P.J. and McCracken, H.A., 2003. A test of the thermal coadaptation hypothesis with black rat snakes (*Elaphe obsoleta*) and northern water snakes (*Nerodia sipedon*). *Journal of Thermal Biology* 28: 331-340.
- Buckland, S. T., Anderson, D. R., Burnham, K. P., and Laake, J. L., 1993. *Distance Sampling: Estimating Abundance of Biological Populations*. London: Chapman and Hall.
- Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. *Introduction to Distance Sampling*. Oxford: Oxford University Press.
- Burnham, M.P., D. R. Anderson and J. L. Laake. 1980. *Estimation of density from line transect sampling of biological populations*. Wildl. Monogr. No. 72. 202 pp.
- CAFECO, 2009. *Environmental impact assessment for the forest management unit n° 11 005*, African Centre for Applied Forestry Research and Development (CARFAD).
- Colewell, R., K. (2006). *Estimates: Statistical estimation of species richness and shared species from samples*. Version 8. Persistent URL <purl.oclc.org/estimates>.
- Cuaron, A.D, 2000. *A global perspective on habitat disturbance and tropical rain forest mammals*. *Conservation Biology*. 14 (6): 1574-1579.
- Danquah, E. (2007). A survey of large mammals of the Ankasa and Bia Conservation Areas. Protected Areas Development Programme. A

technical report submitted to the Wildlife Division of the Forestry Commission, Accra, Ghana.

- De Laat, N., 2011. *Monitoring Biodiversity in Asubima Forest Reserve*.
- Demey, R. and H.J. Rainey. 2004. A preliminary survey of the birds of the Forêt Classée du Pic de Fon. In: McCullough, J. (ed.). A biological assessment of the terrestrial ecosystems of the Forêt Classée du Pic de Fon, Simandou Range, Guinea. RAP Bulletin of Biological Assessment 35. Conservation International. Washington, DC. Pp. 63-68.
- Dramani, D.F., Anornu, G.K., Kobo-bah, A.T. and Oduro-Kwarteng, S., (2014), 'Groundwater Resources Assessment in the Tain River Basin of the Black Volta of West Africa', Energy and Environment Research, 4 (3): 96-104.
- Estes, D. R., (1991). *The behavior Guide to African Mammals: Including hoofed mammals, carnivores and primates*. London, England, University of California press, Ltd.
- European Commission, 2002, Review report for the active substance glyphosate, finalized in the standing committee on plant health and its meeting on 29 June 2001 in view of the inclusion of glyphosate in Annex I of Directive 91/414/EEC.
- Fa J.E., Ryan S. F., Bell, D. J., 2005, Hunting vulnerability, ecological characteristics and harvest rates of 3 bush meat species in afro-tropical forests, Biological Conservation
- FAO, 1976, A framework for land evaluation; FAO Soils bulletin 32, Soil resources development and conservation service land and water development division, Food and Agriculture Organization of the United Nations.
- FAO (1998). World reference base for soil resources (WRB). World Soil Resources Report No. 84, FAO, Rome.
- Gaston, K. J., 2005, Biodiversity and extinction: species and people Progress in Physical Geography 29, 2 (2005) pp. 239–247
- Hall J.B. & Swaine, M.D. (1981) *Geobotany: Distribution and ecology of vascular plants in a tropical forest of Ghana*. Dr W Junk publishers, The Hague Madu A. 2007), The environmental impacts of regional disparity in population and wealth distribution in Nigeria: Journal of Environment Development and Sustainability (EDS).
- Hawthorne W., D. and Ntim Gyakari, (2006) *Photoguide for the forest trees of Ghana: A tree-spotter's field guide for identifying the larger trees*. Oxford Forestry Institute, Oxford, U.K.
- Hawthorne, W.D, Jongkind, C.C.H. (2006) *Woody Plants of Western African Forests. A guide to the forest trees, shrubs and lianas from Senegal to Ghana*.
- Hawthorne, W.D. and Ubu Juam, M., 1995, Forest protection in Ghana, with particular reference to vegetation and plant species, IUCN, Forest Conservation Programme, issue 14;
- Hédl, R., Svátek, M., Dančák, M., Rodzay, A.W., Salleh, A. B., Kamariah A. S., 2009, A new technique for inventory of permanent plots in tropical forests: a case study from lowland dipterocarp forest in Kuala Belalong, Brunei Darussalam, Evolution and Biogeography of Plants, Volume 54, Issue 1-3

- Hill, J.K., Hamer, K.C., Lace, L.A., Banham, W.M.T., 1995. Effects of selective logging on tropical forest butterflies on Buru Indonesia. *J. Appl. Ecol.* 32, 754–760
- Holbech, L. H. (2001). A study on bush meat production and land-use in the Amokwasuazo Community Resource Management Area, off-reserve the Ankasa Resource Reserve, Western Region, Ghana. Protected Areas Development Programme 110 pages.
- IFC, 2007, Stakeholder Engagement: A Good Practice Handbook for Companies, International Finance Corporation, Doing Business in Emerging Markets
- Irié Casimir ZOBİ et al., 2012, Evaluation des caractéristiques physiques de vingt clones de teck (*Tectona grandis* L. F. *Verbenaceae*) dans le centre-ouest de la Côte d'Ivoire, *Rev. Ivoir. Sci. Technol.*, 20 (2012) 147 - 161 147
- IUCN (2012). Antelope Survey Update. Number 2. Compiled by Rod East. The World Conservation Union/Species Survival Commission.
- IUCN. 2010. IUCN Red List of Threatened Species, www.iucnredlist.org.
- IUCN/SSC (1996). Antelope Survey Update. Number 2. Compiled by Rod East. The World Conservation Union/Species Survival Commission.
- ITTO, 2008, Market Information Service
- Jacobs, R., J. (1974). *Geometry*. Freeman and Company, W.H.
- Kanga, L. and Fediereb, G., 1991, Towards integrated control of *Epicerura pergrisea* (*Lepidoptera: Notodontidae*), defoliator of *Terminalia ivorensis* and *T. superba*, in the Côte d'Ivoire, *Forest Ecology and Management*, 39 (1991) 73-79, Elsevier Science Publishers B.V., Amsterdam
- Koster, S.H. and Hart, J.A. (1988). Methods of estimating ungulate populations in tropical forests. *African Journal of Ecology*. 26. 117-126.
- Larsen, T.B., 2005. *Butterflies of West Africa*. Apollo Books. Plate and Text Volume
- Lepczyk, C. A., Flather, C.H., Radeloff, V.C., Pidgeon, A.M., Hammer, R.B., Liu, J., 2008, Human Impacts on Regional Avian Diversity and Abundance, *Conservation Biology*, Volume 22, No. 2, 405–416
- Norton-Griffiths, M. 1978 *Counting Animals. Handbooks on techniques currently used in African wildlife ecology. No.1*, Ed. J.J.R. Grimsdell AWLF, Nairobi.
- Ogoe, F., Sools, R., Wanders, T., 2011. *Monitoring report of Asubima Forest Reserve*. Form Ghana and Form international.
- Orgle, T.K. (1994). *Ecology of burnt forests in Ghana*. PhD Thesis. University of Aberdeen.
- Peres, C.A., 2005, Effects of subsistence hunting on vertebrate community structure in Amazonian forests, *Conservation Biology* 14, pp 240-253
- Rainey, H.J. and A. Asamoah. 2005. Rapid assessment of the birds of Draw River, Boi-Tano and Krokosua Hills. In: McCullough, J., J. Decher and D.G. Kpelle (eds.). *A Biological Assessment of the Terrestrial Ecosystems of the Draw River, Boi-Tano, Tano Nimiri and Krokosua Hills*

- Forest Reserves, Southwestern Ghana. RAP Bulletin of Biological Assessment 36. Conservation International. Washington, DC. Pp. 50–56.
- Scholten, H., Augustine, A., 2012. *Soil reconnaissance mission to Afrenso Brohuma Forest Reserve in Ghana*
 - Sinclair, Ian; Ryan, Peter (2003). *Birds of Africa south of the Sahara*. Cape Town: Struik.
 - Southwood, T., R., E. and Henderson, P., A. (2000). *Ecological Methods* (3rd Edition). Blackwell Science, Oxford.
 - Struhsaker, T.T.; Oates, J.F. (1995). The biodiversity crisis in southwestern Ghana. *African Primates* 1(1): 5-6.
 - Stuart, C.T and M.D Stuart, (2006). *Field Guide to the large Mammals of Africa*. Struik publishers, Cape Town.
 - USDA (1998). *Key to Soil Taxonomy*. 8th Edition USDA Natural Resource Conservation services, Washington DC.
 - White, L., and Edwards, A. (2000). *Conservation research in the African rainforests: a technical handbook*. Wildlife Conservation Society, New York.
 - Wilkie, D., S. (1989). Impact of roadside agriculture on subsistence hunting in the Ituri forest of north-eastern Zaire. *Am.J.Phys.Anthro.* 78,485-494.
 - Wilkie, D., S., and Finn, J., T. (1990). Slash-burn cultivation and mammal abundance in the Ituri forest, Zaire. *Biotropica* 22:90-99.
 - Working Group on Forest Certification, 2012, FSC-STD-GHA-01-2012 Ghana Forest Stewardship Standard EN, version 5
 - Zobi, 2012 Evaluation des caractéristiques de vingt clones de Teck (*Tectona grandis* L.F. Verbenaceae) dans le Centre Ouest de la Côte d'Ivoire, *Rev. Ivoir. Sci. Technol.*, 20 (2012) 147 - 161

APPENDIX A. OVERVIEW MAP OF TAIN II

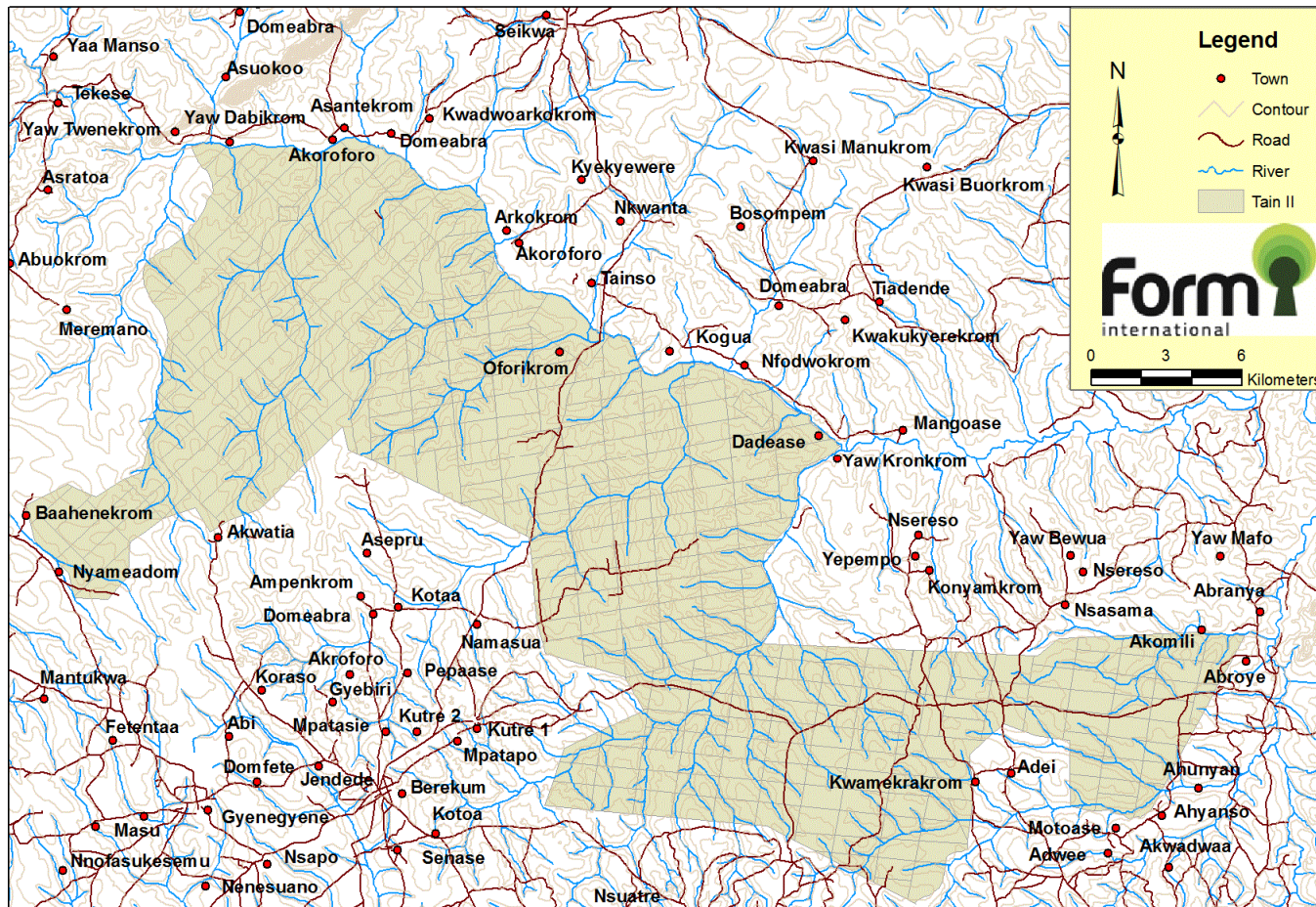


Figure 1. Overview map of Tain II

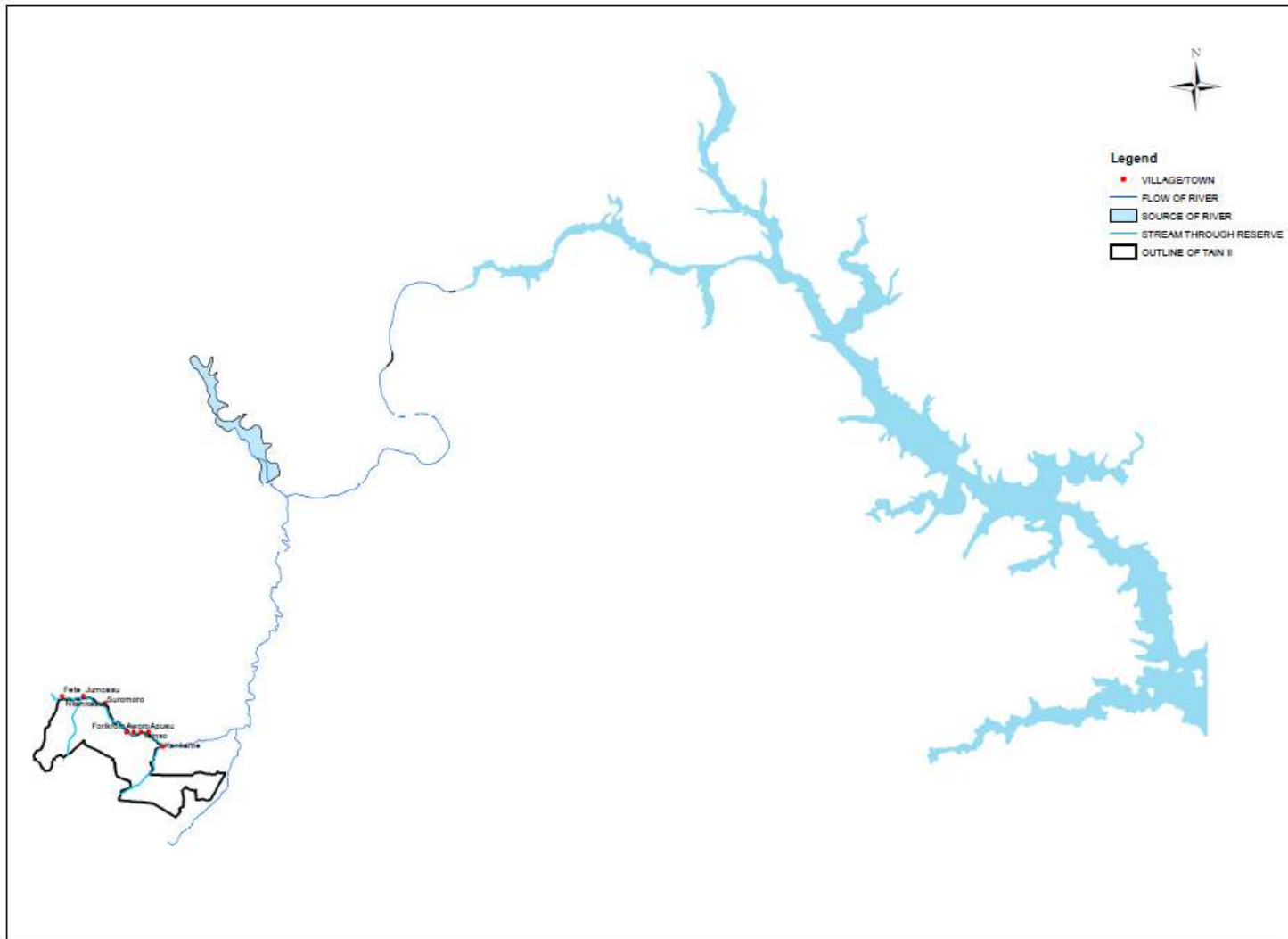


Figure 2. Tain River from Tain II Forest Reserve to Lake Volta

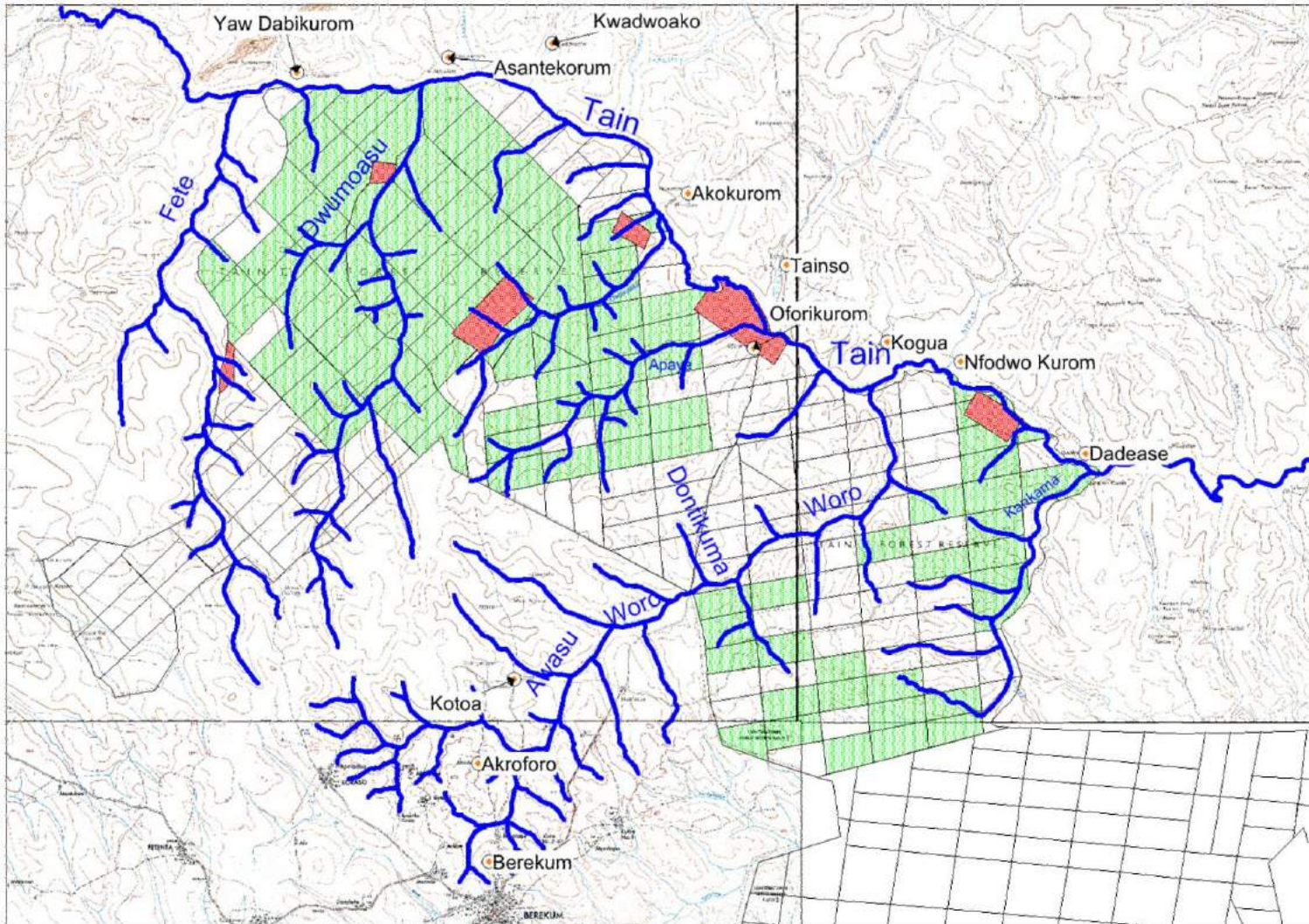


Figure 3. Catchment area within Tain II Forest Reserve.

APPENDIX B. STAKEHOLDER ENGAGEMENT PLAN

Stakeholder mapping

Stakeholders are defined as parties that are likely to be affected by the proposed project. A preliminary survey of 4 days was held in the project area to assess the stakeholders in the area and select relevant groups based on this criterion. The following stakeholder groups were defined:

1. Communities in the project vicinity
2. People farming illegally within the project area
3. People herding cattle within the project area
4. Service providers located close to the project area
5. Local governmental departments
6. Local traditional authorities
7. Owner and inhabitants of admitted farm area

Within each group, a number of stakeholders to act as representatives was selected in a mapping process. This process is elaborated in this document, per stakeholder group. The stakeholder meeting schedule is presented in table 1 below.

Table 1. Stakeholder meeting schedule.

Date	Stakeholder meeting
31-10-2012	Berekum Omanhene and sub-chiefs
1-11-2012	Assembly man of Kutre nr. 1
1-11-2012	Group meeting Kutre nr. 2
2-11-2012	Group meeting Nsukusua
2-11-2012	Group meeting Mpatasie
3-11-2012	Group meeting Pepaase
5-11-2012	Berekum District Fire Office
5-11-2012	Ghana Education Service
5-11-2012	Berekum Holy Family Hospital
6-11-2012	Meeting with Fulani herdsmen
6-11-2012	Interview with household next to Fulani settlement
7-11-2012	Group meeting in Kotaa
7-11-2012	Berekum District Assembly
7-11-2012	Agric. District Office
7-11-2012	Group meeting in Akrofoa
8-11-2012	Group meeting in Oforikrom
8-11-2012	Seikwa Chief and elders
9-11-2012	NCCE
9-11-2012	Group meeting in Domeabra and Anteroom
13-11-2012	Group meeting Kojoakokrom
13-11-2012	Group meeting Asantekrom
13-11-2012	Group meeting Arkokrom
14-11-2012	Group meeting Tainso

14-11-2012	Group meeting Dadease
14-11-2012	Group meeting Nfodwokrom
15-11-2012	Group meeting Meremano
16-11-2012	Sunyani District Forestry Office

1. Communities in the project vicinity

Relevant communities were selected using 3 different methods:

- Detailed maps of the area, obtained from the university in Sunyani
- Detailed assessment of the terrain, driving through the Forest Reserve and taking GPS coordinates of settlements and villages
- Interviews with local community members

Field assessments showed that most of the roads in the project area were not passable by car. From interviews it became clear that most of the communities were not in the possession of motorized transport. These findings led to the conclusion that only the communities located at walking distance of the forest reserve were likely to make use of the Forest Reserve. We observed some small-scale (subsistence) farming within the reserve boundaries, predominantly located on the fringes of the reserve. The maps from the university and the GPS coordinates taken in the field were used to select communities close to the reserve boundaries.

In each village, a group discussion was held. The number of attendants ranged between 8 and 45. We chose not to keep a list of attendance in order to ensure anonymous participation, to encourage people to speak freely. The discussion was led by Marthe Tollenaar, external consultant, following a standardized form (attached to the SEIA). Translation was done by Mohamed Armani, independent consultant.

Before the group discussion we visited the village to make an appointment with the chief or, in his absence, one of the opinion leaders of the village. In this preliminary visit, the purpose of the meeting was explained and the proposed project introduced. We handed an information sheet in English and Twi to the village representative (Appendix D) and asked him/her to assemble the chief, village elders, farmers, both men and women, both young and old community members for the discussion.

After the group discussion, we asked permission to conduct household questionnaires in the village (see appendix X). Households were selected at random and each household was asked for permission to interview one household member.

2. People farming within the project area

From interviews with community members as well as from field assessment, it became clear that there were no people settled in the forest reserve. All of the farms within the reserve were exploited by people from the fringing communities. One settlement was located within the forest reserve and the people liv-

ing there farmed there as well but this land was labeled 'admitted farm area', meaning that it is not considered part of the forest reserve because it is owned by a traditional land owner and not by the Forestry Commission.

These findings led to the conclusion that in order to include the people farming within the project area it would suffice to visit the fringing communities.

3. People herding cattle within the project area

From interviews we learned that there are Fulani herdsmen in the area, herding cattle. Many community members complained that the Fulani cattle damaged their crop and polluted the water. Their presence was verified in the field as we found many traces and a few pieces of actual cattle in the reserve. We did not encounter the Fulani themselves during the first phase of stakeholder mapping but it was clear that they should be included as a stakeholder in the assessment because they clearly make use of the land. Also, we had indications of possible conflicts between local communities and the Fulani. This may affect project establishment.

4. Service providers located close to the project area

The main service providers in the region were assessed and a selection was made for those providers that were likely to be affected by or useful for project establishment. The following service providers were selected:

- Berekum District Fire Office:
Main institution for fire prevention and firefighting in the area. Since fire is one of the main challenges that the proposed project will be facing, it is likely that this institution will be involved upon plantation establishment.
- Ghana Education Service
An education trend will be determined based on the household questionnaires in the social survey. In order to place this trend in a broader perspective, it is essential to discuss with the Education Service. This will provide information on the education level of the future employees.
- Berekum Holy Family Hospital
The future employees of the company will need quick access to health facilities. The Holy Family Hospital in Berekum is the closest facility. It is necessary to assess the capacity and facilities that they have.
- National Commission for Civic Education
The NCCE is a general institution for awareness raising amongst local communities. They have a good understanding of ongoing issues in the region and have the means to reach out to a large group of people.

5. Local governmental departments

The main governmental institutions at the district level that are affected by the proposed project are:

- Berekum District Assembly:
The local governmental institution at the district level is housed in Berekum. This is the official authority in charge of the district.
- Agric. District Office:
Office dealing with agricultural affairs in the district. Since agriculture is the main source of livelihood in the district, this office is relevant as a stakeholder. They are likely to have information on the main issues that are at stake in the agricultural sector. Also for the intercropping activity this office may be relevant.
- District Forestry Office:
Office in charge of forestry in the district. The Forestry Commission is bound to the company with a Public Private Partnership and the company leases the land from the FC. A very important stakeholder.

6. Local traditional authorities

The traditional authorities in Ghana are the former kings of the local tribes. They are still organized as a formal governmental body, the stool, but their power is limited to land-ownership. All other tasks have been handed to the District Assembly.

The chiefs are assisted by a linguist and the village elders. The function of the linguist is to speak for the chief. Visitors are not allowed to speak directly to the chief but must speak to the linguist instead, who then conveys the message to the chief. The village elders consult the chief in his decisions.

There are chiefs at different authority levels: national, regional, district-level, towns and villages. For a project at the district level, the district chiefs should be consulted as well as the village chiefs. Since the project area borders two districts, Berekum and Seikwa, both chiefs are included in the stakeholder assessment. The village chiefs and elders were present in the group discussions held in the respective villages.

7. Owner and inhabitants of admitted farm area

In the preliminary SEIA it became clear that there is one settlement located in the forest reserve. This is an admitted farm area. The inhabitants of this settlement should be included in the assessment, as well as the owner(s) of the admitted farm. The proposed project will not affect the admitted farm but will cause an alteration in the direct surroundings. Access roads and water supply will be shared with the inhabitants of the admitted farm.

APPENDIX C. INFORMATION SHEET FOR GROUP DISCUSSIONS

Form Ghana reforestation project

Introduction

This document contains information on a reforestation project in Tain Tributaries Block II Forest Reserve, proposed by Form Ghana Ltd. Company. The document was composed as an introductory paper to inform stakeholders included in the *Social and Environmental Impact Assessment* (SEIA), carried out by a Dutch consultancy firm.

Tain Tributaries Block II

The Forestry Commission has established Forest Reserve areas throughout the country for the protection of the forests of Ghana. Timber extraction in these reserves is only allowed if it is done in a sustainable and controlled way. The Tain Tributaries Block II Forest Reserve (Tain 2 FR) has been qualified as degraded by the Forestry Commission, due to severe logging, extensive wildfires (especially in the 1980s some heavy episodes occurred) and illegal farming practices. In the 1990's the government of Ghana has developed a national policy to actively restore the ecological, social and economic values of the degraded Forest Reserves in Ghana. This is the basis for **Form Ghana** to establish a commercial timber plantation in the west of Tain 2 Forest Reserve.

Form Ghana Ltd.

Form Ghana is a company that was established in 2007 with the objective of creating large scale sustainable Teak plantations in Ghana. In Asubima Forest Reserve, near Akumadan, **Form Ghana** has leased an area of 1700 ha. Trees were planted here between 2008 and 2011. The majority of the planted trees are Teak, but 220 ha were planted with indigenous trees like Emeri, Ofram and Potrodom. **Form Ghana** has also created buffer zones around the streams to protect the waterways and create refugia for wildlife. Sound management of the plantations assures protection from fire and encroachment.

Commitment

Form Ghana is committed to realization of an improved social standard and employment for the local population, the enhancement of the local economy and a guaranteed timber supply for the forest industry. *Therefore*, employees are offered a safe and healthy working environment, with good employment terms, favorable insurance policy conditions and pension build-up. Local communities benefit directly or indirectly from **Form Ghana** through employment opportunities, revenue sharing, community services and technical assistance. Farmers are offered the opportunity to intercrop within the plantation, with respect for the terms and conditions that apply under FSC certification and **Form Ghana** policy. Examples of these conditions are prohibited use of fertilizers, pesticides and herbicides, burning of fallow land and storage of harvested products on the land.

Biological diversity, water sources, and fragile ecosystems found in or near the plantations will be conserved or restored where possible. This includes the riparian buffer zones; 30 meters on each side of the waterway. The carbon storage function of the

plantation forests contributes to climate change mitigation. Trees planted on the plantations consist for a maximum of 90% Teak and at least 10% mixed local species.

Social Impact Assessment

Form Ghana has commissioned a Dutch consulting company to perform a Social and Environmental Impact Assessment in the direct surroundings of Tain 2 Forest Reserve. The conclusions of this assessment will be used by the company in applying social and environmental measures. Any negative impact that the project could possibly have on the livelihood of the local population is considered and where possible mitigated. Cultural values are recognized, preserved and respected.

ADWUMAKUO 'Form Ghana' KWAEƐ MU NNUA DUA

NNIANI MU

NsƐm a Ɛwɔ Krataa yi mu no fa adwumakuo 'Form Ghana Company Limited' nyehyehyɛ a wayɛ sɛ wɔn bɛdua nnua wɔ kwaeƐ a yɛfrɛ no "Tain II" mu. Saa krataa yi yɛ nnianimu a yɛde bɔ obibiara a kwaeƐ yi fa ne ho, na ɔsane ka dwumadie a adwumakuo bi a yɛfrɛ wɔn 'Form International' a ɔfiri Holland Abrokyire man mu no bɛdie no ho. Adwuma no nkyerɛ mu ne sɛ, adwuma kuo no pɛ sɛ wɔyɛ npɛnsɛnpɛnsɛn mu na wɔn hu mmoa ne ɔhaw a adwumadie a 'Form Ghana' ɛbɛdi no bɛnya wɔ nkuro mma a Ɛwɔ kwaeƐ ne ho no asetena mu ɛne kwaeƐ no asaase no so (Social and Environmental impact Assessment).

Tain Tributaries Block II

Ghana Forestry Commission atwa kwaeƐ bebreɛ atoto ɔman yi mu sɛ neɛ ɛbɛboa ama yɛabɔ kwaeƐ ho ban. Commission no ma ho kwan ma adwuma kuo bi tumi twa nnua (timber) wɔ saa kwaeƐ yi mu. Na mmom, ɛsɛsɛ saa nnua twa yi fa mmara kwan so na ankɔ sɛe kwaeƐ no. Na nso, ɔtɔ dabi a, nnwuma kuo bebreɛ nni mmara no so. ɛba saa na ama kwaeƐ no asɛe. Afei nso, egyahyehyɛ ɛkɔɔso wɔ afe 1980s ɛne kua adwuma ɛbinom yɛ wɔ kwaeƐ mu no nso sɛe kwaeƐ no. Saa pɛpɛpɛ na ɛtoo kwaeƐ "Tain Tributaries Block II". ɛnam saa nti, forestry commission ɛde saa kwaeƐ yi aka kwaeƐ a ɛnni mu wɔ ɔman yi mu no ho. Na ɛfiri 1990s mu no Ghana aban ayɛ ntotoyɛ sɛ ɔbɛbɔ mmɔden na wa siesie kwaeƐ biara asɛe wɔ ɔman yi mu. Saa ɛnti aban too ne nsa frɛɛ adwuma kuo biara a n'ani gye kwaeƐ mu nnua dua ho sɛ ɔmmra na ɔbɛ boa. Na adwuma kuo "FORM Ghana" ɛyɛ adwuma baako a wɔn dua dua nnua wɔ kwaeƐmu wɔ Ghana. Ghana aban de Tain II fa bi ama saa adwuma kuo yi sɛ wɔn dua dua nnua sɛneɛ ɛbɛyɛ na kwaeƐ no bɛtumi afa ne ntoma pa afira.

Form Ghana Ltd.

Yɛ tee **Form Ghana** adwuma kuo mfeɛ 2007. BotaeƐ a ɛda adwuma yi de asi n'ani so ne sɛ wɔ bɛdua Teak nnua wɔ Ghana na w'aton nnua wɔ amanone. Adwuma kuo yi adi kan adua nnua no bi wɔ kwaeƐ a yɛfrɛ no "asubima" a Ɛwɔ Akumadan ɛfiri afe 2008-2011. Saa KwaeƐ yi kɛsɛ bɛyɛ sɛ agroproma (1700) a yɛka abumu. Asaase no fa kɛsɛ deɛ wɔde dua Teak na ɔde bɛyɛ ɔha nkyekyɛ mu du adua nnua a Ɛwɔ kwaeƐ no mu dada te sɛ; ɛmire, ɔfram ne Potrodom. Asaase no faa asuo da no deɛ, adwuma kuo mfa hɔ nka nnua dua no ho sɛneɛ ɛbɛyɛ a wɔn bɛbɔ asuo no ho ban na afei w'agyae hɔ nso ama nnua a Ɛwɔ kwaeƐ yi mu. Adeɛ baako biom a adwuma kuo yi yɛ ne sɛ wɔ hwɛ nnua a w'adua no so yie na w'atumi abɔ nnua ne ho ban afiri ogyahyehyɛ ho.

Ahofama

Form Ghana ayɛ n'adwene sɛ wɔ bɛ boa ama yiedie, nkosoɔ ne adwumayɛ akwanya aba ama nkuro a ɔwɔ baabi a wɔyɛ adwuma no. Afei nso, adwuma kuo yi pɛ sɛ wɔ boa ma Ghana timber adwuma no ɛpagya biom. ɛnam saa nti, company yi hwɛ sɛ wɔn adwumayɛfoɔ yɛ adwuma wɔ kwan a ɛhɔ

teE na ankofa ɔhaw biara ama. Na afei nso wɔtua wɔn adwumayɛfoɔ ka yie Esan hwE sE sika biara EyE sE wɔ tua ɛma aban na yɛde to hɔ ma adwumayɛfoɔ no daakye(pension). Mfasoɔ bebree nso wɔ hɔ ma nkura nketewa ɔwɔ baabi a adwuma yi wɔ no ebi ne sE: mfasoɔ a wɔkyE ma nkuro nketewa nya bi firi nnua ho, mmoa a wɔde ma nkura nketewa, wɔma wɔn nimdeE fa nnua dua ho. Adwuma yin so tumi ma akuafoɔ dua wɔn nnobaeE wɔ nnua w'adua ne ntamu na mmom, gye sE wodi Form Ghana ne FSC(adwumakuo bi a wɔn na wɔma abɔdin krataa a ɛdi adanseE sE obi kwaeE mu adwuma ho te) mmara so. Afei, yɛbɔ kwaeE no mu baabi a mmoa ne nnua a ɛhia wɔ ne asuo ti ne deE asuo da ne baabi a asaase no yE mmerE no ho ban. Mfatoho: anamon aduasa biara a ɛbɛn asuo ho no yɛnnua adeE hɔ. Bio, asaase biara so no wɔde ɔha nkyemu aduokron dua Teak ɛna ɔha nkyemu du nso dua nnua a ɛwɔ kwaeE no mu dada.

Dwumadie no so nsunsuansoɔ

Form Ghana ahyE adwumakuo bi a firi Holland sE wɔn hwE dwumadie yi ho nsunsuansoɔ a ɛbɛba nkuro a ɛbɛn Tain2 kwaeE no ho. Suahunu a yɛbɛnya afiri dwumadie yi mu no bɛboa ama yɛapɛ ɛho pomasiberE. Nsunsuansoɔ bɔne biara a dwumadie yi de bɛba nkuro yi so no wɔbɛhwE na wayi afiri akwan mu. Yɛde buo bɛma nkuro no amammerE.

APPENDIX D. HOUSEHOLD QUESTIONNAIRE

a. Site identification

Village		Respondent	
Date		Household head	
Questioner		Religion	

b. Household identification

# People in household	Men	Women
# Household members living in village	Men	Women
Residence (Month/Year)		

c. Housing characteristics

Type	Wall construction	Roof construction	# Rooms	# Residents

d. Agricultural productivity

Crop	Area (acre)	Production (bags/yr)	Livestock	Amount

e. Agriculture characteristics

Pesticides	No/Yes, type:
Fertilizer	No/Yes, type:
Herbicides	No/Yes, type:
Benefit sharing	% tenant % landlord
Rent (GHS/month)	
Ratio private/commercial production (bags of maize)	
Buyers	
Location	Of/On reserve, % On:

f. Transportation

Bicycle	
Motorcycle	
Car	
Agricultural machines	

g. Composition

Name	Sex (F/M)	Marital status ²	Relation to HH ³	Year of birth	Place of birth	Region of origin	Year of migration	Ethnicity	Education type	Occupation ⁴	Illness (type)	Hospital visits (#)

² 1: Married and living together, 2: Married but spouse working away, 3: Widow(er), 4: Divorced, 5: Never married, 9: Other, specify...

³ 0: Household head, 1: Spouse (legally married or cohabiting), 2: son/daughter, 3: son/daughter in law, 4: Grandchild, 5: Mother/father, 6: Mother/father in law, 7: Brother/sister, 8: Brother/sister in law, 9: Uncle/aunt, 10: Nephew/niece, 11: step/foster child, 12: Other family, 13: Not related

⁴ 1: Farmer, 2: Student, 3: Other, specify...



APPENDIX E. GROUP DISCUSSION QUESTIONNAIRE

1. Village

a. Site identification

Village		Coordinates	
District		Date	

a. Facilities

	Type	Quantity
Electricity		
Drinking water		
Church/mosque		

b. Estimated characteristics

Age	
Nr of residents	

b. Location

Nearest...	Distance (km)	Time (min)	Mode of transportation ⁵	Town/village
Forest				
Water source				
Hospital				
Primary school				
Secondary school				
Dirt road				
Paved road				
Market				

2. Forest

a. Festivals/ceremonies

Activities	Location	Time	Specifications
Burial			
Rituals			
Praying			
Festivals			
Marriage			
Other, specify...			

b. Collected forest products

Products ⁶	% of Total use	Products ²	% of Total use

⁵ 1: On foot, 2: Bicycle, 3: Car, 4: Bus, 9: Other, specify...

⁶ 1: Firewood, 2: Construction materials, 3: Bushmeat, 4: NTFP, specify..., 5: Medicine, specify..., 9: Other, specify...

c. Historical perspective

Features	Condition before deforestation ⁷	Condition now ³
Large trees		
Soil fertility		
Fish		
Wildlife		
Productive plants		
Water quality		
Water quantity		

3. Impact assessment

a. Impact proposed project

Expectations	Concerns

b. Communication with project company

	Condition ³
Company accessibility	
Information transfer	

⁷ 1: poor, 2: fair, 3: average, 4: good, 5: excellent

APPENDIX F. MINUTES OF STAKEHOLDER MEETINGS

Meeting at Berekum District Fire Service 5/11/12

Present

Ofori Richard – Fire volunteer and taungya manager at Kotaa
Oppong Kofi – Volunteer chairman at Namasua
Samuel Morrison – Independent business entity in Teak planting business (Morricom Company Ltd.)
Damoah Timothy – Rural fire coordinator
Solomon Kofi Dwasié – Fire volunteer Genegene 5 miles west of Berekum

Facilities present at the fire station: 1 fire engine, 52 employees, 814 Fire Volunteers (FV).

Protocol

FV's are on patrol almost every day during the dry season, either by motorcycle or by bike. Usually in groups of no less than 5-6 for safety reasons but if they go by bike they sometimes go with just 2. They look for fire outbreak but also for people causing fire hazard (smoking, carrying matches, making fire to cook, carrying guns, smoking rats out of their holes, tapping honey using smoke, making palm tree wine using fire/smoke). People are allowed to burn their farms (either on-reserve or off-reserve) but they have to notify the FV's first and they have to check if the burning is done safely, and even help them out. If they didn't, FV's are authorized to arrest these people and take them to the police. Usually court will not prosecute them if it's their first offence, but rather give them a fright and put them in the cell for 1 week. When the patrol team encounters a fire outbreak, they notify the fire office who then comes in with the fire engine. Also, they will notify the FV's at the villages. They will mobilize the NCCE (National Committee for Civic Education), who will come around the villages with a van with a speakers on the roof. Also, they will use drums (gong-gong beaters) to alarm other villages, or the info centre alarm system (speakers). In the mean time they try to keep the fire under control as good as they can by creating fire belts using cutlasses. The location of the fire outbreak is determined by a zoning system (8 zones in the district) but also by knowledge of the area.

Effectiveness

The FV program exists since 1992 but it has been revitalized 3-4 years ago. The number of FV's is growing despite of the fact that they don't get money for their provided services, and they have to leave their farm unattended to go on patrols. The reason for this is that the older FV's move to new villages and gather new FV's around them. In general though, the FV's are older people because young people are not interested in doing jobs for free. However, the FV's are so motivated that they managed to control bushfires to the extent where people decide to grow cocoa in the area. This was unprecedented. FV's are eager to show the company their motivation and willing to show FG around at the plantation to show that they would really like to be employed by FG.

Still, several villages have been damaged by the fire (Kotaa, Pruso, Akonkrum, Asapru, and Botokrum). About 10 fire outbreaks occur every year.

Training

FV's get trained for 1-2 weeks in the village on marching, fire prevention, fire extinguishing techniques and how to carry yourself like a FV.

Taskforce

NCCE, Forestry (Forest Guards at community level), Seikwa district, municipal level (Oforikrum people are main source of contact with Seikwa FV's),

Difficulties

No resources to provide FV's with cutlasses, motorcycles, fire protection clothes, Wellington boots, funds for transportation costs, food during fire extinguishing exercise. They have to arrange for their own transportation during patrols. The DA is supposed to provide these things but they don't provide enough. The number of FV's is increasing but the logistics don't keep up. If people make costs during fire extinguishing (food/drinks) they can ask the DA for reimbursements but it's usually difficult to get the money back.

There is also a CEO present of a Teak company in the area. He says he takes care of fire hazard by offering financial assistance to the fire department. Only last year a fire reached his plantation (the fire that started in Pruso).

The FV's ask if there are outgrowing possibilities, and if the company will buy land outside of the reserve.

Ghana Education Service (GES) 5/11

Contact Persons

Mr. Akuamoah-Boateng, Deputy Director (02090988196)

Mr. Kwabena Badu, Head of Statistics Dept.

Enrolment

Increasing enrolment in schools can be attributed to a number programs geared towards enrolment drive. These include; the creation of School Management Committees (SMCs), Parent-Teacher's Associations (PTAs), Capitation Grants, school feeding programs and free school uniforms and furniture. Capitation Grants, designed to take the burden of costs off the parents, will be stopped now because the complementary funding from the government is not provided anymore. The SMCs composed of natives, teachers, assemblymen/women, etc., have been particularly active in complementing the efforts of headmasters.

Education system

Usually Kindergarten and crèche/nursery precede formal education. The basic education system is now composed of 6 years primary school (P1-6) and a 3-year Junior High School (JHS) education. Pupils from JHS write the Basic Education Certificate Examination (BECE) with successful candidates admitted to Senior High School (SHS). The duration for SHS has been reduced from 4 to 3 years and graduating students take the West African Secondary School Certificate Examination. Successful graduating students with pass mark below aggregate 24 are able to enroll at the University. Those with pass marks above aggregate 24 are able to enroll at Polytechnics or Teacher's Training College. The new educational system is different from the old set-up (Middle School) for which primary 6 pupils proceeded to 'form 1'. For the old system, students from form 1 – form 3 wrote the common entrance examination and successful candidates proceeded to senior secondary schools (SSS or SHS). Unsuccessful candidates from Form 3 went to Form 4 and obtained the 'middle school leaving certificate'.

There are also private schools that you can attend, which apply the same education system as the public schools. School fees are higher but quality of education is generally better.

Programs

There are some current interventions aimed at improving education. The capitation grant and school feeding programs (which started in 2005?) are meant to reduce the hardship on poor parents caused by the cost of education. Previously JICA and currently DFID support the provision of educational infrastructure in several areas. However some program/interventions exist only on 'paper' as government does not fulfill its part of the bargain adequately or on time. At a recent meeting it was revealed that the DFID support will be discontinued because government has failed to fulfill its commitments.

Teachers posting

Generally, teachers apply to a region (and also a district within the region) of their choice. The GES decides which applicants to accept and also the town/village to be assigned. In 2009 a new system of posting was initiated in the district. All new teachers were posted to rural areas for a period of 3-4 years. Some exceptions were granted on the grounds of health and also female teachers were not posted too far from Berekum in order to increase their chances of getting a proper husband. There are still problems with 'deprived communities' such as Kyereyawkrom, Nkyenkyemamu and Akatim where there is shortage of trained teachers. Pupil's teachers (those without the formal qualification from Teacher's training college) are employed in these villages.

Problems

Major problems faced by the educational sector in the district include:

- Poor educational infrastructures with some schools roofed with palm branches
- The District Assembly (DA) is in charge of all aspect of financing of educational infrastructure with the GES playing a very limited role
- Teachers are poorly motivated in terms of salaries and logistical support for effective supervision
- Allowances such as 'maintenance allowance', which were helpful in the past, have been discontinued
- Inadequate teaching and learning materials
- Salary for people working at the education office is very low

Management

The GES has no project and only perform their mandate of coordinating educational programs in the district. The DA holds quarterly meetings where all issues within the district, including education, are discussed. There is also a Municipal Education Oversight Committee composed of MCEs, DCEs, GES, PTAs, GNAT, NAGRAT, and SMCs which sets and oversee the development of education in the region.

Politics

The main item in the campaign of the NPP (New Patriotic Party) is the promise for free Senior High School (SHS). When asked how this will be possible if the current funding already seems insufficient, Mr. Boateng replies that they will reduce corruption. The funds that become available in this way will be used to facilitate free SHS.

Contact Persons

Hospital Administrator, Public health Coordinator, Social Welfare Officer

Facilities

The Holy Family Hospital (HFH) of Berekum is a municipal hospital owned by the Archdiocese of Sunyani. Services provided are accident and emergency, general in- & outpatient services, physiotherapy, eye care, maternal and child health, Natural family planning ART, CT & PMTCT, pharmaceuticals and X-rays. The HFH also provides specialties such as obstetrics, gynecology, pediatrics and surgery. Cases that cannot be treated by HFH are referred to the Konfo Anokye Teaching Hospital (KATH) in Kumasi. The capacity of the HFH is 400 outpatients per day and 150 inpatient places. The medical facility is accessed by inhabitants of Berekum locality as well as national and even international visitors (e.g. Ivory Coast). Currently the hospital runs malaria and TBC programs and focuses on awareness raising for the consequences of teenage pregnancy.

Cooperation

HFH cooperates with local- and community-based health clinics within the Berekum locality. The hospital provides training, skills building and upgrading for smaller clinics. Also smaller hospitals are sensitized on the need to timely transfer of difficult cases to the HFH to facilitate treatment. HFH also collaborates with radio stations to educate the general public about critical health issues and also to organize programs such as blood donations. The Social Welfare and Public Health Departments provides specific outreach programs for the benefit of surrounding communities. Education is provided through cooperation with churches, football clubs, District Assembly, Municipal, and Regional administration. The HFH can be considered a 'Teaching Hospital' because it provides health training opportunities to students from various health training institutions.

Finance

The hospital used to get financial supports from donors in the past but currently funding opportunities are very limited. Some HFH patients are covered under the National Health Insurance Scheme (NHIS). However, some patients are not insured. Because HFH is a Christian hospital such patients cannot be turned away so they are treated. Rarely do such patients come back to settle their bills. This leaves a huge financial burden on the hospital administration. Institutions from which students come for internships are supposed to make some financial contributions to HFH but these payments are not fulfilled.

The Public Healthcare Department (PHD)

Provides ante-natal and post-natal services and also runs a children clinic. For children, the prevalent issues are upper respiratory- and skin infections. Teenage pregnancy and unsafe abortion are quite high in the Berekum locality. 22-25 pregnancy cases are reported every month for girls between 15-19 years whereas about 2 cases are reported for those between 10-14years. For October 2012, 10 cases were reported for 15-19 years old. The PHD coordinator undertakes educational programs on radio stations (at least 4 times a year) to expose the dangers in unsafe abortions and how it was killing people in the area. HFH has a policy not to terminate pregnancy except the patient has committed unsafe abortion and is bleeding to death. The department is not sure if numbers of cases for unsafe abortion and teenage pregnancy has changed. Recently, 2-3 people died from unsafe abortion. The main problem with unsafe abortion is that the hospital doesn't permit safe abortion and therefore people employ the services of 'quark' or village doctors who have no formal training to undertake such an activity. The PHD provides training to nurses and

community health professionals and implements school health programs for JHS and SHS students. It also educates people on natural methods of family planning. From observations, people are really happy with the natural methods because they don't often like the artificial approach to family planning. The PHD also recently established adolescence friendly clinic to deal with STDs and other issues. But this program is not well patronized because generally people find it difficult to talk openly about such issues.

Social Welfare Department (SWD)

The SWD used to provide financial assistance to needy patients who could not afford their medical bills. The department received funds from individuals and organizations from the USA but for the past 3-4 years no funding has been secured and the hospital administration is not quite sure what to do with this department. There are still patients without health insurance NHIS that cannot afford their bills, or people covered under the NHIS but unable to feed themselves whilst on admission at the hospital. SWD now mainly focus on educating and assisting people to join the NHIS. Costs: GH¢16 and GH¢5 respectively for adults and youngsters (<19).

Meeting with Berekum District Assembly 7/11

We have a meeting with the DA's representative, Mr. Charles Ferka, the Deputy Municipal Coordinating Director (0243318276/ 0203180278). It is difficult to schedule a meeting with him because the office is on strike. Their salary payments will change and the employees disagree, so now there is a nation-wide strike. The Deputy coordinator has not heard of FG project before, except for a request to use their grader. He is not sure whether the DC is aware yet.

Problems

The main problem faced by the DA in Tain FR is the presence of cattle (Fulani). The case came to the district a while ago but it was too big for the office so they had to send it through to the regional level. They tried to evict the Fulani using military forces but they only drove them as far as Seikwa and they returned soon after. One of the key issues is that traditional land-owners secretly accept money from the Fulani in exchange for land. Then they complain about the Fulani to the DA. The Deputy Coordinator recommends FG help the Fulani to fence off their area in order to prevent the cows from entering.

The next big issue is posed by the ongoing bushfires is the FR. The DA plans for a big anti-bushfire campaign in cooperation with the military, police, security, fire volunteers and fire service men. They will go on air. The DA has so far provided pick-ups, boots, cutlasses, fuel and allowances (the latter is however not on a regular basis due to a lack of funds) to aid in effective firefighting. The fire volunteer revitalization and anti-bushfire campaign are local initiatives, funded by locally generated funds.

Another major issue is the problem of road maintenance. Roads are generally poorly maintained and accessibility is not up to standards. The DA is in charge of this and has a grader for this purpose but due to lack of funds they cannot provide fuel for the grader to perform the maintenance work.

Communication

Communication with traditional land-owners depends on the leadership style of the DCA. Political expressions by traditional authorities is making cooperation difficult. The role of traditional land-owners diminishes as chiefs tend to express their political interest, thereby losing part of the capacity in the community. Communication with the villages goes via assembly men, who meet 4 times a year to announce the plans of the DA to the community.

DA is supposed to communicate with forestry through a representative, but the current representative has been staying in Doma. Currently it is up to the assembly men to report illegal activities in the forest to the DA. Cooperation with fringing districts (Jaman South) is very good. They have meetings on issues that concern issues covering both districts.

Meeting with Agric district office 7/11

Contact Person: Mr. Kyei Baffour, District Agric Director, 0244983083/0208209697

Concerns and expectations

The District MoFA director has been introduced to Mr. Willem Fourie (MD of Form Ghana) by the DCE and has been briefly informed about Form Ghana's intended project in Tain II forest reserve. MoFA expects the project to mainly have positive impacts because Teak has so much economic value already in the district. It will have economic benefits for both the company and farmers, creating job opportunities, improving the local economy and possibly infrastructure in the local communities, allow farmers to use the leftover timber and create employment for women. MoFA's main concern is that some farmers are still farming in the reserve and the proposed project may deny these farmers access to land for farming which may have adverse effects for both these farmers and also food production in the district. MoFA would also like to know if Form Ghana intends to undertake harvesting, processing and exporting of its Teak plantation. Can Form Ghana also assist local community development? And does Form Ghana have a program for out growers? Currently there are about 500-1000 out growers in the district with most Teak farms surprisingly located on fertile lands. It will be in the interest of Form Ghana if they could adopt an out growers policy similar to that used by the Twifo Oil Palm Plantation (TOPP). At the moment another group of investors from India are in the district and are exploring the feasibility for cassava production and processing.

Function of MoFA

MoFA is mainly involved in extension and education on crop production. The agency provides technical know-how and advisory services to farmers. MoFA also undertake field suitability assessment for farming. MoFA staff can be contracted by individuals or organizations to perform specific task as determined by the client. Currently farmers mostly seek information about agricultural inputs (where to source quality inputs and best practices for such inputs) from MoFA.

Current MoFA projects include:

- German International Cooperation (GIZ) and African Cashew Initiative (ACI), grafting cashew trees for improved production (3000 grafts were made and sold so far).
- WAPP and RTIMP (Root and Tuber Improvement Project): focuses on cop-pice cassava management. Five (5) acres of cassava field establishment and the intention is to expand this soon.

Major developments and problems in the agricultural sector within the district:

- The cashew market is picking up and some cashew farms are now springing up
- Abandoned cocoa farms are being reactivated and there is influx of people to establish cocoa farms in the district.
- In spite of several Teak farms in the district, MoFA has no experience with Teak Plantation Companies but has only heard about the Taungya Plantation system.

- Cattle grazing is a major problem in the district. The activities of the Fulani herdsmen are strongly associated with bush fires as they burn land to create more grassland. Cattle grazing also pose difficulties for farmers because the cattle also feed on food crops and destroy farms. Suggestions to have fenced areas for cattle have been made.
- Bush fire is on the decline and this can be partly attributed to the bush fire law (requested by the district assembly from MoFA) and the activities of fire volunteers.

Meeting with Seikwa Chief 8/11

The Seikwa chief and his sub-chiefs meet us on a day of mourning as one of the sub-chiefs has passed on. After explaining our mission, we ask him about the villages that he thinks should be included in the assessment. He mentions Dadease, Nfodwokrom, Mangoase, Kogua (?), Tainso, Arkokrom and Kwadwoakokrom.

The chief explains to us that other forestry companies came to his palace before and gave him presents. ABTS provided money to build his palace. Other companies were Oti Yeboah Sawmills, AG Timbers, Sunstex and Ayum. The chief asks us what the benefits of the FG project will be for his chieftaincy. He wonders if Seikwa district is included in the benefit sharing agreement between forestry and FG.

Recommendations

- The company should consider implementing an outgrowing program since many farmers would be interested in selling their Teak. Even the traditional council owns land with Teak.
- One of the sub-chiefs adds that it would be good if the company would provide financial benefit to the out growers during growth of the Teak, as it takes 20 years and otherwise they won't be able to plant anything in the meantime.
- There should be a balanced division in benefits between Seikwa and Berekum, since most of the workers will be employed in Seikwa district (this assumption was corrected by us).

Questions raised

- Will housing be provided for the workers if they have to come from far?
- Will there be social amenities for the communities, especially regarding caring for kids of the Forms?
- Will there be social welfare programs?

Major issues for Seikwa chieftaincy

- 1) There is no location for holding communal meetings. They currently started with this building but they need assistance.
- 2) There is no palace for the Queen Mother.
- 3) Health issues; there is clinic and they would like to expand this to include a nurses training college
- 4) Development of the education facilities and infrastructure on the northern side of the reserve is necessary.

Communication

There is absolute peace and a cordial relationship between the chief of Seikwa and the chief of Berekum. Seikwa chief is the uncle of Berekum chief. Generally, they only cooperate in case there are big issues to be discussed, otherwise they handle it on their own.

The chief does not cooperate with the Seikwa DA because they each have their own function and responsibilities. In case there are major issues in the area, or major decisions to be taken, the DA consults the chief before making plans.

Meeting with NCCE 9/11

Contact Person: District Director, NCCE, Berekum

Concerns

Why did all the process leading to the degradation of Tain II forest reserve persisted in spite of all the forestry systems that were in place?

Core Functions of the NCCE

The NCCE was established in accordance with article 231 of the 1992 Constitution. The commission is an independent body which is tasked to:

- educate Ghanaians to defend the constitution
- educate Ghanaians about their civic rights and responsibilities
- draw governments attention to existing social inequalities

Projects

At the moment the main activity of the NCCE office is education on the impending elections. In this respect the NCCE is focusing on PEACE before, during, and after the elections, as well as, the fundamental rights of each citizen in relation to the electoral process. The main channel for education and sensitization is through identifiable groups such as churches, mosques, etc. The NCCE also organizes forums for interaction between political candidates and the communities through which aspiring member of parliaments for the various constituencies explain their policies to the people. At the moment there are over 36 major and about 10 minor communities in the district.

Other targeted collaborators for NCCE's outreach programs are: Nananom (Traditional authorities), Unit Committee member and Assemblymen/women. The NCCE is also involved in a number of projects in the district. These includes: HIV AIDs Project, Malaria Project, and the Bush Fire Project (for which the NCCE collaborates with the GNFS, Ministry of Information, Ghana Police, MoFA, FC, and the District Assembly). The NCCE has also established civic education clubs in the second cycle schools for which the Constitution Game is one major tool use to educate students about the constitution of Ghana. The NCCE has also been involved in revenue generation campaigns for the DA and also collaborates with radio stations in the district to educate the citizenry, particularly regarding discipline on the roads in the district. The NCCE also participates in the Inter-party Dialogue Committee (IPAC) which is a platform for peaceful resolution of political conflicts in the district. The NCCE also collaborate with private organizations.

* At the moment the NCCE doesn't involve the Omahene of Berekum in its activities because there are on-going conflicts about chieftaincy issues. A section of the royal families do not accept the current chief because the right traditional procedure was not followed during his enstoolment and the case is now being adjudicated by the Regional House of Chiefs (RHC). The RHC has declared that at the moment there is no substantive chief in Berekum until the case is decided. Therefore only the Kontihene of Berekum is recognized by the RHC as being in charge of any traditional issues.

Meeting with Sunyani District Forestry Office 16/11

We met with the District Forest Manager, Mr. Sintim, in his office. The two deputy directors also joined in the meeting, and the administrator joined for the last couple of minutes.

FR degradation

The FR was already degraded in certain patches before the great fire in 1983 destroyed the forest. There are no historical records of the flora and fauna in the reserve. We looked into a management plan from 1970, but the chapter on ecology was not included. The office is now working on a new management plan. The degraded patches were planted with Teak as part of the Modified Taungya System. After the great fire, the Modified Taungya System was continued on a larger scale in selected compartments. The HIPC program, ran by the government, was also initiated to realize reforestation of the reserve. The difference between the two is the benefit sharing agreement (for MTS) and monthly salary (for HIPC), and the initiating bodies. Farmers saying that they planted Teak recently under MTS benefit sharing agreements did so only within the selected compartments, not in other places.

In one of the communities, the chief was under the impression that the land had only temporarily been allocated to the government and would be reallocated to the local land owners after a period of 99 years. When we posed this question to Mr. Sintim he replied that this is not true, the land is permanently converted to Forest Reserve, and he doesn't know where the chief got this idea from.

FR Boundary

People from the village Meremano indicated that the boundary of the FR had been shifted a long time ago from the original line at the Fete River, to more into the reserve. They have planted Teak and cocoa between the two boundaries. According to Mr. Sintim the boundary was never shifted and he doesn't understand where the community got that idea from. According to him the community knows that planting beyond the Fete River is illegal.

Cooperation

The cooperation with other districts is excellent, according to the Mr. Sintim. He shows us a letter that he sent to all stakeholders for the collective eviction of the Fulani in the FR. Jaman North and South are included but Tain is not included. Mr. Sintim explains that all the fringing communities are included in the management of the reserve and will personally be informed on the plans.

Mr. Sintim expects large-scale cooperation between Form Ghana and their office, sharing logistics (vehicles, motors, and machines) and (military) training of employees.

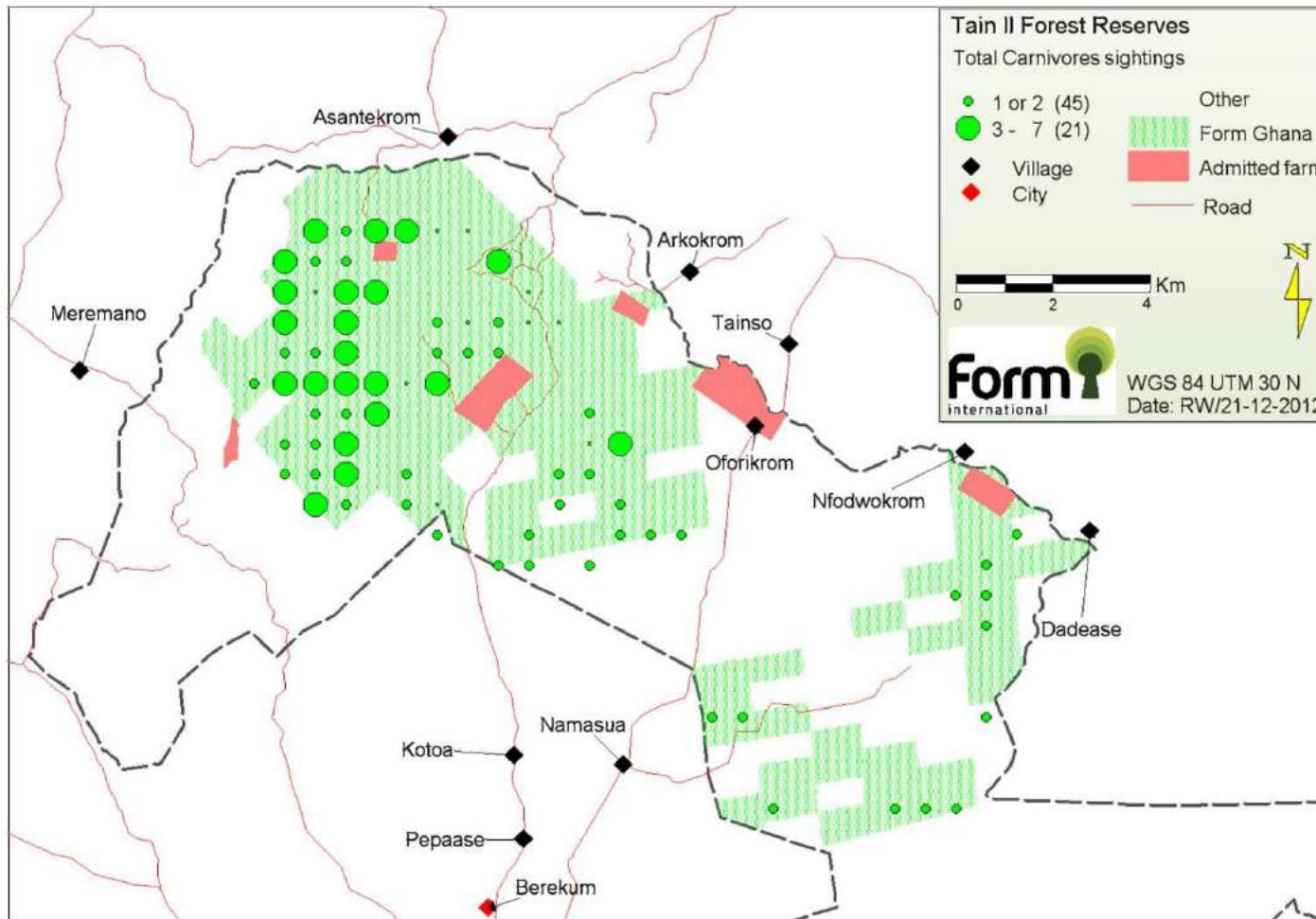
APPENDIX G. FLORA IN TAIN II

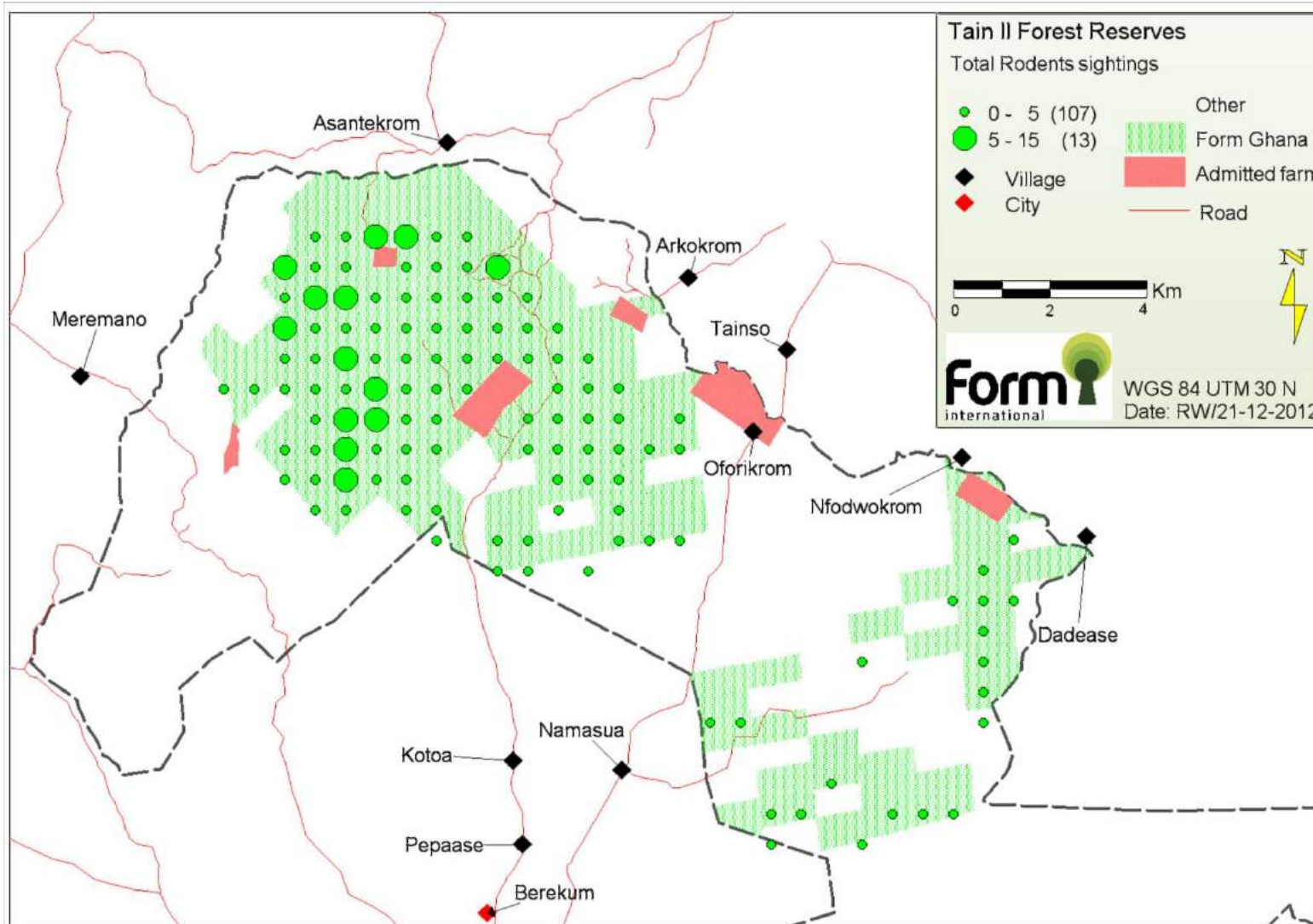
a. Indigenous tree species in Tain II FR

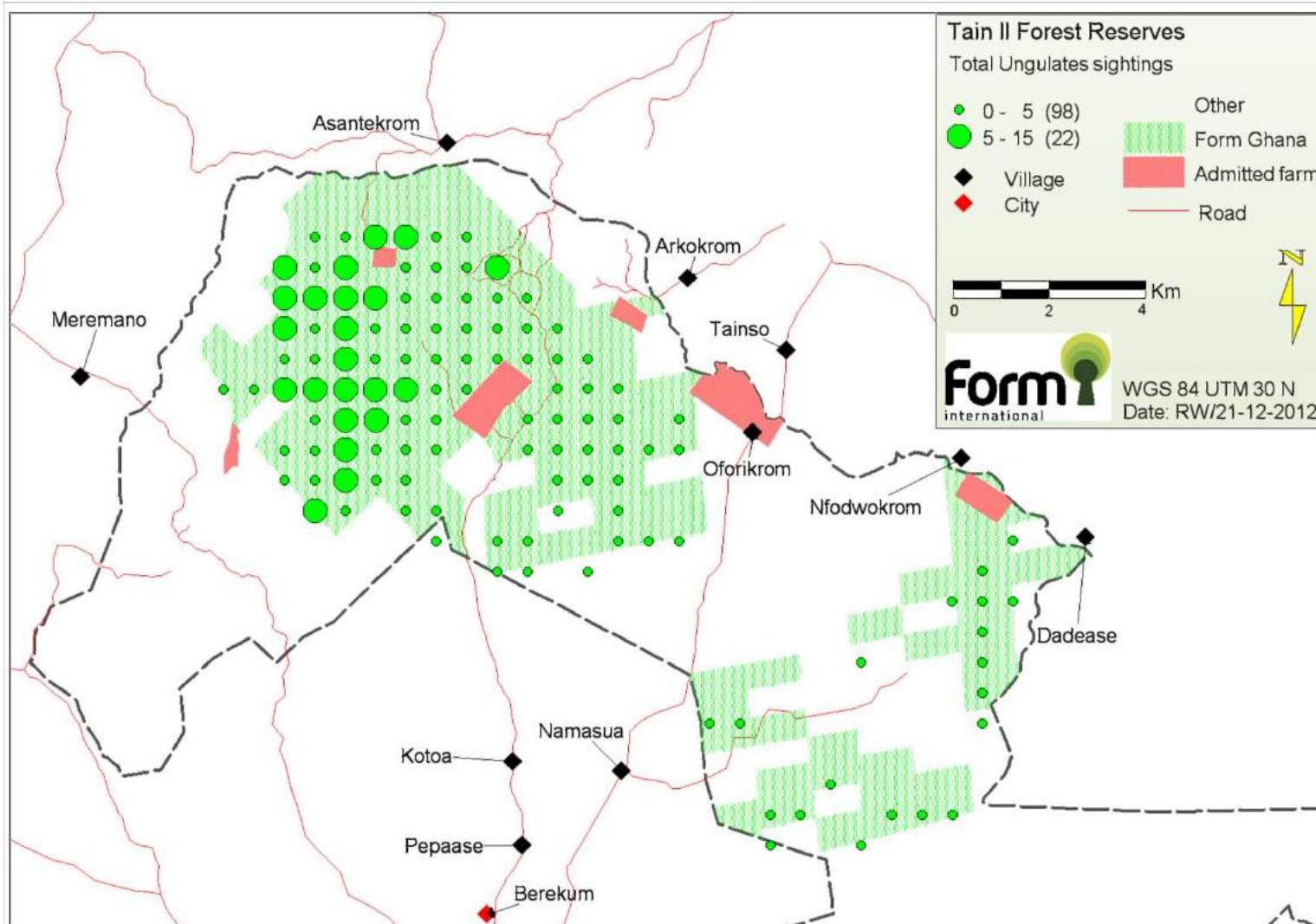
Family	Common name	Tree species	Degraded Area	Farm	Forest	Total
Anacardiaceae	Cashew	<i>Anacardium occidentale</i>			4	4
Apocynaceae	Sese	<i>Holarrhena floribunda</i>		1	18	19
Bignoniaceae	Kuo-kuonisuo	<i>Spathodea campanulata</i>	1	1	3	5
	Sesamasa	<i>Newbouldia leavis</i>	3	4	13	20
Caesalpinioideae	Papao	<i>Azelia africana</i>	1		3	4
Cecropiaceae	Nyankuma	<i>Myrianthus arboreus</i>	3		4	7
Combretaceae	Kane	<i>Anogeissus lero-carpus</i>	2	2	8	12
	Ofram	<i>Terminalia superba</i>			4	4
	Ongo	<i>Terminalia glau-cascens</i>	2			2
	Petrii	<i>Terminalia avicennoidea</i>	2		5	7
Euphorbiaceae	Gyama	<i>Alchornea cordifolia</i>	2		3	5
	Odubrafo	<i>Mareya micrantha</i>			1	1
	Pepea	<i>Margaritaria discoidea</i>	4		8	12
	Satadua	<i>Mallotus oppositifolius</i>	3	2	2	7
	Wama	<i>Ricinodendron heudelotii</i>	2		8	10
Fabaceae (leguminosae-mim)	Ewiemfo Samina	<i>Albizia ferruginea</i>	4		11	15
	Kagya	<i>Griffonia simplicifolia</i>			9	9
	Okro	<i>Albizia zygia</i>	4	1	8	13
	Pampena	<i>Albizia adianthifolia</i>	11		47	58
	Potrodom	<i>Erythrophleum suaveolens</i>	5		5	10
Gentianaceae	Bontodie	<i>Anthocleista vogelii</i>		2	9	11
Leguminosae-caes.	Totoro	<i>Anthonotha macrophylla</i>	1		6	7
Leguminosae-mim	Cassia	<i>Senna siamea</i>	3	1	6	10
	Dahoma	<i>Piptadeniastrum africanum</i>		1		1
	Prekese	<i>Tetrapleura te-</i>	5		1	6

		<i>traptera</i>			
Leguminosae-pap	Apea	<i>Mucana pruriensis</i>	1		1
	Wota	<i>Dalbergia hostilis</i>	1	2	2 5
Malvaceae (Sterculiaceae)	Ananse Dodewa	<i>Cola milleuii</i>	1		14 15
	Oprono	<i>Mansonia altissima</i>			4 4
	Sofo/Foto	<i>Sterculia tracagantha</i>	2		9 11
	Watapuo	<i>Cola gigantea</i>	8	2	24 34
	Wawa	<i>Triplochiton scleroxylon</i>	2	1	10 13
	Wawabi-ma	<i>Sterculia rhinopetala</i>	2		2
	Malvaceae (Bombacaceae)	Akonkodie	<i>Bombax buonopozense</i>	3	
Onyina		<i>Ceiba pentandra</i>	4		2 6
Onyina Koben		<i>Bombax brevicuspe</i>	7	1	3 11
Meliaceae	Kakadikro	<i>Trichilia prieureana</i>	5		5
	White Mahogany	<i>Khaya anthotheca</i>	3		2 5
Moraceae	Kotre Amforo	<i>Ficus capensis</i>	4		1 5
	Kyenkyen	<i>Antiaris toxicaria</i>	13		8 21
	Nyankyere	<i>Ficus exasperata</i>	5		2 7
	Odoma	<i>Ficus anomani</i>	1		9 10
	Odum	<i>Milicia excelsa</i>	4		9 13
	Wonton	<i>Morus mesozygia</i>	7	1	8 16
Palmae	Abe	<i>Elaeis guineense</i>	4		7 11
Phyllanthaceae		<i>Margaritaria discoidea</i>			1 1
Rubiaceae	Konkroma	<i>Morinda lucida</i>			6 6
	Sresokusia	<i>Nauclea latifolia</i>	1		4 5
Sapindaceae	Akyee	<i>Blighia sapida</i>	2		8 10
	Dwendwera	<i>Lecaniodiscus cupanioides</i>			8 8
	Toatin	<i>Paullinia pinnata</i>	1		6 7
Sapotaceae	Akasaa	<i>Chrysophyllum delevoyi</i>	1		6 7
	Asamfinani	<i>Aningeria altissima</i>	3		14 17
Ulmaceae	Esafufuo	<i>Celtis mildbraedii</i>	1		6 7
	Sesea	<i>Trema orientalis</i>	8		8 16
Total			152	22	371 545

APPENDIX H. FAUNA HOTSPOTS IN TAIN II







APPENDIX I. FAUNA IN TAIN II

- a. Mean animal encounter rates per km for the main vegetation types in study area.

Category	Species	Teak	Degraded	Forest	Farmland
Carnivores	Civet	1		20	1
	Cusimanse Mongoose			54	
	Genet	2		35	
	Marsh Mongoose	2	3	33	
Reptiles	Cobra	10	17	17	20
	Green Mamba	5	8	9	15
	Monitor Lizard			10	1
	Puff Adder			1	4
	Rock Python	2	1		1
	Royal Python	1	2	1	1
Rodents	Brush-tailed Porcupine	7	7	98	14
	Giant Rat		3		7
	Grass cutter	19	39	2	71
	Ground Squirrel	1			3
Ungulates	Bushbuck	9	44	72	9
	Maxwell duiker		10	108	
	Red River Hog			37	
	Royal Antelope			9	
Total		59	134	506	147

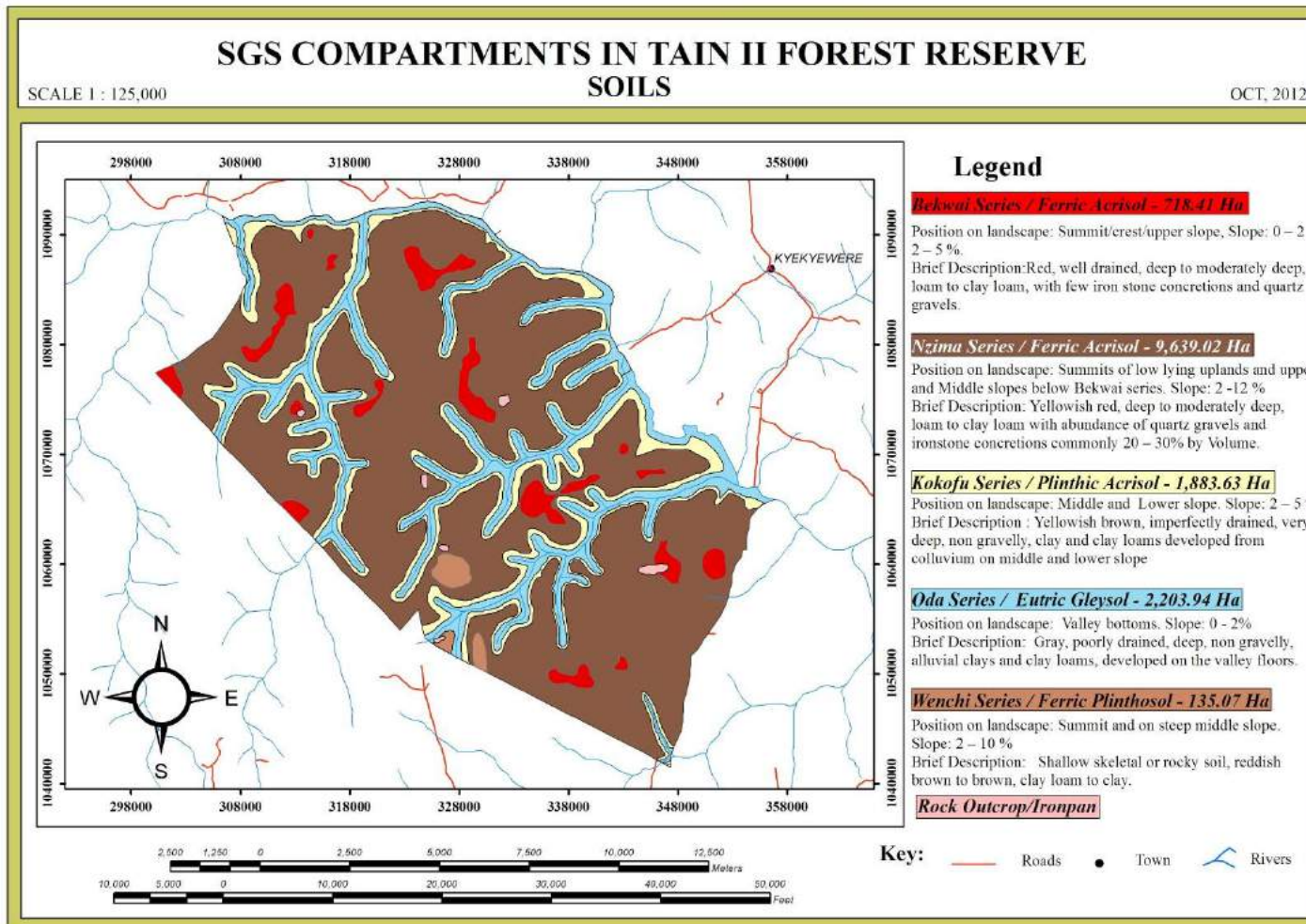
b. Bird sightings per vegetation type in Tain II

Family	Common name	Scientific name	Degraded	Farm-land	Forest	Teak
Accipitridae	Yellow billed kite	<i>Milvus aegyptius</i>	12	4		
Alcedinidae	African Pygmy Kingfisher	<i>Ispidina picta</i>			4	
Apodidae	African Palm Swift	<i>Cypsiurus parvus</i>	20			
Bucerotidae	African Grey Hornbill	<i>Tockus nasutus</i>	8	8	28	
	African Pied Hornbill	<i>Tockus fasciatus</i>	20	8	28	8
Capitonidae	Red-rumped Tinkerbird	<i>Pogoniulus atroflavus</i>			16	
	Yellow-billed Barbet	<i>Trachyphonus purpuratus</i>				4
Cisticolidae	Zitting Cisticola	<i>Cisticola junco</i>	80			16
Columbidae	Blue-headed Wood Dove	<i>Turtur brehmeri</i>	4			
	Green Fruit Pigeon	<i>Treron calva</i>			24	
	Laughing Dove	<i>Streptopelia senegalensis</i>	16			8
	Red-eyed Dove	<i>Streptopelia decipens</i>	36	8	48	24
	Tambourine Dove	<i>Turtur tympanistria</i>	12		12	
Coraciidae	Blue-throated Roller	<i>Eurystomus gularis</i>		8		
	Broad-billed Roller	<i>Eurystomus glaucurus</i>	64			
Cuculidae	Grey-headed Bristlebill	<i>Bleda canicapilla</i>			1	
	Klaas Cuckoo	<i>Chrysococcyx klaas</i>	8	4	1	4
	Senegal Coucal	<i>Centropus senegalensis</i>	3		12	
	Yellowbill	<i>Ceuthmochares aereus</i>		4	16	
Dicruridae	Fork-tailed Drongo	<i>Dicrurus adsimilis</i>			8	
	Shining Drongo	<i>Dicrurus atripennis</i>			12	
Estrildidae	Bronze Manikin	<i>Spermestes cucullata</i>	24			
	Grey-crowned Negro-Finch	<i>Nigrita canicapilla</i>	8		16	
	Lavender Fire-Finch	<i>Estrilda caerulescens</i>			6	
	Orange-cheeked	<i>Estrilda melopoda</i>	24	8		

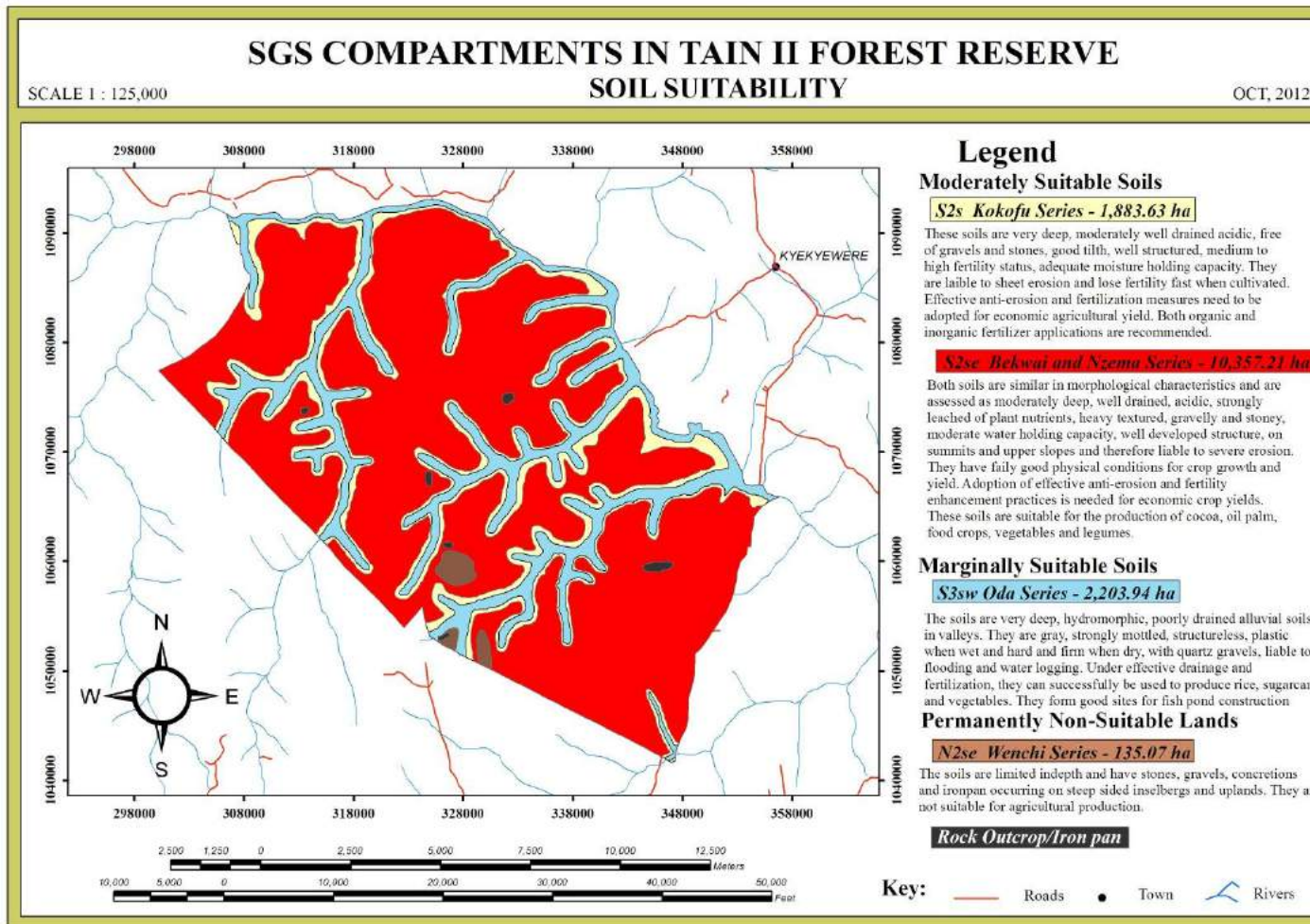
	Waxbill				
Falconidae	Grey Kestrel	<i>Falco ar-</i> <i>dosicicens</i>	12		4
Meropidae	White- throated Bee- eater	<i>Merops al-</i> <i>bicollis</i>	56	114	105
Muscicapidae	Black and White Fly- catcher	<i>Ficedula hy-</i> <i>poleuca</i>			8
	Northern Black Fly- catcher	<i>Melaenornis</i> <i>edolioides</i>			8
	Pale Fly- catcher	<i>Bradornis pal-</i> <i>lidus</i>		4	
	Paradise Fly- catcher	<i>Tersphone</i> <i>viridis</i>			16 8
	Red-bellied Paradise Fly- catcher	<i>Tersiphone</i> <i>rufiventer</i>			24
Musophagidae	Green Turaco	<i>Tauraco persa</i>	7		12
Nectariniidae	Collared Sun- bird	<i>Anthreptes</i> <i>collaris</i>			4
	Copper Sun- bird	<i>Cinnyris cu-</i> <i>preus</i>	4	4	8
	Little Green Sunbird	<i>Nectarinia</i> <i>seimundi</i>			12
	Superb Sun- bird	<i>Nectarinia</i> <i>superba</i>		12	24
Paridae	White- shouldered Black Tit	<i>Parus guin-</i> <i>eensis</i>			4
Phasianidae	Ahanta Fran- colin	<i>Francolinus</i> <i>ahantensis</i>	4	4	24
Phoeniculidae	Black scimi- tarbill	<i>Rhino-</i> <i>pomastus</i> <i>aterrimus</i>			32
	Green Wood Hoopoe	<i>Phoeniculus</i> <i>purpureus</i>	8		24
Picidae	Cardinal Woodpecker	<i>Dendropicos</i> <i>fuscescens</i>			16 12
	Fire-bellied Woodpecker	<i>Dendropicos</i> <i>pyrrhogaster</i>	8		16
Ploceidae	Black headed Weaver	<i>Ploceus mel-</i> <i>anocephalus</i>			8
	Black-winged Bishop	<i>Euplectes</i> <i>hordeaceus</i>	68	61	16
	Grey-headed Sparrow	<i>Passer</i> <i>griseus</i>	12	4	
	Northern Red Bishop	<i>Euplectes</i> <i>franciscanus</i>			20
	Pin-tailed	<i>Vidua</i>	12		20 13

	Whydah	<i>macroura</i>				
	Red-collared Widowbird	<i>Euplectes ardens</i>				4
	Red-headed Bishop	<i>Anaplectes melanotis</i>		8	25	
	Viellot's black Weaver	<i>Ploceus ni- gerrimus</i>	40			40
	Yellow Man- tled Widow Bird	<i>Euplectes macroura</i>	16	4	20	
Pycnono- tidae	Common Bul- bul	<i>Pycnonotus barbatus</i>	32	12	32	21
	Grey-headed Bristlebill	<i>Bleda cani- capilla</i>	4		14	
	Honeyguide Greenbul	<i>Baeopogon indicator</i>			4	
	Icterine Greenbul	<i>Phyllastre- phus icterinus</i>	4		8	
	Little Green- bul	<i>Andropadus virens</i>	4		16	4
	Simple leaf- love	<i>Chlorocichla simplex</i>	16			
Sylviidae	Grey-backed Camaroptera	<i>Camaroptera brachyuran</i>	24	8	16	33
	Olive-green Camaroptera	<i>Camaroptera chloronota</i>			24	8
	River Prinia	<i>Prinia fluviati- lis</i>			32	12
Total			670	287	776	271

APPENDIX J. SOIL MAP OF TAIN II



APPENDIX K. SOIL SUITABILITY MAP OF TAIN II



APPENDIX L: DATA FROM THE WATER SAMPLES

Sample ID	WHO Guideline Values	Sample location						
		1	2	3	4	5	6	7
Date received		28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012
Date analysis		29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012
Temperature (oC)		28.5	28.4	28	28.1	28	27.9	27.9
pH	6.5-8.5	6.65	6.75	6.81	6.84	6.8	6.81	6.77
Apparent Colour (PtCo)	15	270	253	267	265	290	251	318
Turbidity (NTU)	5	35.9	34.09	42.34	37.15	35.43	32.59	45.44
Conductivity (us/cm)	1000	106	104.9	104.4	106.2	104.6	107.1	228
Total dissolved Solids	1000	70	70	70	70	70	80	228
Suspended Solids	-	20	23	23	23	24	22	53
Total Solids	-	90	93	93	93	94	102	281
Alkalinity	200	78	70	68	68	60	32	120
Total Hardness	500	44	40	36	38	44	39	100
Calcium Hardness	-	30	32	28	34	30	30	64
Magnesium Hardness	-	14	8	8	4	14	9	36
Calcium	200	12	12.8	11.2	13.6	12	12	25.6
Magnesium	150	3.4	1.9	1.9	1	3.4	2.2	8.7
Chloride	250	18	21	23	16	21.1	19	20
Nitrate	50max	0.051	0.75	1	0.23	0.26	2.6	0.23
Sulphate	400	19	0	0	21	22	7	20
Copper	0.1	0.37	0	0.44	.	0	0.13	0.44
Iron	0.3	2.63	2.93	2.83	2.83	2.83	2.93	2.63

Sample ID	WHO Guideline Values	Sample location						
		8	9	10	11	12	13	14
Date received		28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012
Date analysis		29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012
Temperature (oC)		27.7	27.5	27.5	27.2	27.3	27.3	27
pH	6.5-8.5	6.86	6.92	7.1	7.8	7.01	6.96	7.05
Apparent Colour (PtCo)	15	186	290	301	278	269	388	299

Turbidity (NTU)	5	21.85	36.43	34.99	34.25	46.99	45.54	42.36
Conductivity (us/cm)	1000	188.2	104.7	104.9	104.4	106.2	16.9	106.6
Total dissolved Solids	1000	188.2	104.7	104.9	104.4	106.2	70	70
Suspended Solids	-	25	25	26	26	27	34	30
Total Solids	-	213.2	129.7	130.9	130.4	133.2	104	100
Alkalinity	200	64	60	104	64	62	60	56
Total Hardness	500	84	36	44	42	44	52	40
Calcium Hardness	-	72	30	28	26	40	38	34
Magnesium Hardness	-	12	6	16	16	4	14	6
Calcium	200	28.8	12	11.2	10.4	16	15.2	13.6
Magnesium	150	2.9	1.5	3.9	3.9	1	3.4	1.5
Chloride	250	22	25	22	20	25	21	20
Nitrate	50max	0.4	0.021	0.5	0.12	0.24	0.23	0.4
Sulphate	400	0	0	14	16	17	12	20
Copper	0.1	0	0.13	0.13	0.4	0.1	0	0.44
Iron	0.3	2.63	2.35	2.73	2.63	2.63	2.73	3.34

		Sample location						
Sample ID	WHO Guideline Values	15	16	17	18	19	22	23
Date received		28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012
Date analysis		29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012
Temperature (oC)		26.9	27	26.7	26.8	26.9	26.7	29
pH	6.5-8.5	7.03	6.91	6.96	6.89	7.05	6.92	6.96
Aparrent Col-our (PtCo)	15	335	163	82	124	109	311	219
Turbidity (NTU)	5	48.12	25.88	11.77	28.63	13.38	54.47	23.15
Conductivity (us/cm)	1000	106.8	190.4	251	252	233	182	195
Total dissolved Solids	1000	80	130	180	180	160	130	130
Suspended Solids	-	34	34	13	31	14	48	24
Total Solids	-	114	164	193	211	174	178	164
Alkalinity	200	62	11	134	146	138	100	110
Total Hardness	500	40	82	104	106	90	72	84
Calcium Hardness	-	32	70	82	104	86	70	80
Magnesium	-	8	12	22	2	4	2	4

Hardness								
Calcium	200	12.8	28	32.8	41.6	34.3	28	32
Magnesium	150	1.9	2.9	5.3	0.5	1	0.5	1
Chloride	250	36	28	31	23	21	20	18
Nitrate	50max	0.2	0.43	0.35	0.7	0.58	1.2	0.85
Sulphate	400	20	9	9	10	3	21	8
Copper	0.1	0	0.3	0	0	0.63	0	0.1
Iron	0.3	3.34	2.14	0.72	3.48	1.93	3.85	1.88

Sample ID	WHO Guide-line Values	Sample Location							
		24	25	26	27	28	29	30	31
Date received		28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012	28-11-2012
Date analysis		29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012	29-11-2012
Temperature (oC)		29.3	29.1	29.3	29.1	29.2	29.2	29	28.7
pH	6.5-8.5	7.06	7.07	7.05	6.91	6.83	6.9	6.94	6.87
Aparrent Col-our (PtCo)	15	346	358	326	90	131	87	108	92
Turbidity (NTU)	5	48.06	47.52	42.6	14.03	15.35	6.14	40.78	9.1
Conductivity (us/cm)	1000	111.1	109.3	226	226	157.5	238	278	278
Total dos-siolved Solids	1000	80	80	80	160	110	170	200	200
Suspended Solids	-	36	35	31	14	15	10	12	10
Total Solids	-	119	115	111	174	165	180	121	210
Alkalinity	200	72	64	60	124	80	130	116	112
Total Hard-ness	500	42	44	46	104	72	100	86	100
Calcium Hardness	-	30	32	36	92	52	98	76	8
Magnesium Hardness	-	12	12	10	12	20	2	10	14
Calcium	200	12	12.8	14.4	36.8	20.8	39.2	30.4	34.4
Magnesium	150	2.9	2.9	2.4	2.9	4.9	0.5	2.4	3.4
Chloride	250	24	23	24	22	19	22	38	42
Nitrate	50max	0.28	0.65	0.5	0.3	0.65	1	0.12	0.2
Sulphate	400	0	20	19	0	5	5	7	5
Copper	0.1	0	0	2.4	0	0	0	0	0
Iron	0.3	5	4.1	5.5	1.88	1.88	0.8	1.68	1.49

ANNEX M: METHODOLOGY ECOLOGICAL SURVEY

Using GIS applications, a grid consisting of cells, each 1km of length or breadth was superimposed on a map of Tain II FR showing the Form Ghana compartments (Figure 1).

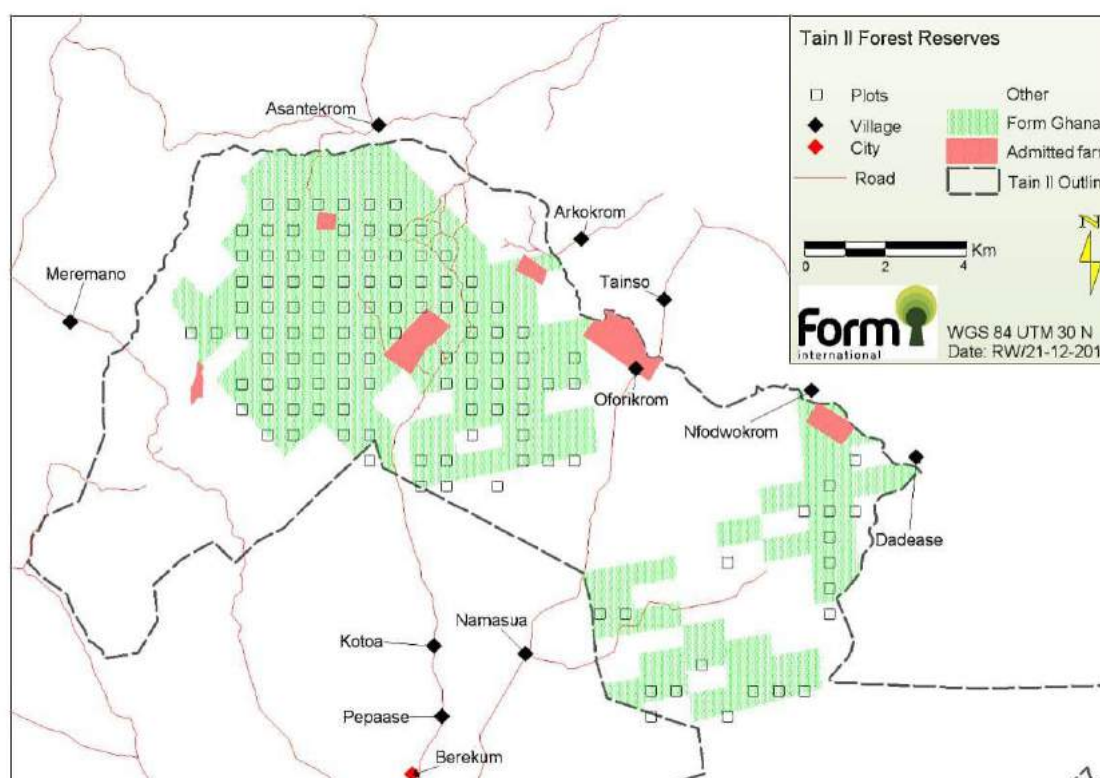


Figure 1. Map of Tain II Forest Reserve showing distribution of compartments and transects.

One hundred and twenty transects of 1km in length were systematically distributed over the various compartments based on the number or cluster of compartments found at a particular place. The intersections of the grid formed the beginning of each transect. A total of 100 transects was laid out the biggest cluster (constituting about 100 compartments) located in north-west of study area. The remaining twenty transects were distributed equally over the two smaller clusters located in north-east and south of the study area, conforming to a systematic segmented line transect design. All transects were oriented northwards as a rule of thumb (Norton-Griffiths 1978).

Determination of the survey transect system set-up was based on three basic requirements;

1. a length of transect long enough to cover animals with large territories and home ranges (ungulates, carnivores);
2. a transect system sufficiently fine-grained to determine the habitat preferences and density estimation of species with restricted range and small territories;

3. a length of transect long enough to include most vegetation and farm types typical of the study area.

As a basis for comparing flora and fauna relationships, each transect was associated with a vegetation plot. Thus each vegetation plot was systematically placed in the middle and across a fauna assessment transect (Norton-Griffiths 1978).

It is impossible to count animals directly in the forest/farm/farm bush mosaic such as that of the study area because of the poor visibility. Hence, the field team conducted a sign count survey, using the line transect method (Burnham *et al.*, 1980; Buckland *et al.*, 1993, 2001) adapted for forest conditions. Two survey teams of four technicians, led by a forest guard (line cutter) did the identification of organisms to ensure consistency in data collection procedures. The technicians consisted of experts in four taxonomically well-known groups: mammals, herpetofauna, avifauna and vegetation. The following notes were made each time an animal sign was recorded:

- Distance along the transect, measured by the GPS
- Vegetation type in the area
- Date that the transect was walked
- Number and types of animal signs
- Number of hunting activity (empty cartridges, wire snares, etc.)
- Number of farming activity
- Distance to water sources
- Length of vegetation type traversed on transect (km)

Other notes were made on ecological and human factors that might explain the distribution of animals including distance to water sources (ponds, rivers, streams) and number of human signs (farming and hunting activity).

The starting point of each transect was reached by navigation with a compass and a GPS. Once on the transect, all animal signs observed along the transect centreline were recorded. The team member responsible for navigation directed the line cutter whilst all team members walked in line towards the line cutter, scrutinizing the undergrowth and foliage on either side for animals or their signs including droppings, trails, feeding activity and vocalizations.

Flora survey

Sample plots were laid at the mid-point (500m) of each transect. Plots were sized 50m by 50m dimensions for forest vegetation and 20m by 20m for any other vegetation type. Each of these plots was associated with a 5m by 5m and 2m by 2m plot for more detailed assessment of saplings, seedlings and grass species. The sample plots were demarcated with the help of ranging poles, a prismatic compass and a linear measuring tape. The transect line passed through the middle of the plot to facilitate movement through the plot.

An enumeration team was made up of a tree spotter and a recorder. Moving clock-wise, all trees were identified, recorded and diameter at breast height (Dbh) measured and recorded. Nomenclature of tree species followed Hawthorne and Jongkind, (2006) and Hawthorne and Ntim Gyakari, (2006).

Tree density and relative density were estimated as;

$$\text{Tree density} = \frac{\text{Total number of trees in all plots}}{\text{Total sampled area}}$$

$$\text{Relative density} = \frac{\text{Number of a particular species}}{\text{Total number of species}}$$

Small mammals

Mammals are considered 'small' in this study if they weigh less than 1kg, as described by Stuart and Stuart (2006). Examples of small mammals are rats and squirrels. Small mammal populations are strongly related to habitat, vegetation cover and flora diversity. Higher vegetation cover and diverse flora habitat have proved to result in higher abundance and diversity of small mammals (Blouin-Demers et al., 2003). Reasons for this relationship are their short lifespan, rapid population dynamics and low hunting pressure in comparison to larger mammals.

Only live-trapping methods were used for small mammals. Fifty Sherman live traps were used simultaneously. Trap lines were set along trails, hauling roads and selected transects, in various habitat types. Traps were placed either randomly or at fixed intervals of 25m on each side of roads, paths and cut lines. Majority of traps were placed on the ground, lightly covered with leaves, bark etc., whereas some were placed on fallen trees or lianas. Others were set close to heaped brushwood, network of aerial roots, holes in the ground or hollow trees. Traps were baited with peanut butter. Trap sites were indicated by ribbons made of orange nylon rope fixed at eye height on twigs. Voucher specimen were collected and preserved as wet specimens in 70% ethanol and later identified at the Faculty of Renewable Natural Resources museum.

Medium-sized mammals

Mammals were classified as 'medium-sized' when the average weight was over 1kg (Estes, 1991; Stuart and Stuart, 2006). Many medium-sized mammal species have been exploited locally and are likely to have been driven to local extinction during the past century (e.g. Wilson, 1988). The IUCN Red List noted that many animals found in Ghana are threatened, endangered or extinct (IUCN 2010). Indiscriminate hunting and clearing of forest for agricultural purposes have played a major role in the decline and extinction of wildlife species in the area. In Ghana, however, there are few records that show the loss of wildlife species in the country. Mammals assist the maintenance and regeneration of tropical forest by predation, seed dispersion, grazing, and frugivory (Cuaron, 2000).

Large mammal surveys comprised both direct and indirect methods (White and Edwards, 2000). All large mammals and their signs were included in the survey to make a complete species list for the area. Direct sightings, vocalizations, dung (scats and pellets) and tracks (trails) counts were recorded systematically along line transects and also on ad hoc basis outside transects. For the most part, transect surveys began in the early hours of the morning but the major determinant of the duration of a survey was the type of vegeta-

tion and the availability of animal signs. Mammal signs recorded on transects were used to generate a species list.

Avifauna

Birds are good indicators of spatial biodiversity and sustainability because they are high in the food chain and occupy a broad range of ecosystems. Compared to other taxa, a wealth of data has been (or can be) collected by volunteers and professionals. Bird population sizes, trends and conservation status are often well known and they appeal to a wide audience. Therefore, an increasing interest in the use of ornithology data can be observed. Habitat indicators can be used to assess macro level changes, but also to identify more subtle changes in biodiversity within habitats. By highlighting these changes, bird indicators can point to the need for more detailed research to identify the causes of changes in population of different species. As West-African forests are rapidly disappearing, the survival of the birds is becoming increasingly dependent on ever fewer areas. Despite of a number of field studies conducted in the region in recent years (e.g. Demey and Rainey 2004; Rainey and Asamoah 2005; De Laat 2011), the avifauna in the majority of these forests remains largely unknown.

Shorter transects were used to survey the avifauna of the area. Transects were located near make-shift camps in the forest along existing tracks and. Field work was carried out in the morning, from dawn (usually 6:30GMT) until noon, and in the afternoon from 15:00GMT until sunset (18:00GMT). In order to avoid the high temperatures in the afternoon in which bird activity is generally low.

Additionally, mist netting was employed to capture the shy and cryptic understory bird species that are difficult to record during the transect walks. Notes were taken on both visual observations and bird vocalizations. Some recordings were made for archiving purposes. For each field day, a list was compiled of all the species that were recorded. Numbers of individuals or flocks were noted, as well as basic information on the habitat in which the birds were observed. For the purposes of standardization, we followed the nomenclature, taxonomy and sequence of Sinclair and Ryan (2003).

Reptiles and Amphibians (herpetofauna)

Herpetofauna surveys comprised both direct and indirect methods. Species were recorded systematically along line transects and also on ad hoc basis outside transects. Suitable habitats and refuges for reptiles were also visited and surveyed for different species. A combination of both visual and acoustic encounter survey techniques were used to detect and record frogs. All individuals sighted were captured marked and released. Each site was visited for 10 times over the survey period. Voucher specimen were collected and preserved as wet specimens in 70% ethanol and later identified at the Faculty of Renewable Natural Resources museum.

Data analysis

An indirect technique such as an index count, which produces relative numbers based on encounter rates, was used to estimate species densities.

Animal sign density = [number of signs / total distance walked]

Index counts relate animal numbers to an index of animal signs detected along line transects (Buckland *et al.*, 2001; Barnes *et al.*, 1997).

EstimateSWin800 version 8.0.0 (Colewell, 2006) was used to determine species diversity and richness in the various vegetation types. Habitat preferences of the various mammal species were assessed based on Jacobs' Preference Index (Jacobs, 1974). Comparative analysis to show species composition similarity between vegetation types was done using Jaccard Similarity Index (Southwood and Henderson, 2000). Where appropriate, simple descriptive statistics was used and results presented in the form of graphs, tables and charts for easy observation and understanding.

Factors affecting fauna distribution

Regression analyses were used to assess the factors that influence fauna distribution in the study area. In this case, the statistics package StatView 5.0.1 was used. The goal was to build mathematical models that described the distribution of animal species.

As the response variable, the number of animal signs recorded on transects are typical count data: they are not normally distributed and they consists of integers, positive numbers and sometimes there are many zeroes. Therefore, variables were statistically normalized before analyzing.

ANNEX N ENVIRONMENT SETTINGS TO CONSIDER ACCORDING TO AFDB

12.1.1 Human Environment

The components to consider in the human environment include the elements and characteristics of the Social, Cultural and Economic environments as well as infrastructures and services and land use patterns in the project area and its zone of influence.

- Under the Social Environment, the Proponent must consider issues related to population, gender, health, civil society, and societal framework.
- Under the Cultural Environment, consideration should be given to issues such as:
 - Cultural heritage, customs and traditions, traditional activities, fundamental values, religious and/or ancestral beliefs, ethnic dialects, leisure, etc.;
 - Right and use of natural resources related to cultural practices (religious sacrifices, traditional medication, etc.);
 - Cultural factors contributing to the exclusion of some groups from development benefits;
 - Major concerns, opinions, interests, and aspirations of local populations;
 - Environmental problem awareness, attitude towards nature;
 - Architectural, archaeological and landscape heritage, as well as any other heritage element protected or not by laws or regulations.
- Under Economic Environment, issues to consider include:
 - major economic activities at the local and regional levels and growth trends;
 - Right, use and dependence on renewable natural resources;
 - Inequality patterns, economic differences and poverty determinants;
 - Working conditions and employment situation in the region;
 - Infrastructure and services; and
 - Land use patterns.

12.1.2 Natural environment

The components to consider in the natural environment include:

- Climate, weather conditions and air quality and regional conditions (microclimate, meso-climate or macroclimate), emphasizing aspects that may affect the project's activities.
- Geology, topography and soil issues the local and regional levels, emphasizing vulnerable or problematic aspects of land and soils, as well as topographic characteristics which may be modified by the project.
- Water and hydrologic cycle including surface water, ground water, near-shore waters, coastal shores and seas.

- Ecosystems types, functions, protected areas and sensitive zones, integrity, interactions, conservation and protection measures.
- Vegetation types, characteristics, biodiversity, threats, conservation and protection measures.
- Wildlife biodiversity ecological and behavioral characteristics, threats, conservation and protection measures.

Country authorities are expected to be responsive to the civil society's request, issues and concerns on bank supported programs and projects.

12.1.3 *Environment and Social Impact Assessments*

The following provides a summary of the objectives of an ESIA in accordance with the AfDB guidelines; it presents the scope of work to be carried out and the key tasks to be undertaken during the study. Major tasks that shall be highlighted in this section because of their importance in the preparation of an ESIA include among others:

- Describing the proposed project by providing a synthetic description of the project relevant components and presenting plans, maps, figures and tables.
- Identifying the policy, legal and administrative framework relevant to the project.
- Defining and justifying the project study area for the assessment of environmental and social impacts.
- Describing and analyzing the physical, biological and human environment conditions in the study area before project implementation. This analysis shall include the interrelations between environmental and social components and the importance that the society and local populations attach to these components, in order to identify the environmental and social components of high value or presenting a particular interest.
- Interrelations between environmental and social components and the importance that the society and local populations attach to these components, in order to identify the environmental and social components of high value or presenting a particular interest.
- Presenting and analyzing alternatives to the proposed project, including the "without project" option, by identifying and comparing the alternatives on the basis of technical, economic, environmental and social criteria.
- For the selected alternative, identifying and assessing potential importance of beneficial and adverse environmental and social, direct and indirect, short and long-term, temporary and permanent impacts, on the basis of a rigorous method.
- Defining appropriate mitigation/enhancement measures to prevent, minimize, mitigate, or compensate for adverse impacts or to enhance the project environmental and social benefits, including responsibilities and associated costs.
- Developing an environmental and social monitoring program, including indicators, institutional responsibilities and associated costs.
- Preparing a resettlement plan, if required.

- Carrying out consultations with stakeholders in order to obtain their views on and preoccupations about the project. These consultations shall occur during the preparation of the ESIA Report to identify key environmental and social issues and impacts, and after completion of the draft ESIA Report to obtain comments from stakeholders on the proposed mitigation/enhancement measures.
Preparing an Environmental and Social Management Plan (ESMP). This management plan shall be presented as a distinct document from the ESIA Report.

AfDB Guidelines on Cooperation with Civil Society Organizations

The AfDB considers the African civil society as a primary stakeholder and helps to enhance transparency and accountability through change of information disclosure policies and enhance participation of stakeholders in the bank operations. The civil society includes groups such as the Non-Governmental Organizations (NGO's), Community Based Organizations, people's organization, trade unions and religion groups among others. The civil society organizations are central to the bank's efforts to implement the participatory approaches especially in reaching to the poor people and women who are the priority target groups that generally have little influence and control over decisions and actions that affect their lives.

The African Development Bank (AfDB) has adopted an integrated approach to environmental assessment in the so-called Integrated Environmental and Social Impact Assessment (IESIA) guidelines. The Guidelines' major objective is to provide reference material on how to adequately consider cross-cutting themes while assessing the environmental and social impacts of a project. The IESIA Guidelines assist in the project design, as many potential adverse impacts can be avoided or mitigated by modifying or adding certain project components to the initial design. They also provide guidance on how to adequately consider cross-cutting themes in both the preparation and assessment phases. The cross-cutting themes prioritized by the Bank are the following: poverty, environment, population, gender and participation. In addition, the Bank has recently adopted health priorities that are transversal issues by nature: HIV/AIDS and Malaria control. Consequently, health outcomes are also considered as a cross-cutting theme in the IESIA Guidelines. There are several operational principles discussed in the guidelines;

- Gaining and providing information: The bank is expected to make available information to the public and also draw knowledge, information from them. The regional member country authorities are expected to be responsive to the civil societies request, issues and concerns on bank supported program and projects,
- Involvement of the civil society organizations (CSO) in policy making: The bank collaborates with the civil society organizations and the regional member country to factor in the interest of the stakeholders in both policy and project activities. The bank takes deliberate measures to remove barriers such as gender biases and other inequalities to allow effective participation,

- Civil Society Participation in operation: It's the responsibility of the region member country to give responsibility to the CSO in programs financed by the bank loans,
- To foster effective CSO involvement the AfDB request the regional member country to provide institutional support to CSO for capacity building purposes,

AfDB Policy on Poverty Reduction

Poverty is not limited to the lack of the physical resources for development, but also rooted in the inability of poor people to influence forces and decisions that shape their lives. AfDB considers the empowering of the poor people to actively participate in the development interventions for sustainable poverty reduction. The main objective of this policy is to provide a framework for action by putting the poverty reduction at the center of bank lending and non-lending activities for the regional member country.

There are several guideline principles highlighted in the policy. These include:

- The bank focuses in the analysis of incidences and in-depth causes of poverty in Africa and these consequently result in formulation of policies and intervention mechanisms;
- Support of national capacity building, promotion of participatory approach, development of new forms of partnership and establishment of poverty monitoring systems;
- Internal policy coherence to strengthen the existing sector policy and fill gaps in specific areas of poverty reduction;
- Requiring a strong partnership that facilitates the consistence between the bank poverty policy and poverty reduction strategies;
- Handling the new conceptual framework that expands the concept of poverty beyond income measures and its causes; addresses the economic and non-economic causes of poverty.