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- ❖ FARMERS within the communities for keeping faith with the consultants and cooperating with us during the interviews
- ❖ The FSD, for providing useful information which we could not have had from elsewhere
- ❖ Other RESPONDENTS and individuals who made our trips and visits a well of rich experience

In God we trust!

Water/hydrology studies were also conducted to determine the potential for the project's impact on water bodies and its environmental and social benefits for those living near the forest. These sources of data were fed into a social and environmental impact matrix to highlight areas of major concern for the project management.

Overall, the project mainly intends to plant over 70% of the area with Teak. In addition, the rest of the area with forest patches, riparian forest, etc. will be stocked with indigenous tree species. In the view of this the consultants, in consultation with the relevant stakeholders determined that, in view of the highly degraded nature of the forest, the project would bring overwhelming positive environmental and social benefits to the area. In future the intended forest cover will enhance water, soil, forest and general ecological integrity (bio-diversity) as well as provide sustainable sources of income and other goods and services for local people. The issues of benefit sharing and land access are key issues that the project management has to deal with expeditiously and decisively.

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- Production of timber with job opportunities for local people in several project activities in the plantation
- Providing farmers with temporary access to farm land within the plantation according to specified criteria and options on a sustainable basis.
- Allowing farmers to grow certain crops on the fire belt
- Allow the use of firewood species such as Cassia to be planted on the fire belts
- Provide extension services and technical training for both farmers and workers on the plantation to enhance productivity and incomes through improved market access.
- Ensure high safety standards in the entire operation and access to better health care facility to the fringing communities
- Transparent benefit sharing with relevant stakeholders.

3. METHODOLOGY

3.1 Reconnaissance survey /scoping

A preliminary study was conducted that included visits to the Forest Service Division and the project site located in Asubima Forest Reserve on 24th Dec 2007. The team comprised sociologists, ecologists, limnologist and wildlife specialist. The purpose was to become familiar with key stakeholders and to understand the prevailing conditions to inform the subsequent scoping of the surveys. During the visit background information about the reserve and the FORM project was collected from the FSD and FORM project staff as well as from field visits made to the project site and some communities in the area. A checklist of issues assessed during this visit can be found in Appendix 1.

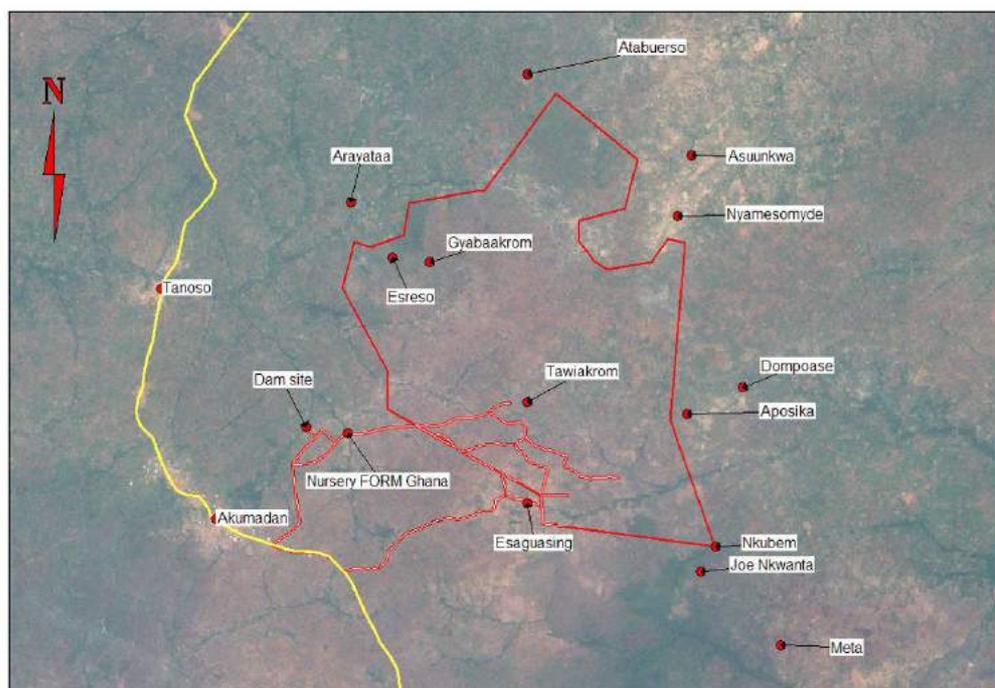


Figure 2: Asubima Forest Reserve showing important communities

3.2 Main survey

Based on the findings from the reconnaissance survey the main survey was sectioned into four phases as follows:

- Participatory/interactive appraisal of communities for social issues and ethno ecology
- Interaction with traditional authorities and District Assembly

- Vegetation survey
- Wildlife and watershed surveys

3.3 Data collection

3.3.1 *Sites surveyed for the social study*

About nine (9) target communities/settlements were identified for the appraisal. These are: Atrensu, Yaa Danso, Esreso, Joe Nkwanta, and Beposo. The rest were Dompouse, Nkubem, Akomadan zongo and Esuguasua. Others are Esunkwah and Tawiakrom which are settlements of Beposo. Overall about 75 participants attended the appraisal group discussions.

The project manager of FORM, Mr. Issifu Banda who has an in-depth knowledge of the site together with officers of the Forestry Service Division (FSD) helped to identify the target communities. A random sample of 50 households was selected for interview with structured questionnaires. Seventy-five (75) farmers were also present at a rapid appraisal group discussion. About 25 farmers and group leaders finally participated in the impact assessment of the project. The project staffs were also involved in this process, both separately and together with the communities.

3.3.2 *Socio - economic study*

A check list of relevant questions (Appendix 2) was used to conduct interactive appraisal of respondents. The process also served to enlighten participants about the project, its purpose and potential benefits to them. They were encouraged to express their opinions about the project and what they expected to contribute and also benefit from its presence in the area. A structured questionnaire was used to collect data on the socio-economic characteristics of the fringe communities of the reserve. It was assumed that this information was not specific to the project site and therefore could be generalized.

3.3.3 *Vegetation study*

In this particular assessment, every compartment within the project area was regarded as a population within which samples were collected. Thus, a 2.5% sampling intensity was adopted for every compartment within the project area. To achieve this intensity, two-line plots dimensions 20 m width by 800 m long were laid. These line plots were located at random along the long side of each of the compartments. There being therefore 80 possible lines within each compartment. Each line plot was subdivided into eight (8) recording units of 20 m by 100 m (see figure 2).

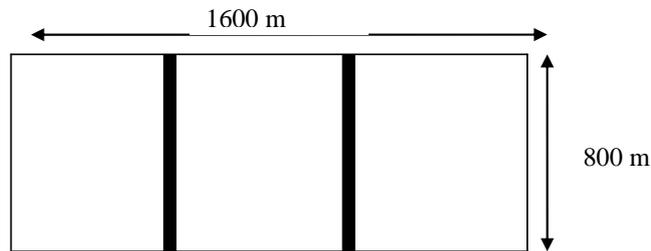


Figure 3: Layout of flora inventory design

All tree species were recorded by their reference local name and code, and their diameter at breast height measured and recorded as well. The minimum diameter limit was 10 cm at dbh for all the 16 subplots.

Relascope was used to estimate basal area at every 50 m within a subplot. Thus 16 basal areas were estimated using a relascope per compartment.

In order to find out the various land use within the FORM site, five main categories of land uses within the Reserve was obtained through a reconnaissance assessment of the FORM site. These are farms, grasslands, remnant natural forest, *Chromolaena odorata* (akyeamong) and plantations. In every subplot within a compartment, the major land use is given the tally "one" (1).

Microsoft Access program was used to process the data. A set of report formats were used to generate the stand tables of species - diameter frequency distribution, basal area and standing volume. Volume was derived from the use of existing volume tables, obtained from earlier Forestry Commission national inventory.

3.3.4 Fauna study

Assessment of wildlife populations in the Agro-forestry project area in Asubima Forest Reserve, Ghana was done using Participatory Rural Appraisal (PRA) and transect-walks along footpaths. This was complemented with observing, asking, listening, discussing problems and opportunities, and identifying the main management zones with local farmers in communities within the area.

The indirect effects of human activities on wildlife such as fire and farming include forest modification and invasion by the exotic weed *Chromolaena odorata*. Whereas some respondents in the Reserve think that no wildlife species benefit from human activities, others were of the view that species such as the Giant rats (*Cricetomys gambianus*), Grasscutters (*Thyonomys swinderianus*), and Bush bucks (*Tragelaphus scriptus*) do benefit from human activities. The wildlife species recorded in different status in this study could mean that, certain wildlife species depend upon periodic destruction and renewal

of the forest, with various species occurring at different stages in succession.

The research team identified species by sight and sound using recordings of the songs and calls of most species from the disks produced by Chappuis (1972 through 1984) These were obtained by special order from the British Library of Wildlife Sounds. The team's own recordings were also used to complement the Chappuis records. Over 150 hours were required to become proficient at identifying the vocalizations. The most useful training technique was to listen to songs played in random order from a compact disk, and attempt to identify each song before looking at the track number.

All surveys were completed during 1000-1600. On each footpath, the observer walked, listened and looked for birds up to 50m on each side of the footpath, spending 6 minutes on each 50-m segment of the footpath. Each species was marked as present if it was detected by song or sight anywhere in the footpath area during the visit. We did not attempt to determine the number of individuals of each species on a footpath. A species was considered present if it was detected in the 50m on each side of footpath.

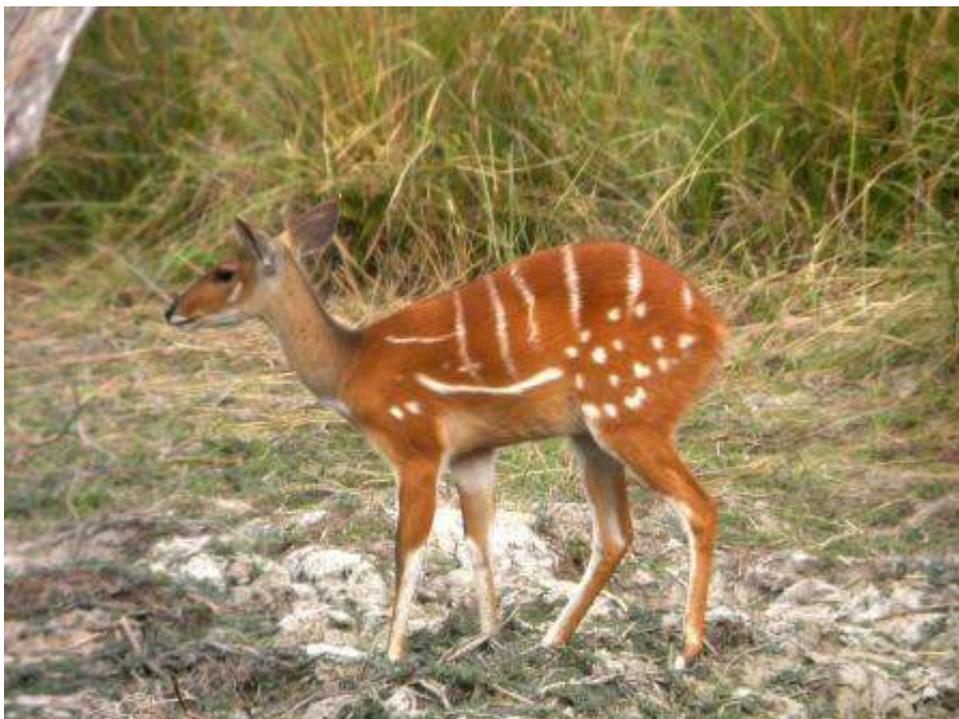


Figure 4: Bush buck. Photo: www.pendjari.net

Farmers were interviewed in each hamlet that was encountered by the research team as it moved across the forest reserve. A total number of 50 respondents were selected from 16 communities. Well structured questionnaires were used to access the farmer's knowledge of various wildlife species, their preferred habitats, threats and uses. The extent

of the farmers understanding of the concept of wildlife conservation and their general view on aspects of wildlife management in the Reserve was assessed. Illustrations in the field guides by Kingdon (1997) and Serle and Morel (1977) were used to insure that farmer responses applied to the species of interest.

3.3.5 Hydrological survey

Three main activities were carried out as methodology for the water/hydrology study: first reconnaissance survey, followed by sampling of water for quality analysis and finally informal interview with the fringing communities.

The reconnaissance survey was undertaken to get familiarized with fringing community members, the project area and also to identify the locations of the various water bodies that fall within the project area. In the process empty containers of a wide range of agro-chemicals, with various trade names were identified. This was done with the assistance of a staff of the FORM, a native of the Asubima who has also worked with FORM for quite some time and is therefore very familiar with the area.

Water quality analysis

Samples of the identified water bodies were collected into well-sealed plastic containers and sent to the laboratory. The following water quality parameters were analyzed: pH, turbidity, dissolved oxygen, conductivity and nitrate content (Table 4).

Interviews

Informal interviews with local people living in the area solicited about the existence of water bodies and their socio-economic and cultural impact on the peoples' lives. Information related to the importance and adequacy of the water bodies, occurrence of conflict among individuals or groups in the use of the water resources, knowledge about the factors which affect water bodies, reasons for farming so close to the water bodies and suggestions for conserving the water bodies.

Five water bodies including a water fall, rivers (one closer to the water fall, Asugoshia, Aterensu and Hwenteam) were identified and selected for data collection in the project area. The water bodies include a steep descent of the water under gravity (waterfall), those that flow beneath rocks, through rocky channels or over relatively softer soil.

3.4 Environmental audit

Vegetation inventory was undertaken to determine vegetation (tree stocking) within the reserve where the FORM plantation project is to be established. This was carried out using expert personnel from inventory section of the Forest Service Division (FSD) in Kumasi. The wildlife and watershed surveys were carried out by the Department of Wildlife and Range Management and the Department of Fisheries and

Watershed Management respectively (Appendix), all of the faculty of renewable natural resources of the KNUST.



Figure 5: Waterfall in compartment 1, site of great scenery and of importance for conservation. Photo: T. Wanders

4. PROJECT AREA DESCRIPTION

The Agro-forestry project is within the Asubima Forest Reserve (AFR), near Akumadan in the Ashanti region. The AFR lies within a grid reference of 7N272W52 with an area of 79 km² (Hawthorne and Abu-Juam 1995). It was reserved in 1945 and last logging was recorded in 1989.

The Forest Reserve is located within Offinso Forest District in the Ashanti Region. The Reserve is managed along with Afrensu Brohuma, Mankrang, Afram Headwaters, Gianima, Kwamisa Group, Asufu Shelterbelt East and Opro River and together they constitute Forest Management Unit (FMU) 33. The Reserve covers a total area of 7,870 ha out of which approximately 1729.9 ha constitute the area allocated to FORM Ghana Limited for commercial plantation development. The entire Reserve is located within the dry semi-deciduous forest zone (DSFZ), (Hall and Swaine 1981).

In the early 1990s, after the national forest inventory project, the condition score for the Reserve was given as 6, indicating the area to have no significant forest left. As a result of that inventory, large proportions of the area were designated as convalescence to allow the forest to recover before logging could be permitted. However, satellite imageries obtained during the 2001 Multi Resource Inventory (2001 MRI) indicated that the entire Reserve had not recovered prompting management to exclude it from the 2001 MRI. According to Hawthorne and Abu-Juam 1995, there were 61.7ha of teak plantation but the Reserve was too degraded. However, there was a healthy core of forest, with some pleasant patches.

4.1 Literature review on Asubima Fort Reserve

Literature search yielded scanty information on the internet about the Asubima forest reserve. Satellite imagery shows that the forest reserve is degraded with large open brown patches indicating bare earth with sparse areas of green that show some vegetation (satellite views.net, 2008). It is bounded on the south west by Nkinkensu and Akomadan further North West to Techiman On the north east is Nkoranza (see map in Appendix).

Like most degraded forest reserves in Ghana, the area has been degraded through a number of activities such as farming, fire damage, over-exploitation and illegal logging for timber. Abebrese MO (2002) mentions farm practices like shifting cultivation as the main farming practice in Ghana, and one of the main causes of tropical forest disturbance and retrogression to secondary forest vegetation in Ghana. There does not seem to be information about the historical development or degradation of the reserve, but news items dating back to 2003 report of unsustainable activities and indicate that teak may

have been planted in the forest long before that time; this could only mean that the forest must have been open to allow this action.

Ghana News Agency (GNA) reports of illegal felling of Teak trees in the reserve with the connivance of local peoples such as Ataboaso and Woraaso (GNA 2003).

There are reports of an international non-governmental organization and its Ghanaian counterpart; Africa Reforestation Union (AWV) restoring 7,863 hectares of totally degraded forest at Asubima Forest Reserve in the Brong Ahafo Region (GNA 27 Oct 2005).

Wagner et al. have conducted entomological studies in Asubima forest reserve reported in Forest Entomology in West Tropical Africa: Forests Insects of Ghana.

(www.springerlink.com/index/n204849684772708.pdf)

Agyman et al, 2001 are cited also to have reported on soil characteristics of Asubima (Reforestation plan. Asubima Forest Reserve).

Monoculture in cocoa production is another farming practice, which leads to secondary forest formation in Ghana. Fire (White 1983) and forest tree harvesting are mentioned as causes the degeneration of virgin forests to secondary types of forests in Ghana. Specific interventions are plantation development by the taungya system in collaboration with local communities. Literature has not specifically mentioned Asubima but Afram Head waters forest reserve which is close to this forest is the subject of a study that may well reflect the situation in Asubima.

Search through students' dissertations yielded little information on the project area. Amponsah – Kwatiah, 1993, conducted studies on the effect of changes in rural land use pattern on agricultural development in Offinso District. This study shows that farming is the predominant occupation among respondents. The area is describes as falling within the semi-equatorial climatic zone with seasonal moisture deficit being the major limiting influence in agriculture. The study further reports that the rapid expansion of cash-crop and food-stuff farming had reduced the original vegetation to secondary forest. The vegetation contained valuable trees such as Wawa (*Triplochiton scleroxylon*), Odum (*Milicia excelsa*), Sapele (*Entandrophragma cylindricum*) and Kokrodua (*Pericopsis elata*). There were derived savannah conditions resulting from destruction of the forest by man in the northern parts i.e. around Nkenkansu, Nsenoa, Akomadan and Kobreso. Thus the study estimated that the savannah was gradually encroaching southwards. Apparently, the Forest reserve of Asubima was not spared from this process. Because parts of Asubima extend into Offinso lands, this study is about the closest one could get that gives a good picture of the environmental economic and cultural conditions one would expect in Asubima.

The only other source for information seems to be the management plan of the forestry Commission (FSD) which is responsible for managing the forest reserve. Existing inventory reports indicate that the flora and fauna were more abundant than they are today. North-south socio-economic disparity in Ghana is a contributory factor to regional migration (Equity & Development 2006), which possibly drops off large numbers of stage-wise migrants in the area looking for cheap farmlands to cultivate subsistence crops. Population pressure has been identified also as a factor in forest degradation as high demand for resources outstrips natural regeneration (Madu 2007).

Satellite imagery shows the reserve as a severely degraded area with much of the greenery receded and lots of brown patches evident (<http://www.satelliteviews.net/cgi-bin/w.cgi?c=gh&UF=-2070021&UN=-2870533&DG=RESF>).

Previous Inventories of Asubima

The Reserve was inventoried in 1989. This was systematic sampling using a sampling intensity of 0.25% without stratification. Here, all tree species were included in the assessment. Again, under a Collaborative Forest Management (CFMP) project sponsored by the African Development Bank (ADB), a portion of the Reserve was inventoried. The results of these earlier inventories are summarized in Table 1 below.

Data Type	1989		2005
	All species	FIP 1	All species
Stem Numbers (ha-1)	51.00	25.80	6.50
Basal Area (m ² ha-1)	16.70	N/A	1.70
Volume (m ³ ha-1)	109.70	81.10	20.80

Table 1: Summary of inventory of Asubima forest reserve in 1989 and 2005

The main species recorded in 1989 were *Ceiba pentandra* (Onyina) *Milicia excelsa* (Odum) and *Triplochiton scleroxylon* (Wawa).

It was commented particularly in the 1989 inventory report that in relation to similar forest within this eco-zone, this Reserve was poor especially in the stocking of FIP species ≥ 70 cm dbh. The total number of species identified at that time was 41, which was also noted to be low for the DSFZ (150) eco-zone. The report recommended that harvesting should be curtailed because of low stocking essentially putting the area under convalescence and conversion.

4.2 Description of the socio-economic environment

4.2.1 Occupation and age of the people

All the respondents were farmers. Many (44%) of them were farming in the forest reserve. These farmers lived temporarily on squatter settlements within or around the forest but had their families in the town of Akomadan and other villages. Majority of the respondents fell between the ages of 25 and 55 years and are heads of households living and farming in the communities near the forest reserve (Figure 1)

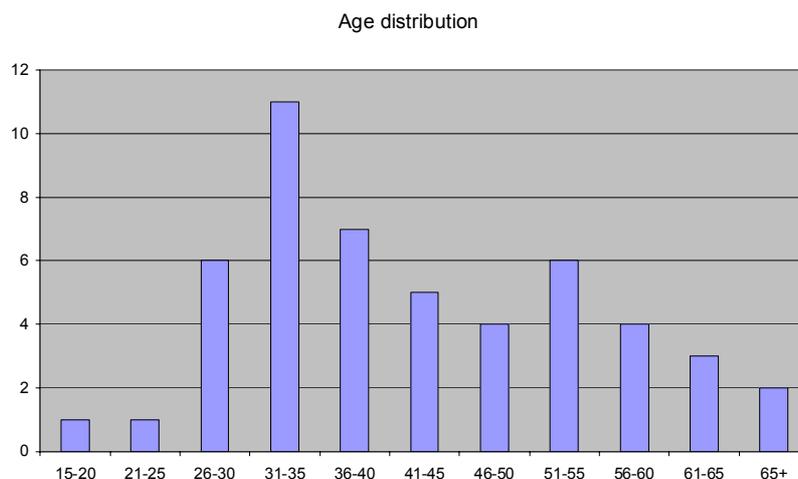


Figure 6: Age distribution of the respondents (N=50)

4.2.2 Marital status and household size

Almost all the respondents were married. It was found that some farmers conveniently have a second wife in the town to enable their children to attend proper schools and another one who lived with them in the forest area to help them on the farms. The average household size was about 6.14 persons per household. The highest recorded was 15 persons in a household.

Size	2	3	4	5	6	7	8	9+	n
# households	0	6	4	10	8	9	5	8	50

Table 2: Household size

4.2.3 Literacy/ level of education:

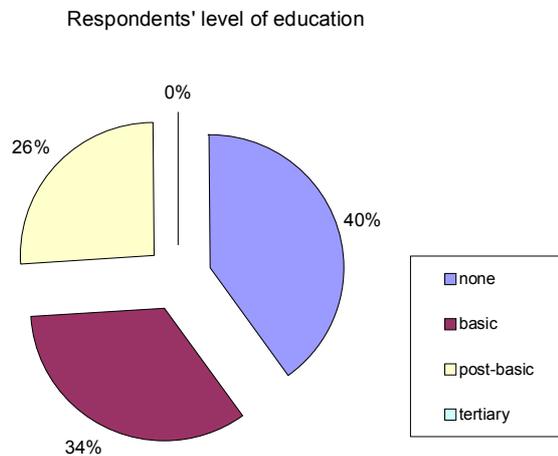


Figure 7: Respondents' level of education

Many (40%) of the respondents had no formal education. About 34 % of them reported of some basic education which many of them did not complete. Fifty eight percent (58%) however has other livelihood skills apart from farming skills. Some of these skills were machine operation and repair, driving, carving and weaving, building construction and carpentry as well as trading and wine tapping. None of those in the house hold sample mentioned skills in plantation work but a few of the farmers who attended the discussions did mention some past experience in plantation activities.

4.2.4 Social status

A large proportion of the respondents, were migrants or at least had not been born in the communities where they were found. The sample indicates a larger number of non-native ethnicity (Figure 4). Many of them also seemed to be from the northern parts of the country but there were many instances of other tribes. Most communities reported at least 10 different ethnic groupings or languages. Esunkwah is particularly noted for northern migrants who are said to have entered the forest to farm after it had been opened up by the wild fires of the early 1980s.

Many communities had more migrants or residents of other non native language groups as against the natives (PEN/DANIDA survey indicates this). Tribes such as Grunshie, Konkomba, Moshie, Dagarti (Dagarti), Basare, Gruma, Brong and Asantes were represented usually outnumbering the natives. Others were Ewes, Nzemas, Busanga, Sisala and Gonjas. On average those who were migrants,

not born in the community, had lived in them for a total of 6.2 years. Migrant born residents aged mostly between 26 to 45 years and averaged about 30 years. This may indicate the peak period of

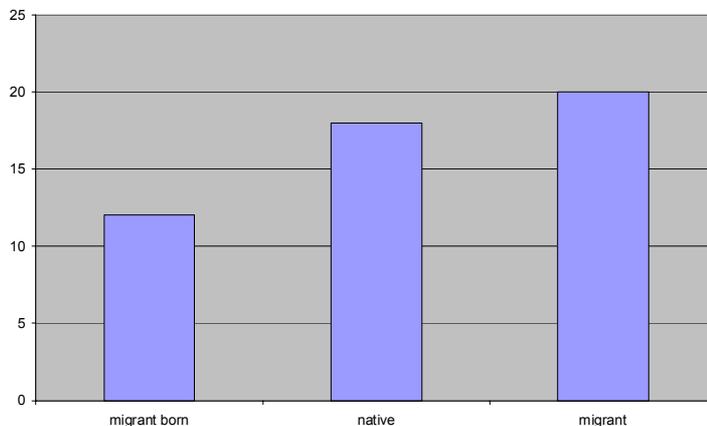


Figure 8: Nativity status

migration to the area which is estimated from oral tradition to be about 30 year ago in the mid- to- late 1970s.

Age	15-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66+	N
#	1		4	3	3	2		1	1		1	16

Table 3: Age distribution of migrant-born residents

For those born within the area most had been born within 10km of their current residence.

4.2.5 Main agricultural crops cultivated.

Yam, cassava, maize and vegetables (such as tomato, pepper and beans) are the main crops grown by the farmers. Yam is popular with the northern tribes (especially the Konkombas). Most are farmers who feel uncomfortable with the fact that they are working under illegal conditions.

Farming is the main income generating activity. Wet lands are scarce and do not yield aquatic foods for local consumption or for sale. Yams and maize appear to be the main crops that can be stored and carried over to the next farming season and to stave off hunger or earn some cash. In Akomadan area, tomato farmers are reported to experience wide fluctuations in prices as farmers speculate the cultivation of the crop that leads to over production in some years and the consequent fall in prices. Many farmers say they produce tomatoes as a matter of tradition or simply because every one else is cultivating the crop.

4.2.6 Value of assets/prevalence of poverty

Respondents were asked to enumerate the household items they possess and their economic present value. This is to give indication of affluence or poverty prevalence. Most respondents have very few personal or household items that could be regarded as assets. About 27% of households had assets that were valued 900 Cedis and above. The rest were below this mark with 29% of them also owning little asset that valued below 100 Cedis (about US\$96).

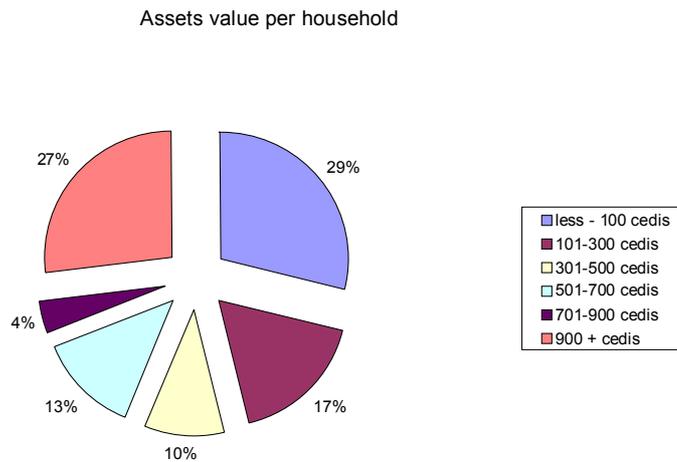


Figure 9: Presentation of the values of the assets per household

4.2.7 Occupation, access to farmland land and ownership

The average farmer in the Asubima forest reserve area has 2.5 ha of pure crop land and has 1.54 ha under fallow. Of all the respondents 44% of them admitted that they farmed in the reserve.* The data analysis shows that 56% (i.e. 28 out of 50 respondents) of those farmers are actually in the forest reserve solely for crop farming. More migrants were farming illegally as compared to natives; 15 out of 18 of those who were migrants were farming within the reserve as opposed to 4 out of 17 natives. Plantation farms indicate a mix of private plantations and taungya farms, the latter being very small.

* The issue of illegality was not raised with this question. It is recognized that many farmers practice taungya where it is allowed but they also do have illegal extensions to these as well as having purely crop farms in the reserved forest.

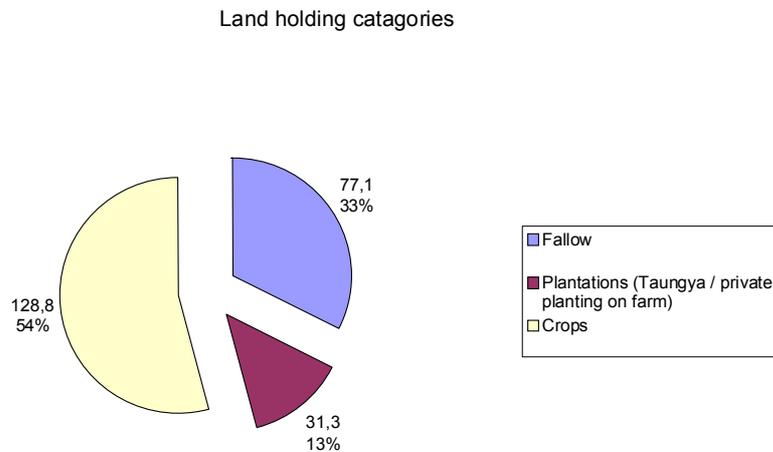


Figure 10: Land holding categories in Asubima

4.2.8 Characteristics of settlements

(Asubima Forest Reserve, Ghana: Latitude: 7.45 / Longitude: - 1.8666667)

Some of the settler communities have been established as early as the 1970s. Many settlers had arrived in the communities during the past three years indicating that there is continuing migration into the area. The communities range from the boundary of the forest to about 5 Km away. Some farmers have constructed temporary shelters in the reserve where they rest while working. Typically mud houses averaging about 45 to 60 m³ serve as temporary shelter for most farmers. The more affluent farmers have built or hired permanent houses in the bigger towns where they raise their children and send them to school.

4.2.9 Infrastructure: Roads, schools and water

The road network was generally poor and without any directional signs to facilitate travel within the forest area. Many communities are cut off during the rains and transport is difficult to obtain due to the bad nature of the roads. Many farmers therefore either travel long distances on foot or by bicycle. Schools are lacking and children have to walk to school through the bush at great peril to themselves. Farm houses are sparsely distributed within the forest.

4.2.10 Culture and tradition

The population of the study area is multi-ethnic. Over 50% of the village communities have migrant farmers predominantly cultivating yam and maize. Vegetable production particularly tomatoes is very

important as a source of short term cash. Speculation in this field of activity is however very high and this leads to much loss of investment and thus unstable incomes ever other year; farmers tend to over cultivate the crop when ever there is high price of the commodity due to scarcity in the preceding year. The consequences are usually low prices and lack of market for the crop leading to poverty in the following year.

Responses indicate that there were no areas in the forest reserve of cultural or special significance. There are however taboo days stipulated by the land owners (i.e. the natives) on which people could not go to the forest. These taboo days differ from place to place. This rule did not seem to apply to any specific part of the forest but would seem to rather pertain to the traditional sources of authority. Tuesdays, Sundays, and Fridays were taboo days for Offinso, Nkoranza and Techiman respectively whose stools own shares in the Asubima reserve. Traditionally women in their menstrual period were not allowed to visit the streams for any reason such as fetching water upon the pain of mystical forebodings. Such rules were however not being obeyed in recent times by many people.

The traditional leaders are aware of severe forest degradation caused primarily by perennial wild fire followed by uncontrolled logging, and illegal farming. These factors have turned the forest to grass land making it easily prone to perennial wild fires. As a result poorer rains and higher temperatures are experienced in the area. These conditions have led to the reduction in game and wildlife population to the near absence of some popular forest products such as snails and mushroom.

The Forestry Service Division's efforts at tree planting for reforestation have in part been thwarted by the tendency for farmers to prevent plantation canopy from closing by destroying the young trees. Respondents during the study however submitted that since the operations of the new reforestation project by FORM would ensure sustained access to land for farming, the farmers would ensure that the trees grew well since there would be no fear of loosing their livelihoods.

4.2.11 Indigenous knowledge of ecological dynamics of the reserve

Most of the participants, especially those who had lived in the place for more than 20 years, admit that there has been severe degradation of the environment since the late 1970s to the present day. It is reported that much degradation is due to wild fires and unchecked illegal tree logging by both timber companies and chainsaw operators. In the wake of these activities illegal farming encroached into the opened forests. Indications of increasing severity of degradation are presented by the presence of elephant grass and other herbaceous plants in many parts of the forest reserve.

According to the respondents, intensive timber extraction was going on before the 1983 forest fire. This activity, according to them, actually

opened the forest and allowed the fire to gain entry. This further opened the area killing many game species and other small animals. After this, farmers began to enter the opened up forest to farm. By that time many of the timber trees had either been logged or destroyed by the fire. The older members of the communities report that there used to be tree species such as Odum (*Milicia excelsa*), Wawa (*Triplochiton scleroxylon*), Papau (*Azelia africana*), Onyina (*Ceiba pentandra*), Ofram (*Terminalia superba*), Emire (*Terminalia ivorensis*) and mahogany (*Khaya spp*) in large stocks. Others were Dahoma (*Piptadeniastrum africanum*), Mansonia (*Mansonia altissima*), Hyedua (*Daniella spp.*) and Arokuma (*Antrocaryon micraster*). These have now become very scarce in the reserve. When the forest was in good shape some 30 years ago many different products, (both flora and fauna) could be obtained by the communities; Parrots, and other birds, antelopes, grass cutters could then be found in the forest.

Thus, the main reasons (in order of importance) attributed to the degradation of the forest were; excessive logging, wild fires and clearing of the forest for farming as well as group hunting with dogs and fire. Others say that the noise from heavy machinery used for logging may also have driven away the animals of the forest.

4.2.12 *Dynamics in the farming environment and their causes*

Many respondents, who are farming in the reserve, report rapid changes in the farming environment over the years. The changes they mention are reduced soil fertility, less rain, more violent winds and more excessive heat that scorches crops.

A very negative manner of using fire was narrated in which Borassus palm nuts are used to prepare fire bombs by farmers to surreptitiously set wild fires. Wind is more destructive now than before and shade can only be found in the planted teak forests. *Chromolaena odorata* (Akyeampong), which now dominates much of the reserve, fuels wild fires and makes farming difficult.

4.2.13 *Infrastructural development of the area and amenities*

Many settlements fringing the Asubima Forest Reserve, especially the small farmer squatter hamlets found inside and close to the reserve, have a poorly developed infrastructure. The people mention absence of potable water, sanitation facilities, good roads and transportation to and from the farm as the major problems they face. They have no easy access to clinics or health posts and there are no good roads to facilitate all-year-round movement. Access to markets for farm produce such as perishable vegetables is a major problem for farmers. Most of them live in small settlement of small mud, thatch-roofed structures measuring on average 20sq meters. Generally most of the fringe communities lacked basic social amenities such as schools, electricity and public recreational and meeting places. But many had good

drinking water from bore holes. Most communities also lacked access to banking and credit facilities. The table below presents the availability of some facilities in selected communities. Like most rural communities in Ghana even the present facilities are in poor shape or inadequate to supply the needs all the people in the communities. These however serve as a foundation for future improvement.

Amenities Community	Potable water/borehole	School	Clinic	Electricity	Access Road (year round)	Credit facility/bank
Adjeikrom	x	x	x	x	x	
Akomadan zongo	x	x	x	x	x	x
Arapata					x	
Atabourso	x	x			x	
Atrensu**	x					
Bosomponso	x	x			x	
Dompoase*	x				x	
Ekrufi	x				x	
Esreso**					x	
Esugwasua*	x					
Esunkwah*	x	x				
Gyabaakrom**						
Joe Nkwanta*					x	
Nkubem*						
Tawiakrom**						
Woraso	x					
Yaa Danso*	x				x	

Table 4: Some fringe communities and type of amenities available

*Farmers in these communities cultivate crops within FORM's allocated area in the forest reserve.

**These settlements are located inside the forest reserve

4.2.14 Forest use - Access and rights

The Asubima forest reserve is under the management of the Offinso Forest District. Due to previous overexploitation of timber in the past and the subsequent wild fires that ravaged the forest illegal farming activity became rampant. In order to mitigate these negative effects the FSD has initiated projects that grant limited access to farmers under the Taungya system to plant trees and cultivate crops until the canopy closed. Otherwise, there are no legally admitted farms or communities

within the reserve. By customary rules local people have access to non timber forest products and communities could also access timber for development work by obtaining permits from the FSD. Products extracted were poles for construction, game and fruits. But these are no longer common as in the past and most households have to rely on their farm produce throughout the year for sustenance. People in the study appear to derive very little economic value from forest products and none of the respondents reported depending on the collection of NTFPs as their primary occupation.



Figure 11: Akumadan growers association. Photo: P. Hol

4.2.15 The project incentive and activity structure

The main incentives that were expected to produce positive impacts were listed as follows:

- Alternative livelihoods development to reduce poverty in target communities
- Employment of some members of target communities and integration of illegal farmers and regular supply of farm land
- Social infrastructure: school, clinic transportation water electricity etc
- Training in farming, plantation and nursery management skills
- Fire management and reforestation of the severely degraded forest to restore environmental services and other tangible benefits.
- Multi-species forest plantation scheme

4.2.16 *Informal discussion with farmers*

Interviews with farmers in informal interactions enabled them to express their expectations and fears about the project. Since all respondents were farmers they all saw tree planting as a threat to their livelihood.

- **Awareness of project goals by farmers.**

The farmers were asked if they were aware that the company had planted trees at an earlier time i.e. some 7 years ago. Many responded in the affirmative. Some attested to the fact that the tree stands were beneficial to them for providing shade. Some observed wildlife seeking refuge under the trees stands. Others thought that the dry leaves of teak would crackle upon any one walking through and this drives the animals away hence very few animals actually are found here. According to them, animals could live in teak plantations that were less than 5 years old as there would be better forage underneath them.

- **Experience in plantation work**

Only a few of the participants had actually worked on the plantation or work on it at present. One hunter thought the environment was good for hunting, while others said the nature of the plantation provided for little other vegetation growth. Overall, the aesthetic value of the plantation was much appreciated. Respondents thought that farm lands that were adjacent to the plantation had better conditions for crops cultivation. In addition farmers could collect fuel wood from the nearby plantations. Farmers admitted that they entered the reserve to farm and hunted for game. In the past, rats and grass cutters used to abound when the forest was in better shape but due to over use, illegal logging and wild fires the forest condition became severely degraded. Many farmers today remember those better days and think that the establishment of forest plantation could be a good thing to return some of the benefits they used to enjoy in the past. In any case the present one that had been planted by FORM earlier seems to have made things better; for instance it gives shade to tomato farms that are nearby.

- **Ownership and access rights**

Respondents acknowledge that the reserve now is under the authority 'ownership' of the company but are concerned about what they would do if the land is taken from them. As such they were ready to accept the terms of the company that would allow them to engage in livelihood activity on the land. When respondents got better educated about the intentions of the company during the discussions, they responded that having then known better their fears had been allayed.

- **Availability of skills for plantation work.**

The respondents represented largely unskilled labourers with and without any experience in forest plantation work. They expected that if they were employed they would be trained in specific activities that need to be performed in the plantation. The respondents identified tending activities in the plantation as areas in which they would need training: planting, thinning, pruning and the creation and maintenance of fire belts were the key activities. Other activities of interest to the respondents were basic nursery activities such as potting of seedlings, watering etc. Five people expressed competence as drivers and mechanics of heavy equipment who could offer their services to the company. A few also were interested in providing security services.

At the time of the survey, some of the farmers claimed that they were engaged in pruning, fire belt maintenance and 24 hour security patrols. Most respondents said that they did not have any special skills in plantation work but were ready to be trained for any specialized jobs assigned to them.

- **Incentives and attitudes**

Respondents think that if they should be employed to work in the plantation equipment such as boots, uniforms with company inscription and other working tools would serve as motivation for them. The old tendency was for farmers to prevent plantation canopy from closing but they now seem to suggest that since the intentions of the company are good and in their interest they would ensure that trees grow well without fear of losing their livelihoods since the program will ensure constant supply of farm land for them.

4.3 Description of the vegetation of Asubima

The vegetation of the reserve is mostly of the dry semi-deciduous forest type which contained valuable timber trees such as Wawa, Odum, Sapele and Kokrodua (Amponsa-kwatiah, 1993). Derived savannah conditions are observed in large areas of the reserve which are resulting from the destruction by man. The savannah has virtually taken over the reserve. Due to intensive farming activity and reported annual fires very little of the original forest remains and what is left is secondary forest and with many areas of grass lands. Where there is secondary vegetation especially in sparsely population climbers, shrubs and soft woody plants are mainly observed. In the past farmers protected big trees on farm but these have been logged and very few remain today.

An inventory was conducted in compartments 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 27 and 28 of Asubima Forest Reserve.

The results from the land use options within the site are presented in graph 1. It could be seen that there is virtually no stretch of land within the project area constituting natural forest. Plantation forest dominates in compartment 1, 2 and 13 while compartment 6 is mainly plantation (teak).

Chromolaena odorata (Akyeampong) weeds and grasses have replaced the original high forest while farming activities are on going in all the compartments except compartment 6.



Figure 12: Overview of Asubima Forest Reserve. The reserve is now a mosaic of Teak and agriculture. Photo: T. Wanders

Basal Area

Graph 2 is the estimates of Mean Basal Area (MBA) per ha and their standard errors obtained from each of the sixteen subplots per compartment. Apart from compartment 6 which shows appreciable recovery as a result of intensive plantation establishment (MBA = 6.2 m²/ha), all the compartments within the project area have basal area far below the minimum threshold (5m²/ha) required for conversion of natural forest to plantation forest. The results show that certain compartments such as compartments 8, 11, 12, 27 and 28 are virtually without trees and more particularly big trees. In all the density of the site is very discouraging.

Volume and Stem Numbers

Volume in m³ and stem numbers estimates of each compartment is presented in appendixes 2 and 1 respectively. It could be seen that *Ceiba pentandra*, *Ceitis mildbraedii*, *Cola gigantea*, *Rhodognaphalon buonopozense*, and *Nesogordonia papaverifera* are the main natural tree species dominating within the project area while the commonest exotic species is *Tectona grandis* (teak). Diversity is quite low in the project area even though tree diversity in general is low in the Dry Semi deciduous Fire Zone (DSFZ) where Asubima is located. Results of inventory are presented in Annex 5 showing the estimated level of stocking for various economic and other tree species in the area. As compared to previous inventory most species are noted to have declined considerably.

4.4 Description of the Fauna of Asubima

Species richness (number of species detected on a footpath) varied from 1.8 in the recently fire damaged vegetation to 15.7 in the riverine forest (Table 5).

Vegetation type	Mean	N	SD
Riverine forest	15.7	12	3.7
Fallow land	14.8	4	3.8
farm land	11.4	8	1.8
teak plantation	10.7	6	1.8
Recent fire damaged vegetation	1.8	4	1
	11.7	38	5.4

Table 5: Number of bird species per 1km footpath) by vegetation type

List of Individual Species

The list of individual species according to habitat types is presented in annex 3. Sharpe's apalis (*Apalis sharpii*) was highest in the riverine forest (0.96) and teak plantation (0.88), but zero in the recently fire damaged vegetation and farmland (1.00). Seven species of birds occurred in the recently fire damaged vegetation with a mean abundance of 0.25, suggesting that most species avoid the burnt or degraded areas.

Farmers' knowledge of fauna

Most respondents felt that wildlife populations have diminished greatly in the last decade, and bush fire was considered the main cause of this decline. The other respondents felt that over-exploitation was responsible for decline of game species.

The vast majority of respondents believed that many wildlife species (e.g. monkeys, reptiles, squirrels, duikers, grass cutter, tortoise and the giant rat) were harmed by forest fire. However, some respondents stated that some species benefited from fire, at least in the short term.

In particular they felt that grass cutter (*Thryonomys swinderianus*), giant rats (*Cricetomys gambianus*), and bushbuck (*Tragelaphus scriptus*) benefit from the cover and food provided when the fire-following invasive weed, *Chromolaena odorata* colonises burned areas.

Respondents had encountered 36 of 38 species of game mammals



Figure 13: One of the species of frogs from Asubima Forest Reserve. Photo: T. Wanders

that they were queried about, 6 of 6 reptile species, and 13 of 13 bird species, suggesting that most animals persist in the study area despite the combined effects of both fire and agriculture (Annex 4).

Birds in forests play important ecological roles as predators (on invertebrates and seeds) and seed dispersers. Very little work has been done to understand how these processes are altered in patches lacking a large fraction of the native avifauna.

The effect of vegetation alteration on wildlife is more difficult to predict in this study because this often depends on the cause of change and degree of degradation. Findings in the present study may be limited, in that information from interviewees gave little indication of how particular species were affected directly or indirectly by vegetation alteration. Nevertheless, using farmer's knowledge on forest animals, the tropics are undoubtedly essential for their future conservation.

Almost all farmers interviewed agreed that wildlife population has diminished as a result of human activities such as fire and farming. From the available data, although it seems apparent that alteration of vegetation has effect on wildlife populations especially, mammals and

reptiles, it is difficult to indicate how particular species are affected either directly or indirectly.

Vegetation alteration in the short-term makes hunting easier although, respondents are of the view that a lot of time and energy is required, with uncertain and infrequent success whenever there is forest degradation. Forest degradation also promotes the fast spread of the “Akyeampong” weed (*Chromolaena odorata*) which modifies the forest to suit generalist and opportunistic wildlife species, especially rodents rather than real forest species that seldom survive in fire-climax communities. The information generated from this study will inform, and also, become a resource for forest reserve managers. It is high time forest reserve managers do everything within their means to create a suitable environment for the entire array of plant and animal species that occur in their reserve.

4.5 Description of aquatic systems

Forest degradation in Asubima is so extensive that it has affected the existing water bodies. Analysis of samples of the water bodies shows severe deterioration of quality parameters such as pH, turbidity, dissolved oxygen (DO), conductivity and nitrate content (Table 6). There is also severe reduction of water volume/level due to siltation and evaporation.

It was observed that the integrity of the water bodies is high as they are well structured and maintained. This means that the ability of contaminants to enter the water supply system will be minimal. However, it is easy for contaminants to move through the watershed due to the sensitivity of the area to physical, geological, and hydrological factors. The proximity of contaminant sources to the water bodies is issue of concern. In most cases observed farming activities were too close to the water bodies. A distance of more than one meter rarely exists between the water bodies and farms. Inflow of artificial fertilizer (23:15, 15:15, urea, sulphate of ammonia, daeting) and pesticides (champion, sulphur, harvest more, sampi, foco, agua, set, typical, carat, poison) which most farmers depend on are a potential source of contamination to the water bodies. These have the tendency to reduce aquatic biodiversity not to mention cause other aquatic threats. For instance, increased turbidity leads to impedance and hence decrease light penetration which in turn affects the food chain in the short-term and biodiversity in the long- term.

Interviews with local people indicated that fringe communities depend on these water bodies for survival. They use them as food source where crabs and snails are usually obtained for domestic consumption but in declining quantities. Fish in particular is very scarce in the waters of Asubima Forest Reserve. The water bodies are also used for irrigating farms. Informal interactions and also interviews conducted with the communities revealed that no conflicts exist among individuals and groups in the use of the water bodies. Overall the water bodies are threatened by the process of deforestation and are therefore inadequate to supply the social and economic needs of local communities.

Parameter	Water fall	River	Aterensu	Asugoshia	Hwenteam
PH	6.8	6.74	6.78	6.72	6.47
Turbidity (NTU)	1.19	3.13	5.14	6.15	8.34
Dissolved Oxygen/(m/l)	6.17	4.12	0.80	0.80	0.07
Conductivity (μ s/cm)	44.00	54.00	87.00	97.90	193.00
Nitrate (m/l)	21.40	23.70	24.20	24.70	34.40

Table 6: Water quality indicator measurements

5. SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT

5.1 Description of potential impacts of this project

The proposed restoration activities/actions by FORM may have both positive and negative impacts on the social and aquatic environment. The positive impacts may be:

- Moderation of temperature;
- Reduction in evaporation;
- Increased soil water storage;
- Reduction in flooding;
- Enhancement of aquatic biodiversity;
- Purification of water through absorption of pollutants by plant along the banks of the water bodies.

The negative impacts may be:

- Water pollution due to spillage of fuel and oils;
- Increase in sediment loads and siltation in water bodies;
- Lowering of water table due to uptake of water by plants;
- Risk of over-utilization of agrochemicals.

With the establishment of the severe negative effect on the water bodies due to anthropogenic activities, it is recommended that:

- Immediate remedial actions; re vegetation using native plant species (and not exotic species), reconstruction of river pathways, and shading be under taken
- Buffer zones should and established. In this direction, the proposal or intension of the FORM to extend the buffer zone from 30 meters to 60 meters is commendable.
- Education on the importance of the existence of the water bodies and the factors which affect this existence should be intensified.

5.2 SWOT analysis of Asubima plantation project

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, plans, 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 describes 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. Thus findings from the SEIA and other wider considerations are considered for this analysis.

	Positive	Negative
Internal	Strength	Weakness
External	Opportunity	Threat

Table 7: SWOT matrix used for opportunity analysis

Relevant issues or findings that go into this exercise are listed as follows:

- Poor community knowledge and awareness of the company and its project plans.
- Many insecure farmers working illegally in the reserve.
- High environmental/forest degradation.
- High agricultural potential.
- Poor linkages with the District assembly.
- Poor communication with the traditional land owners.
- High migrant settlement and activity- people of many tribes and languages. This diversity posed a challenge to corporate management of the project.
- Women absent from discussions according to traditional restrictions; what roles can they play?
- Need to make productivity analysis to determine capacity of individual households to access adequate plots of farm lands under the project.
- The management plan, e.g. multi species planting, social responsibility, integration of farmers etc.

5.2.1 Strengths

The project's development plan: FORM has key strength in its plan that integrates both social and environmental considerations into the project. The choice of a variety of tree species is a good thing for the ecology and bio-diversity.

FORM's intention to also integrate local people as much as possible, with security of access to farm land, is another contributor to the strong position of the company. Currently on-going developments are positive and future intended ones such as school and clinic for the benefit of local people are all commendable and sell the position of the company very well.

Inventory information obtained by the consultants and indeed the entire document may add to the strength of FORM in undertaking plantation initiative. The data shows the much degraded nature of the reserve and thus the urgency to put the place under reforestation.

5.2.2 Weaknesses

Management information base: Need to make productivity analysis to determine capacity of individual households to access adequate plots of farm lands under the project.

Women were absent in discussions according to traditional restrictions; what roles can they play?

5.2.3 Opportunities

The nature of degradation itself is an opportunity that stands the company in good stead to enjoy support from many sides, especially government and land owners.

Government policy support for plantation as a strategy for recovery of degraded forest is a source of strength for FORM

There is a large and willing source of labour to perform day-to-day plantation activities for the company that could also be trained for specialized jobs.

5.2.4 Threats

High agricultural potential: According to respondents Asubima forest reserve has very good soils for cultivating a variety of crops. Perhaps due to this reason many farmers are apparently engaged in farming there. The flow of migrants into the area is relentless. The population profile indicates youths mostly in to farming. With this background, any alternative or competing initiatives that are introduced must, under normal conditions, prove more beneficial to potentially admitted or integrated farmers. If there remains a shortage of this, they could pose problems for the project in future.

Poor communication with the traditional land owners could expose the company to future litigation on access to products from the plantation (the forest reserve).

High migrant settlement and activity: people of many tribes and languages. This diversity poses a challenge to corporate management of the project.

Poor linkages with the District assembly could limit the company's operational flexibility and ease of access to localized resources and administrative support.

Poor community knowledge and awareness of the company and its project plans could be a source of uncertainty and lack of cooperation from the communities.

High environmental degradation exposes the plantations in the medium term to threats of fire which ranges more easily on open grasslands. This could raise the cost of operations in addition to the cost of preventing illegal logging in the future.

The social and environmental impact assessment was based on structures field data and informal interviews with farmers and other stakeholders. The assessment itself was participatory and the results were had been discussed and determined in an open frank and transparent manner. The project management plan served as an important source for decision making in the process as in included the enhancement and mitigating activities that produce the expected impacts.

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Soils					
Improvement in soil integrity	good husbandry and plantation practices	Xxxxxx	Xxxxxx	Xxxxxx	Any vegetative matter should be allowed to decompose on-site so as to restore soil organic matter
Increased soil infiltration		Xxxxxx	Xxxxxx	xxxxxx	Any vegetative matter should be allowed to decompose on-site so as to restore soil organic matter
less runoff		Xxxxxx	xxxxxx		well planned roads and drains along shoulders
less erosion		Xxxxxx	Xxxxxx		erosion will be very minimal and in the short term due to some clearing for construction works

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	high	
Water					
Increase in soil water storage	Planting in water catchments	Xxxxxx	Xxxxxx	Xxxxxx	
Reduced evaporation of water bodies	Planting in water catchments	Xxxxxx	Xxxxxx	Xxxxxx	
Moderation of water temperature	Planting in water catchments	Xxxxxx	Xxxxxx		
Reduction in flooding downstream of plantations	Planting in water catchments Protection of water bodies from farming and other negative acts	Xxxxxx	Xxxxxx		
Enhancement of aquatic biodiversity		Xxxxxx			

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Ecology					
Increased conservation value (forest integrity and biodiversity)	planting in non-forested and degraded areas	Xxxxxx			Improvement of vegetation coverage
Protection of natural vegetation and ecosystem	using mixtures of genotypes especially indigenous species to limit extent of monoculture creation of corridors of natural vegetation between blocks of remaining natural forests and habitats	Xxxxxx			Enhancing biodiversity Increasing natural vegetation coverage and refugia for wildlife populations
Acoustic environment	creation of protection zones around rivers	Xxxxxx	Xxxxxx		No relevance or influence on acoustic environment.
Reduces hunting activities		Xxxxxx	Xxxxxx		FORM policy and action will actively check hunting and poaching in the plantations to allow fauna to flourish. Will eventually provide sustainable game for local communities
Reduction in stocking of invasive species (B. papyrifera)		Xxxxxx	Xxxxxx		Documentation of peat planting medium treatment needed to ensure adherence to standards for sterilization Broussonetia papyrifera is known to colonize open forest areas but upon closure of canopy its spread will be checked.

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Forest /others					
Reduction of pressure on forest to provide timber and other products in future	Use of wide range of tree species to provide range of goods and services to replace those from the natural forest	Xxxxxx	Xxxxxx	Xxxxxx	Restoration of forest coverage and climate regulation functions of the forest.
Creation of wind breaks to reduce wind erosion and damage		Xxxxxx	Xxxxxx	Xxxxxx	Reduction of wind speed and damage
Sequestration of carbon dioxide		Xxxxxx	Xxxxxx	Xxxxxx	Progressive build-up of biomass – wood yields
Improvement of local climate-rain and moderating effects of temperature		Xxxxxx	Xxxxxx		Improvement of climatic conditions and habitat for flora and fauna (biodiversity).

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
Infrastructure		Low	Medium	High	
Provision of roads, schools, health ports, communication facilities	Identification of communities' infrastructural needs; use of these to plan future improvements to benefit the local communities.	Xxxxx	Xxxxx	Xxxxx	Improved rural transport Improved health service Improved access to basic education

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Economic and social benefits					
Increase in local wage earning opportunities.	Employment of local labour wherever possible; pays attention to equal distribution of opportunities to all segments of the community particularly women.	Xxxxx	Xxxxx	Xxxxx	Benefit sharing agreement with locals provides 6% of TSV 20 years from planting Farmers will utilize land cleared by FORM to reduce their production cost significantly (at least 20%) Farmers will be paid in addition for work they do for FORM Farmers will have access to farm land over 20 year planting cycle Farmers will be trained to manage their own plantations
Increase in local economic activity and rural development	Use of local business or initiatives to provide services to the plantation	Xxxxx	Xxxxx		Increased employment opportunities and local entrepreneurship
Participation of community in viable economic activity	Development of links between plantation and local communities; investigate ways for communities to participate in sharing of benefits	Xxxxx	Xxxxx	Xxxxx	More viable economic crops will be introduced to farmers for cultivation to improve access to markets and increase their incomes on more sustainable basis.
Credit incentive		Xxxxx	Xxxxx		
Sharing of benefits		Xxxxx	Xxxxx		Specific crops compatible with farming have been identified and are found to be also in the interest of farmers. Maize, Soya beans, Ground nuts, tomato, pepper, yam beans mostly the traditional items cultivated Average of 1.5 H of land will be available to each farmer (meets the average cultivated land of farmers in the area as determined by the consultants)

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Land Tenure					
Resolution of tenure/access issues and disputes and recognition of customary rights	Maintenance of regular communication with land owners and communities	Xxxxx	Xxxxx	Xxxxx	Security of tenure to farm land for participating farmers in arrangement different from taungya (farmers do not do the clearing at their own cost and have no share in trees)
Physical delineation of land boundaries	Have clear demarcation of lands by assisting land owners to determine these	Xxxxx			Dialogue and transparency of documentation will enhance mutual trust among all stakeholders. A joint project stakeholders management committee will be available to deal with emerging issues on a regular quarterly basis including farmers land owner management and other relevant interest groups

Positive effects on:	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
Services		Low	Medium	High	
Provision of goods and services from plantation: timber fuel wood fodder poles, game etc	planting of multipurpose trees and variety of tree species Agreement on access to plantation for some services Provision of extension support to farmers/communities	Xxxxx	Xxxxx	Xxxxx	Goods and services deriving from felling and pruning. Introduction of Jatropha and Aloe Vera cultivation will increase access to goods and services Cassia for fire protection will provide fuel wood for communities

Positive effects on: Reinforcement of capacities	Enhancement opportunities that FORM is capable of employing or is employing	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Transfer of knowledge	Providing training and extension services to farmers	Xxxxx	Xxxxx	Xxxxx	Engagement of 2 forest engineers in nursery and plantation technology will help to increase social capital through training and extension services
Social capital	Fire management skills imparted to local communities	Xxxxx	Xxxxx		Fire management will bring added incentives and benefits to local communities and farmers.
Transportation	Making transport available or roads to facilitate private transportation	Xxxxx	Xxxxx		Roads and transport are primarily for the benefit of the company but will extend naturally to the community

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Soils					
Increase in soil erosion	use of appropriate clearing and harvesting methods to reduce erosion	Xxxxxx			
Soil compaction	use of appropriate clearing and harvesting methods to reduce compaction avoidance of inappropriate machines	Xxxxxx			
Loss in soil fertility	preservation of top soils and using good land husbandry use of nitrogenous trees and cover crops	Xxxxxx			
Soil acidification					No known effects on acidification of soils related to tree species proposed to the site. Studies will however be done to monitor the effects. Leguminous or nitrogen fixing plants may be planted to enrich the soils.

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Water resources / hydrology					
Water pollution from <ul style="list-style-type: none"> • Pesticides; • Fertilizers; • Fuels and oils; • Sewage. 	Controlled use of bio-degradable pesticides away from water bodies Proper handling of fuels and prevention of spillage & careful disposal of wastes Provision of sewage disposal and treatment facilities	Xxxxxx			FORM activities will not pollute water bodies: No use of fertilizers Biodegradable pesticides will be used but not close to water bodies Fuel reservoirs will be protected to avoid leaks spilling into water as a standard measure Protocols on proper waste management to be adhered to meet the standards set by Forest stewardship council for certification of timber from plantations. These modalities will be put in place fully by 2010.
Increases in surface runoff	Preservation or creation of vegetated protective strips along water courses Design of good drainage system to include control devices	Xxxxxx			
Higher risk of flooding with increase in river flow		Xxxxxx			Flooding and siltation will be acceptable natural conditions that cannot be determined for the new situation in the future.
Higher sedimentation loads in rivers and siltation downstream		Xxxxxx			
Lowering in water table e.g. in arid area	Selective use of plants to avoid any negative impact on ground water (to check high evapo-transpiration)	Xxxxxx			The reserve is highly deprived; planting can only improve the water levels. There will be no negative impact.

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Ecology					
Reduction in biodiversity through removal of natural forest and replacement by monoculture	Stocking residual forest stands and degraded corridors	Xxxxxx	Xxxxxx		The planting of over 70% of allocated area with <i>Tectona grandis</i> is of concern for ecological balance and floral diversity. Largely monoculture planting on the proposed scale could lead to unpredictable consequences
Destruction of unique, endangered ecosystems and species	protection of areas with remaining natural forest				No impact: remain areas of natural vegetation are to be protected and restored.
Introduction of exotic species leading to unexpected, uncontrolled weed spreading to local ecosystem	use of indigenous and exotic species in mixed plantations protection of habitats and creation of reserves				No impact; species to be used are not invasive types rather the eventual closure of canopy will eliminate <i>Broussonetia papyrifera</i> from the area significantly
Introduction of pests and diseases to the area	use of indigenous tree species where feasible careful selection for planting and proper quarantine measures for planting materials and seeds regular monitoring for pests outbreaks and research into these to control them	Xxxxxx			Already existing pathogens/pests could proliferate under ideal conditions provided by monoculture. However no risk of introducing new forms of pests exists.

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
Fires		Low	Medium	High	
Uncontrolled fires	<p>Development of fire control measures (fire belts reduction of fuel litter in plantation) and avoids planting of too many of trees likely to produce high litter load.</p> <p>Provision of easy and rapid access roads to plantation, and adequate trained fire fighting teams and equipment and two watch towers manned day and night</p>	Xxxxxx			<p>Due to high volume of litter to be produced much expenditure has to go into fire prevention and management. This will affect finance and logistical provisions of the company in the medium to long term. The risks, as well as the stakes, will be high.</p> <p>Fire management will be in collaboration with the local initiatives a good source of employment for the communities. Farmers will not use fire as a tool for land clearing</p>

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
Infrastructure		Low	Medium	High	
Poorly planned roads, buildings dams and other utilities	selection of ridge tops for roads, avoid poorly drained areas; construction of side drains and culverts	XXXXXX	XXXXXX		Perimeter road to be provided to facilitate easy movement and entry in and out of the area with the use of expert road construction personnel
Increases in traffic flow	Easily accessible plantation quadrants to both trucks and workers for fire management and transportation etc. Regular maintenance of all plantation roads and infrastructure Considerations in environmental health in place for accommodation, workshops and offices Use of traffic control for heavy vehicles and equipment.	XXXXXX			Illegal movement of logs in the area will be prevented

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	Medium	High	
Land use and customs					
Displacement of other users	Identify all land uses and users				No expected negative effects in this area; not relevant
Loss of goods and services by communities	Agree access to plantation land for some goods and services	Xxxxxx			Rearrangement of tradition such as taboo days may have long term repercussions for the customs practiced in the area
Customs and traditional practices	Select certain tree species that will provide goods and services needed by communities	Xxxxx			Refer to positive effects

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	medium	high	
Tenure / access to farm land and products					
Loss of customary tenure / access by communities / farmers (proxy legal tenure rights in this case)	Use customary tenure / access system to secure agreement with local people	XXXXXX	XXXXXX		Meet with chief and agree on terms to limit physical benefits to NTFPs
Loss of access or possibility of access by people occupying forest reserve	Identify the legal and traditional land owners	XXXXXX	XXXXXX		
Dispute over actual ownership of land and increase in social tension	Delineate and agree all plantation boundaries. Establish good communication with local communities and agree on dispute resolution mechanisms. Establish land ownership and access with interested parties	XXXXX			Set up a committee of chiefs, labour government and company to set agenda for management the company's operations

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	medium	high	
Economic					
Insufficient economic benefit to local people (actual or perceived)	Ensure material benefits to all segments of the community.	Xxxxxx			All staff so far are local people More benefits will flow to local communities than they enjoy under present conditions In future land owners will agitate for share of benefits if these are not negotiate at start of project
Lack of access to plantation facilities	Use local initiatives to provide services to the plantation where possible Establish profit sharing schemes e.g. for stool where appropriate Give the community access to clinic etc Provide extension service and training to farmers / forest users				Access to clinic will not be free but will be affordable.
Crop damage and loss of income to farmers		Xxxxxx			Farmers having crops on lands to be planted with trees will be given due notification to complete their cycles before tree planting to minimize losses. They will be relocated as appropriate

Negative effects:	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
Migration		Low	medium	high	
Influx of migrants to the indigenous communities due to employment opportunities. Breakdown in traditional social structure	Give priority to local labour. Obtain the consent of local people and government to introduce migrants to the plantation. Identify land and housing needs for migrants	Xxxxx			

Negative effects: Other	Mitigation measures	Magnitude of impact			Remarks on interventions and extent of impact
		Low	medium	high	
Destruction of cultural historical and scientific sites	Identify important sites and protect them with guaranteed access to locals and scientific community	Xxxxx			Initiate scientific documentation of important cultural heritage of the area as part of social responsibility agreement
Change in landscape	Design plantation to fit into natural landscape.				
Health and safety	Workers should be provided with safety equipment.	Xxxxx			The provision health facility and safety equipment to workers will minimize accidents and injury
Security	Establish working relationship with police fire and EPA + other relevant agencies to mitigate social and personal conflict and hazards	Xxxxx	Xxxx		
Quality of life					
Conflicts and crime		Xxxxxx	Xxxxxx		It is expected that population dynamics fuelled by economic incentive will lead to certain forms of social instability of vices. Existing mechanisms will be used to mitigate these as happens elsewhere.
Poaching					
HIV/STD/AIDS and social promiscuity					

Type of Impact	Negative Impacts			neutral	Positive Impacts		
	high	medium	low		low	medium	high
improvement in soil integrity					1	1	1
increased soil infiltration					1	1	1
less runoff					1	1	
less erosion					1	1	
increase in soil erosion			1				
soil compaction			1				
loss in soil fertility			1				
soil acidification			1				
increase in soil water storage					1	1	1
reduced evaporation of water bodies					1	1	1
moderation of water temperature					1	1	
reduction in flooding downstream of plantations					1	1	
enhancement of aquatic biodiversity			1				
Water pollution from: Pesticides; Fertilizers; Fuels and oils; Sewage.			1				
increases in surface runoff			1				
Higher risk of flooding with increase in river flow.			1				
higher sedimentation loads in rivers and siltation downstream			1				
Lowering in water table e.g. in arid area			1				
increased conservation value (forest integrity and biodiversity)					1		
protection of natural vegetation and ecosystem					1		
Acoustic environment					1	1	
Reduces hunting activities					1	1	
Reduction in stocking of invasive species (<i>B. papyrifera</i>)					1	1	
Reduction in biodiversity through removal of natural forest and replacement by monoculture.		1	1				
Destruction of unique, endangered ecosystems and species.					1		
Introduction of exotic species leading to unexpected, uncontrolled weed spreading to local ecosystem.					1		
introduction of pests and diseases to the area			1				
reduction of pressure on forest to provide timber and other products					1	1	1

Type of Impact	Negative Impacts			neutral	Positive Impacts		
	high	medium	low		low	medium	high
in future							
Creation of wind breaks to reduce wind erosion and damage					1	1	1
sequestration of carbon dioxide					1	1	1
improvement of local climate- rain and moderating effects of temperature					1	1	
Uncontrolled fires			1				
Provision of roads, schools, health ports, communication facilities					1	1	1
poorly planned roads, buildings dams and other utilities				1			
increases in traffic flow				1			
Increase in local wage earning opportunities.					1	1	1
Increase in local economic activity and rural development					1	1	
Participation of community in viable economic activity					1	1	1
Credit incentive					1	1	
Sharing of benefits					1	1	
Displacement of other users				1			
Loss of goods and services by communities				1			
Customs and traditional practices			1				
Resolution of tenure/access issues and disputes and recognition of customary rights					1	1	1
Physical delineation of land boundaries					1		
Provision of goods and services from plantation: timber fuel wood fodder poles, game etc					1	1	1
Transfer of knowledge					1	1	1
Social capital					1	1	
Transportation					1	1	
Loss of customary tenure / access by communities / farmers (proxy legal tenure rights in this case)				1			
Loss of access or possibility of access by people occupying forest reserve				1			
Dispute over actual ownership of land and increase in social tension			1				
Insufficient economic benefit to local people (actual or perceived)				1			

Type of Impact	Negative Impacts			neutral		Positive Impacts		
	high	medium	low			low	medium	high
Lack of access to plantation facilities					1			
Crop damage and loss of income to farmers			1					
Influx of migrants to the indigenous communities due to need for labour. Breakdown in traditional social structure			1					
Destruction of cultural historical and scientific sites			1					
Change in landscape					1			
Health and safety			1					
Security		1	1					
Quality of life					1			
Conflicts and crime					1			
Poaching					1			
HIV/STD/AIDS and social promiscuity					1			
Overall Impact of the Asubima Plantation Project	0	2	20	14		29	26	13

7. CONCLUSIONS

7.1 The study objectives

The conclusions and subsequent recommendations are presented under the study objectives. The objectives of the study were to:

- Review socio-economic cultural and environmental base line information on the project area
- Identify and characterize stakeholders
- Undertake baseline socio-economic and environmental studies of the target area
- Assess social and environmental impacts of proposed project by means of SWOT³ analysis and evaluation of FSC[□] standards for plantation development
- Make recommendations for enhancement of positive impacts and mitigation of negative effects.

7.1.1 *Review baseline information on the project area*

Review of literature about the study area yielded very little information. There were brief reports from the Ghana News Agency in terms of degradation and illegal activities. No serious studies have been conducted on the area and the only indication was an insect entomology study that could not be accessed on the internet. A student's dissertation on Offinso district however may be a useful source for determining some characteristics about the project area since these are close by and within the same ecological a traditional area. Satellite imagery however shows clearly the degraded nature of the forest reserve.

7.1.2 *Identity and characterisation of the stakeholders*

The main stake holders that are likely to influence the success of the proposed project have been characterized. Illegal farmers could be an asset to the project. Land owners could pose a threat in terms of benefit sharing if they are not engaged from the very beginning by the company. These are the chiefs of Nkoranza Offinso and Akomadan /Techiman.

The local administration (District Assembly is an important player in the area of local development and other business related matters that could stand the company in good stead if they were properly engaged. They would be concerned with local development projects, environmental and ecological protection and general health, security and socioeconomic well being of local people. Devolutions of this administrative structure are found in the various communities that fringe the forest reserve and play a key role in daily administration at the local level.

³ Strengths weaknesses, opportunities and threats analysis

7.1.3 *Baseline socio-economic and environmental information about the target area*

Farming in the forest reserve is actively going on and this is very lively being done by those farmers who have no other options to farm land there is indication that migrants may be predominant in this activity.

Since the farmers are not legally accommodated in the reserve they welcome any initiative that will ensure secure tenure of farm land for them. The youthful population is a potential source of reliable labour for the company. In addition the project will provide scarce social amenities and forest goods for the communities.

7.1.4 *SWOT and impacts analysis*

The threats that are posed to the operations of the company are more emphatic but many are minor and could be turned into advantages. Better to foresee these that to be complacent and pay dearly in future.

There are few negative impacts that were identified. The positive impacts for both environment and society are overwhelming and should be encouraged.

Studies of the management plan and real operational initiatives on the ground prove that the few identified negative impacts will be well mitigated

The overwhelming planting of Teak in the degraded area is seen as not very expedient but the severity of both social and environmental conditions warrant that action to reforest the reserve be expedited

7.2 General conclusions

Overall the reserve is severely degraded and requires reforestation. The inventory of this study shows that there is no natural forest present at this time. This confirms responses from the communities who say they have no such forests (over 90% of responses) i.e. forest that has not been touched for at least 15 years (PEN/DANIDA surveys)

Illegal farming is common in the forest reserve. This implies that farming is well entrenched and that there could be many people involved illegally which could pose a threat for the project if they are to be ejected.

The issues of access to the reserve for plantation development and even farming as well as products thereof are unresolved. The FSD, traditional land owners (and their associates), farmers (who claim they have been permitted to farm by the FSD) and the company have tenure problems to sort out through negotiation to prevent future legal battles.

Generally the company can be sure of much good will from all sides; government, traditional land owners interested in royalties or economic benefit and farmers seeking security of access to farm land. Thus in the mean time subject to the following recommendations the company could continue to implement its action plan.

7.3 Recommendations

Social integration through employment provision for local people and access to farm land benefit sharing with land owners should be negotiated as quickly as effectively as possible to avoid future litigation and mistrust among stakeholders.

Poverty is endemic in Asubima fringe communities. Roads and other social amenities are lacking. Estimations indicate that the road density of the forest reserve area is less than 5 m per hectare. It will be in the corporate interest of the client to contribute to the upgrading of roads and to ensure that the district administration is made aware of this.

The enhancement measures and mitigations have been incorporated in the impact matrix and should serve as working social and environmental plan for the project. In particular

Corridors for the protection of indigenous wild life should be created or protected where necessary to protect the biodiversity integrity of the reserve.

As much as possible the client is encouraged to access FORIG and FRNR's expertise to conduct scientific studies in the plantations and invite students to understudy the process and collect data for scientific work.

FORM is also encouraged to review its plan to cultivate over 90% of the proposed area with teak. This could be reduced to a reasonable of 70 to 60 percent because other equally valuable trees such as Odum and Wawa have been known to do well in the area and should not take too long to rot.

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ANNEX 1: QUESTIONNAIRE FOR THE SOCIO-ECONOMIC SURVEY

1. Identification and location of household.							
Household name and code	*(name)	(HID)					
Village name and code	*(name)	(VID)					
District name and code	*(name)	(DID)					
Name and PID (see B. below) of primary respondent	*(name)	(PID)					
Name and PID (see B. below) of secondary respondent	*(name)	(PID)					
GPS reference point of household (UTM format)							
Distance of the household from the centre of village (in minutes of walking and in km)	min	km					
B. Household composition							
1. Who are the members of the household?							
Note: Recall the definition of households in the Technical Guidelines.							
1. Personal Identification number (PID)	* Name of household member	2. Relation to household head1)	3. Year born (yyyy)	4. Sex (0=male, 1=female)	5. Education (number of years completed)	6. Non-formal education (number of years completed)	7. Special skills
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

1) Codes: 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 or sister; 8=brother/sister in law; 9=uncle/aunt; 10=nephew/niece; 11=step/foster child; 12=other family; 13=not related (e.g., servant).	
2) One may ask about age, and the calculate 'year born' when entering data.	
3) Codes: 1=shop/trade; 2=agric. processing; 3=handicraft; 4=carpentry; 5=other forest based; 6=other skilled labour; 7=transport (car, boat,...); 8=lodging/restaurant; 9=brewing; 10=brick making; 11=landlord/real estate;	
12=herbalist/traditional healer/witch doctor; 13=quarrying; 19=other, specify:	
2. We would like to ask some questions regarding the head of this household.	
What is the marital status of household head?	
Codes: 1=married and living together; 2=married but spouse working away; 3=widow/widower; 4=divorced;; 5=never married; 9=other, specify:	
How long ago was this household formed (see definition of household)	years
Was the household head born in this village?	(1-0)
If 'yes', go to 5.	
If 'no': how long has the household head lived in the village?	years
Does the household head belong to the largest ethnic group/caste in the village?	(1-0)

C. Land

1. Please indicate the amount of land (in hectares) that you currently own and have rented in/out.

Note: See definitions of land categories in the Technical Guidelines.

Category	1. Area (ha)	2. Ownership (code tenure)	Main products grown/harvested in the past 12 months. Max 3 (code-product)		
Forest:					
Natural forest					
Managed forests					
Plantations					
Agricultural land:					
Cropland					
Pasture (natural or planted)					
Agroforestry					
Silvipasture					
Fallow					
Other vegetation types/land uses (residential, bush, grassland, wetland, etc.)					
Total land owned (1+2+3+...+9)					

Land rented out (included in 1-9)				
Land rented in (not included in 1-9)				
D. Assets and savings				
1. Please indicate the type of house you have?				
1. Do you have your own house? 1)				
2. What is the type of material of (most of) the walls? 2)				
3. What is the type of material of (most of) the roof? 3)				
4. How many m2 approx. is the house? m2				
1) Codes: 0=no; 1=own the house on their own; 2=own the house together with other household(s); 3=renting the house alone; 4=renting the house with other household(s); 9=other, specify:				
2) Codes: 1=mud/soil; 2=wooden (boards, trunks); 3=iron (or other metal) sheets; 4=bricks or concrete; 5=reeds/straw/grass/fibers; 9=other, specify:				
3) Codes: 1=thatch; 2=wooden (boards); 3=iron or other metal sheets; 4=tiles; 9=other, specify:				
2. Please indicate the number and value of implements and other large household items that are owned by the household.				
Note: see latest version of "PEN codes list" for a complete list of items and codes.				
	1. No. of units owned	2. Total value (current sales value of all units, not purchasing price)		
Car/truck				
Tractor				
Motorcycle				
Bicycle				
Hand phone/phone				
TV				
Radio				
Cassette/CD/ VHS/VCD/DVD/ player				
Stove for cooking (gas or electric only)				
Refrigerator/freezer				
Fishing boat and boat engine				
Chainsaw				
Plough				
Scotch cart				
Shotgun/rifle				
16. Wooden cart or wheelbarrow				
17. Furniture				
18. Water pump				
19. Solar panel				
20. Timber trees outside forests				
21. Generator				
22. Farm sprayer				
99. Others (worth more than approx. 50 USD purchasing price)				
3. Please indicate the savings and debt the household has				
How much does the household have in savings in banks, credit associations or savings clubs?				Lc\$
How much does the household have in savings in non-productive				Lc\$

assets such as gold and jewelry?		
How much does the household have in outstanding debt?		Lc\$
E. Forest resource base		
How far is it from the house/homestead to the edge of the nearest natural or managed forest that you have access to and can use?	1. ... measured in terms of distance (straight line)?	Km
	2. ... measured in terms of time (in minutes of walking)?	min

ANNEX 2: CHECKLIST OF BIRDS FOR ASUBIMA FR

Scientific name	English name	Reverine	Fallow	farm	Teak	Fire
<i>Alethe diademata</i>	Fire-crested alethe	0.38	0.50	0.38	0.25	0.00
<i>Apaloderma narina</i>	Narina's trogon	0.52	0.50	0.25	0.00	0.00
<i>Apalis sharpii</i>	Sharpe's apalis	0.96	1.00	1.00	0.88	0.00
<i>Baeopogon indicator</i>	Honey-guide greenbul	0.36	0.50	0.50	0.13	0.00
<i>Bleda canicapilla</i>	Grey-headed bristlebill	0.86	0.75	0.75	0.50	0.25
<i>Bleda syndactyla</i>	Bristle-bill	0.48	0.25	0.25	0.00	0.00
<i>Buccanodon duchaillui</i>	Yellow-spotted barbet	0.04	0.00	0.00	0.00	0.00
<i>Bycanistes cylindricus</i>	Brown-cheeked hornbill	0.00	0.00	0.25	0.00	0.00
<i>Bycanistes subcylindricus</i>	Black-&-white-casqued hornbill	0.20	0.00	0.13	0.00	0.00
<i>Campethera caroli</i>	Brown-eared woodpecker	0.00	0.00	0.00	0.00	0.00
<i>Campethera maculosa</i>	Golden-backed woodpecker	0.04	0.00	0.00	0.00	0.00
<i>Calyptocichla serina</i>	Serine greenbul	0.00	0.00	0.00	0.00	0.00
<i>Cercotrichas leucosticta</i>	Northern bearded scrub-robin	0.34	1.00	0.63	0.13	0.25
<i>Cercococcyx olivinus</i>	Olive long-tailed cuckoo	0.32	0.00	0.00	0.00	0.00
<i>Coracina azurea</i>	Blue cuckoo-shrike	0.48	0.00	0.00	0.75	0.25
<i>Columba malherbii</i>	Bronze-naped pigeon	0.04	0.25	0.25	0.00	0.00
<i>Criniger barbatus</i>	Bearded greenbul	0.72	0.50	0.38	0.38	0.00
<i>Criniger calurus</i>	Red-tailed greenbul	0.62	1.00	0.13	0.63	0.00
<i>Criniger olivaceus</i>	Yellow-thr'd olive greenbul	0.20	0.25	0.13	0.25	0.00
<i>Dryoscopus sabinii</i>	Sabine's puff-back flycatcher	0.34	0.00	0.50	0.00	0.00
<i>Fraseria ocreata</i>	Forest flycatcher	0.00	0.00	0.00	0.25	0.00
<i>Gymnobucco calvus</i>	Naked-faced barbet	0.80	1.00	0.63	1.00	0.25
<i>Halcyon badia</i>	Chocolate-backed kingfisher	0.08	0.00	0.00	0.00	0.00
<i>Hylia prasina</i>	Green hylia	1.00	1.00	0.88	1.00	0.25
<i>Ixonotus guttatus</i>	Spotted greenbul	0.00	0.00	0.00	0.00	0.25
<i>Lamprotornis cuprecauda</i>	Copper-tailed glossy starling	0.10	0.00	0.00	0.00	0.00
<i>Macrosphenus concolor</i>	Grey longbill	0.80	1.00	0.38	0.38	0.00
<i>Malaconotus cruentus</i>	Fiery-breasted bush-shrike	0.44	0.75	0.63	0.00	0.00
<i>Malimbus nitens</i>	Blue-billed malimbe	0.10	0.25	0.00	0.00	0.00
<i>Malimbus rubricollis</i>	Red-headed malimbe	0.72	0.25	0.13	0.38	0.00
<i>Mesopicus pyrrhogaster</i>	Fire-bellied woodpecker	0.40	0.25	0.13	0.13	0.00
<i>Neocossyphus poensis</i>	White-tailed ant-thrush	0.04	0.00	0.38	0.13	0.00
<i>Nicator chloris</i>	West African nicator	0.46	0.75	0.63	0.50	0.00
<i>Phoeniculus bollei</i>	White-headed wood-hoopoe	0.00	0.00	0.00	0.25	0.00
<i>Platysteira castanea</i>	Chestnut wattle-eye	0.56	0.25	0.13	0.13	0.00
<i>Pogoniulus atro-flavus</i>	Red-rumped tinker-bird	0.00	0.25	0.13	0.50	0.00
<i>Prionops caniceps</i>	Red-billed shrike	0.14	0.25	0.00	0.00	0.00
<i>Saruthrura pulchra</i>	Pygmy rail	0.08	0.00	0.00	0.38	0.00
<i>Stiphornis erythrothorax</i>	Forest robin	0.12	0.50	0.25	0.00	0.00
<i>Stizorhina fraseri</i>	Rufous flycatcher	0.62	0.50	0.63	0.00	0.25
<i>Tauraco macrorhynchus</i>	Black-tip crested turaco	0.00	0.00	0.13	0.00	0.00
<i>Tockus camurus</i>	Red-billed dwarf hornbill	0.34	0.25	0.25	0.00	0.00
<i>Tropicranus albocristatus</i>	White-crested hornbill	0.70	0.75	0.50	0.88	0.00
<i>Trochocercus nitens</i>	Blue-headed crested flycatcher	0.42	0.00	0.00	0.50	0.00
<i>Trichostoma rufescens</i>	Rufous-winged illadopsis	0.40	0.25	0.00	0.00	0.00
<i>Turtur brehmeri</i>	Blue-headed dove	0.28	0.00	0.00	0.38	0.00
<i>Urotriorchis macrourus</i>	Long-tailed goshawk	0.00	0.00	0.13	0.00	0.00

Proportion of footpaths on which species were detected with respect to vegetation type. (Each proportion is the mean across vegetation types)

ANNEX 3: CHECKLIST OF ANIMALS AS SEEN BY FARMERS

Common name	Scientific name	Status ^a	Months since last seen ^b
MAMMALS:			
Bush Buck	<i>Tragelaphus scriptus</i>	VC	53.5
Ogilby's duiker	<i>Cephalophus ogilbyi</i>	R	3.9
Maxwell's duiker	<i>Cephalophus monticola maxwelli</i>	VC	0.8
Red colobus	<i>Colobus badius waldroni</i>	R	20.7
Black & white colobus	<i>Colobus polycomos vellerosus</i>	U	48.5
Mona monkey	<i>Cercopithecus mona lowei</i>	VC	0.9
Bosman's potto	<i>Periodictus potto</i>	VC	7.7
African civet cat	<i>Viverra civetta</i>	VC	5.1
Two-spotted palm civet	<i>Nandinia binotata</i>	VC	5.5
Marsh mongoos	<i>Herpestes paludinosus</i>	R	28.3
Cusimanse	<i>Crossarchus obscurus</i>	VC	0.7
Tree Hyrax	<i>Dendrohyrax arboreus dorsalis</i>	VC	1.4
Honey Badger	<i>Mellivora capensis</i>	R	144
Crested porcupine	<i>Hystrix cristata senegalica</i>	U	62.4
Brush-tailed porcupine	<i>Atherura africana</i>	VC	2.5
Giant rats	<i>Cricetomys gambianus/emini</i>	VC	0.1
Grasscutter	<i>Thryonomys swinderianus</i>	VC	0.2
Lesser Bush baby	<i>Galago demidovii</i>	VC	1.7
Fruit- bats	<i>Eidolon helvum</i>	VC	1.9
Hammer-headed fruit bat	<i>Hypsignathus monstrosus</i>	U	0.1
Dwarf mongoose	<i>Galerella sanguinea melanura</i>	VC	1
REPTILES			
African python	<i>Python sebae</i>	VC	32.2
Nile Monitor lizard	<i>Varanus niloticus ornatus</i>	VC	9.7
Nile crocodile	<i>Crocodilus niloticus</i>	C	47.1
Tortoise	<i>Kinixys sp.</i>	VC	8.8
Chameleon	<i>Chameleo sp.</i>	VC	7.7
BIRDS			
White crested guinea- fowl	<i>Agelastes meleagrides</i>	VC	0.9
Crested guinea fowl	<i>Guttera edouardi</i>	VC	7.8
Ahanta francoline	<i>Francolinus ahantensis</i>	U	1.6
Palm-nut vulture	<i>Gypohierax angolensis</i>	VC	9.3
Harrier Hawk	<i>Polyboroides radiatus</i>	U	3.1
Great sparrow hawk	<i>Accipiter melanoleucus</i>	VC	0.3
Yellow-casqued hornbill	<i>Ceratogymna atrata/elata</i>	VC	2.3
Great Blue turaco	<i>Corythaeola cristata</i>	C	15
Owl		VC	0.7
Woodpecker		C	0.6
Yellow fronted canary	<i>Serinus mozambicus</i>	VC	0.1

Data on species encountering rate and status on 21 mammals, 5 reptiles and 11 species of birds^a based on the percentage of respondents that had ever seen the species: >75% = very common (VC), 50-74% = common (C), 25-49% = uncommon (U), and 1-25% = rare (R), and 0% = possibly extinct (PE). ^b average time since last sighting for those farmers who have seen the species.

