
Monitoring report 2015

Asubima & Afrensu Brohuma Forest Reserves



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1. INTRODUCTION

Management is a continuous process. This means that the management will be adapted over time related to changes in the field. To keep track of these changes, Form Ghana applies a system of monitoring in which annually information is gathered. The process of evaluation and adaptation will lead to further fine-tuning of the management plan.

The current report informs on the various monitoring activities that have taken place the past year, and what has been learned from it. As more knowledge is gained on monitoring activities, these are further refined and the setup of the monitoring system will be adapted.

This annual monitoring report is public to allow interested persons to be informed on the progress of Form Ghana and the impact its activities have on the people and the environment in Asubima and Afrensu Brohuma Forest Reserves.

Form Ghana Ltd.

Willem Fourie

General Manager

1.1 Plantation monitoring

The objective of Form Ghana is to establish and manage the timber plantation in an ecologically, financially and socially sustainable manner. These management objectives are divided into criteria and for each criterion, a set of measurable indicators are determined as well as the means to verify them (Table 1).

Monitoring framework

| Management objectives | Criterion | Indicator | Verifier |
|--|------------------------------------|--|-----------------|
| 1. Establish and manage the timber plantation in an ecologically sustainable manner with a maximum of 90% Teak and at least 10% of mixed local species with conservation of natural, riparian forest | 1.1 Extent and condition of forest | 1.1.1 Area planted with Teak | Map |
| | | 1.1.2 Area managed as forest plantation / buffer zone | Map |
| | | 1.1.3 Changes in planted area | Map |
| | 1.2 Biological diversity | 1.2.1 Extent of area protected | Map |
| | | 1.2.2 Fauna population and diversity in the forest reserves | Report |
| | | 1.2.3. Flora diversity in the buffer zones | PSP |
| | | 1.2.3. Existence and implementation of procedures to identify / protect endangered, rare and threatened species | Procedures |
| | 1.3 Forest health | 1.3.1 Check of the growth rate of the plantation | PSP |
| | | 1.3.2 Check of the growth rate of the Buffer zones | PSP |
| | | 1.3.3 Monitoring of fire frequency | Fire report |
| | 1.4 Soil protection | 1.4.1 Procedures to protect soil productivity and avoid erosion | Procedures |
| | | 1.4.2 Effectiveness of activities undertaken to avoid soil erosion | PSP |
| | | 1.4.3 Procedures to avoid impact from work in the forest | Procedures |
| | 1.5 Water protection | 1.5.1 Procedures to protect forest and vegetation along water courses | Procedures |
| | | 1.5.2 Checking of water quality | Sample analysis |
| 2. Guarantee financial and economic sustainability through the generation of income from the produced round-wood and carbon sequestration | 2.1 Forest production | 2.1.1 Harvest of round wood | Tables |
| | | 2.1.2 Comparison of yield with yield tables | Tables |
| | | 2.1.3 Calculation of current stored carbon in the plantation | Calculation |
| | | 2.1.4 Calculation of current stored carbon in the buffer zones | Calculation |
| | 2.2. economic aspects | 2.2.1. Cost benefit of plantation | Table |
| | | 2.2.2 Value of wood sales | Sales data |
| 3. Provide social benefits by offering good economic conditions for | 3.1 Social benefits | 3.1.1 Number of people (partially) depending on the plantation for their livelihood (employees, inter croppers, out growers) | Annual report |

| Management objectives | Criterion | Indicator | Verifier |
|---|-----------|--|-------------------------------|
| employees and the surrounding smallholder community | | 3.1.2 Training and capacity building for employees, inter croppers and out growers | Table |
| | | 3.1.3 Information of the public | Website, stakeholder meetings |
| | | 3.1.4 Worker health / Accidents on work floor | Statistics |

1.2 Monitoring methods

In order to check compliance with the management objectives, Form Ghana has developed a monitoring system consisting of several activities. Different monitoring methods are adopted to optimize verification of different indicators. All indicators are monitored at least once every five years. Specific indicators can be monitored annually or bi-annually.

Each indicator is described in detail in the following paragraphs.

1.2.1 Extent and forest condition

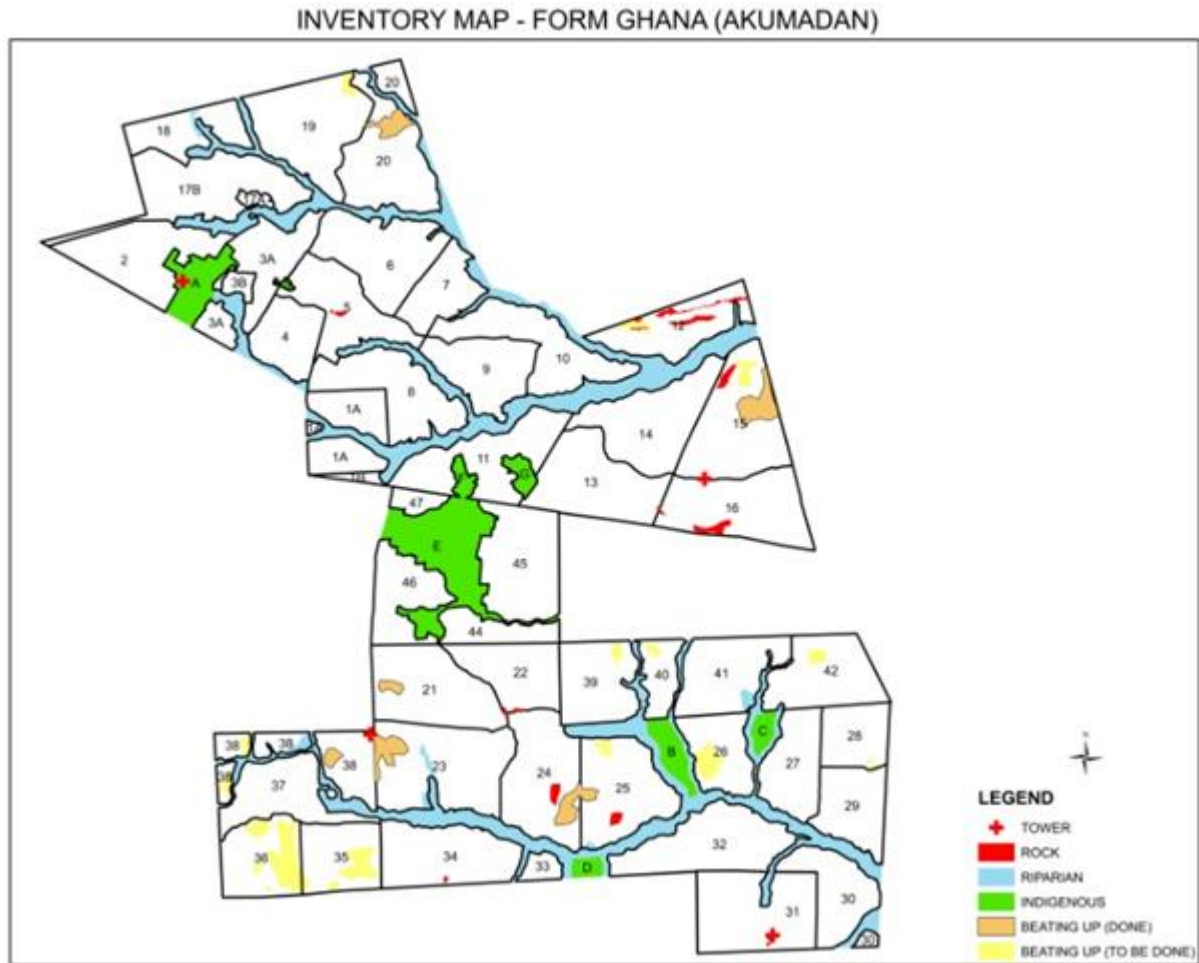
By the end of 2012, a total of 3,469 ha of land in Asubima and Afrensu Brohuma Forest Reserves falls under the management of Form Ghana. See Appendix 1 for the development of the plantation over time.

Currently, 14.7% of the area consists of indigenous vegetation and is actively being restored into its former state as productive forest (Table 2).

Stratification of Form Ghana plantations

| Planting year | Area Teak (ha) | Area indigenous (ha) |
|---------------|----------------|----------------------|
| 2001 | 53.8 | 12.3 |
| 2003 | 18.0 | 0 |
| 2004 | 42.0 | 0 |
| 2008 | 151.0 | 20.5 |
| 2009 | 512.0 | 83.3 |
| 2010 | 576.3 | 83.7 |
| 2011 | 845.4 | 139.1 |
| 2012 | 736.7 | 170.4 |
| Total | 2935.4 | 509.3 |
| % | 85.3 | 14.7 |

An inventory has been done to check which areas are not performing well enough. These areas have been mapped and subtracted from the productive plantation area. These areas are indicated as rock in the map below. It concerns about 20 hectares in total.



Map of planted areas in Asubima and Afrensu Brohuma by Form Ghana

1.2.2 Biological diversity

No monitoring has been performed on the fauna, but monitoring has been performed on the flora in the buffer zones. The report on this monitoring will however only be available by end of January 2016. The next five year monitoring of fauna is foreseen in 2016.

In the plantation one individual of the CITES species Kokrodua (*Percicopsis elata*) is present. This tree was discovered in 2010, and verification in 2015 has confirmed it is still in good health.

The monitoring of biological diversity has started in 2008. In 2011 research on birds, small mammals, butterflies and vegetation in the buffer zones was done. The results of this study are reported in a specific report available on the Form Ghana website.

1.2.3 Forest health

Analyses of forest growth and health as well as soil erosion are based on the PSP measurements taken in the plantation. Every year after planting, additional plots are created in the newly planted compartments. The number of plots will therefore increase yearly. PSP monitoring is done according to Protocol 13: Monitoring.

The basic shape of a PSP is a circular plot with a pole in the centre. GPS coordinates of the pole determine the site location. Each sample plot has a size of 800m². This plot

size does not change over time and the size is chosen so that a plot contains a sufficient amount of trees even after subsequent thinnings.

Height and DBH (diameter at breast height) of the trees in the plots as well as overall health of the plantation is assessed annually.

The measurements taken in these plots are:

- Date of measurement
- Tree diameter at breast height (DBH): the diameter of each tree is measured at breast height with measurement tape or calliper.
- Height: The height of all trees is measured as accurately as possible with a clinometer (Suunto) or a measurement pole;
- Tree health, pests and diseases: it is recorded whether the measured trees are healthy or affected by disease.
- Soil erosion: any visual sign of erosion will be noted (rills, gullies, splash erosion, crusting);
- Undergrowth: A note is written on the amount of undergrowth and the type of undergrowth.

The data from these plots are entered in an Excel sheet, where they are further analysed. A summary of the plots for this monitoring activity is presented below in table 3.

PSP monitoring in 2015 focused on the plant year 2001, 2008, 2010 and 2012. A total of 202 PSPs have been selected this year for monitoring plantation growth and performance of Teak and 20 plots for the indigenous. Sampling density for Teak was 0.97% and for indigenous it was 1.3%.

Summary results of the monitoring of Teak

| Plant year | Average planting density (#/ha) | N (#/ha) | +/- | H _{av} (m ¹) | +/- | H _{dom} (m ¹) | +/- | DBH (cm) | +/- | V (m ³ /ha) | +/- |
|------------|---------------------------------|----------|-----|-----------------------------------|-----|------------------------------------|-----|----------|-----|------------------------|------|
| 2001 | 1111 | 388 | 75 | 19.5 | 1.2 | 21.2 | 2.0 | 24.0 | 1.9 | 157.9 | 24.4 |
| 2008 | 1667 | 935 | 212 | 8.8 | 1.9 | 10.5 | 1.9 | 9.6 | 2.3 | 34.4 | 20.5 |
| 2010 | 1111 | 740 | 211 | 7.6 | 1.5 | 9.3 | 1.6 | 8.7 | 1.7 | 19.8 | 11.4 |
| 2012 | 1111 | 792 | 202 | 5.8 | 1.4 | 7.2 | 1.8 | 5.9 | 2.1 | 7.9 | 6.9 |
| Ahmed teak | 600 | 363 | 92 | 9.6 | 4.5 | 12.4 | 4.2 | 13.7 | 7.0 | 48.9 | 32.0 |

N is calculated as the total number of trees/records per plot (800m²), then extrapolated to one hectare (N/ha) and the average of all plots of the same plantyear is calculated.

H_{av} = the average height per plot, then the average of all plots of the same plantyear is calculated.

H_{dom} = the average height of the 100 largest (DBH) trees per ha. The average height of the 8 largest trees per plot is calculated, resulting in the *H_{dom}* per plot. Then the average of all plots of the same plantyear is calculated.

DBH = Diameter at breast height (1.3 m.). The average per plot is calculated, then the average of all plots of the same plantyear is calculated.

V is calculated as $V_{tree} = \pi * r^2 * H * \text{form factor}$. (r = radius = $\frac{1}{2}$ DBH). Then the sum of the volume per plot is calculated, extrapolated to a Volume / ha, then the average of all plots of the same plantyear.

Form factors are based on the adapted Ivory Coast yield tables (0.36)

Summary results of the monitoring of indigenous

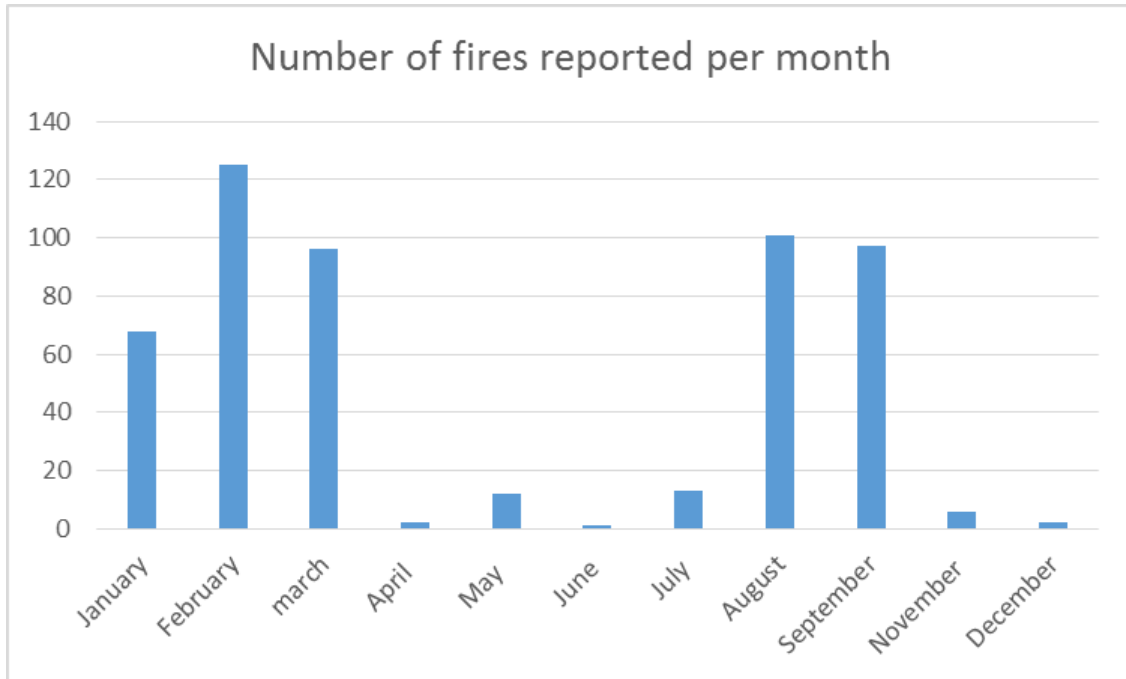
| Plant year | Species | Planting density (# / ha) | # of trees | N (# / ha) | Proportion | H _{av} (m ¹) | DBH _{av} (cm) |
|-------------|-------------------------------|---------------------------|-------------|------------|------------|-----------------------------------|------------------------|
| 2010 | <i>Albizia ferruginea</i> | | 49 | 61 | 19,1% | 6,0 | 8,4 |
| | <i>Ceiba pentandra</i> | | 41 | 51 | 16,0% | 3,8 | 6,8 |
| | <i>Cola gigantea</i> | | 22 | 28 | 8,6% | 2,0 | 5,7 |
| | <i>Erythrophleum ivorense</i> | | 14 | 18 | 5,5% | 8,5 | 9,9 |
| | <i>Khaya spp</i> | | 117 | 146 | 45,7% | 2,5 | 3,9 |
| | <i>Terminalia ivorensis</i> | | 13 | 16 | 5,1% | 3,3 | 6,7 |
| | Total | | 1172 | 256 | 320 | 100,0% | 3,7 |
| 2012 | <i>Albizia ferruginea</i> | | 41 | 51 | 19,3% | 2,5 | 1,7 |
| | <i>Bombax buonopozense</i> | | 5 | 6 | 2,4% | 2,6 | 2,1 |
| | <i>Ceiba pentandra</i> | | 24 | 30 | 11,3% | 2,2 | 1,9 |
| | <i>Cola gigantea</i> | | 62 | 78 | 29,2% | 0,8 | 1,2 |
| | <i>Erythrophleum ivorense</i> | | 7 | 9 | 3,3% | 1,0 | 1,4 |
| | <i>Khaya spp</i> | | 54 | 68 | 25,5% | 1,4 | 1,4 |
| | <i>Nauclea diderrichii</i> | | 1 | 1 | 0,5% | 1,1 | |
| | <i>Terminalia ivorensis</i> | | 18 | 23 | 8,5% | 1,6 | 1,0 |
| | Total | | 1111 | 212 | 265 | 100,0% | 1,6 |

1.2.4 Protection against fire

Fire is a great potential threat to the plantations. In 2015, 523 fires were reported by the security team. 520 of these fires were located outside the Form Ghana area. 3 fires were within the Form Ghana boundaries, but could quickly be quenched by the rapid response teams. Fire occurs mostly during the first three months of the year and the frequency of occurrence quickly drops with the onset of rains.

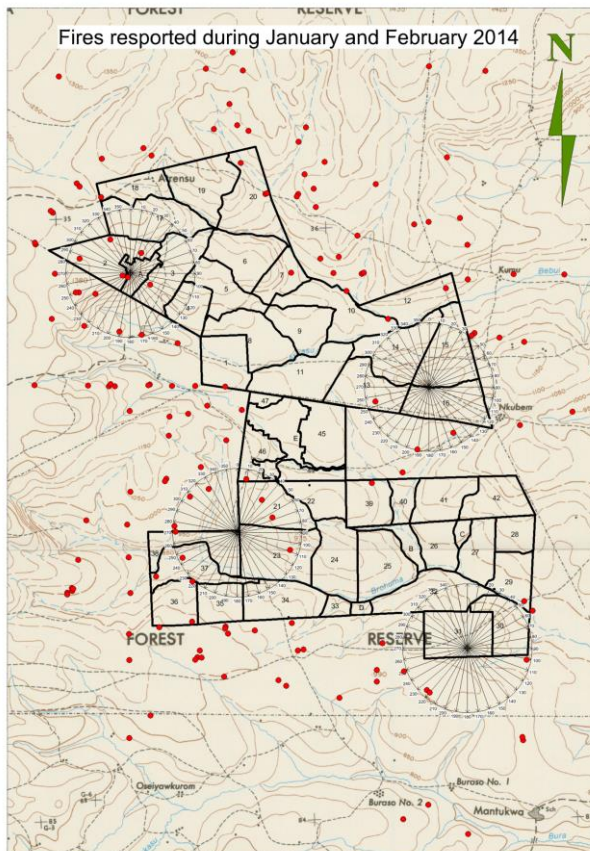
Fire occurrences

| Month | Fires outside | Fires inside |
|-------------|---------------|--------------|
| January | 68 | |
| February | 124 | 1 |
| march | 96 | |
| April | 2 | |
| May | 12 | |
| June | 1 | |
| July | 13 | |
| August | 100 | 1 |
| September | 96 | 1 |
| November | 6 | |
| December | 2 | |
| Total fires | 520 | 3 |



Fires summarized per month of 2015

In 2015 an experiment was done with the plotting of each reported fire on a map. The results show that the information can be very useful, but that the effort involved in plotting all fires requires a new approach. To this end sectors will be drawn around the plantation on a special reporting map in which the reported fires can be ticked.



Spatial distribution of the fires in January and February 2014

This way we can know which sector is most likely to generate fires that pose a threat to the plantations. In the map below it can be seen that the January and February fires of 2014 seem to be evenly distributed. But adding more data may show areas with higher risk and areas with lower risk.

1.2.5 Soil protection

On sloped terrain erosion can be a problem, especially on the more sandy soils of Asubima. For this reason we pay special attention to erosion on the roads and in the plantation. Especially in older plantation areas, erosion can become a problem as the dense crowns can create shade that few understory plants can survive in. By regular and timely thinning this erosion can be kept in check as it stimulates undergrowth.

In the permanent sample plots erosion is checked every time the plot is measured. No erosion was found during PSP monitoring in 2015.

1.2.6 Water protection

The protection of the buffer zones is effective in the respect that they have been fully planted. The trees planted will need time to grow into trees and in that way restoring the buffer zones in full.

Water samples in 2008 showed that all water was polluted to a certain extent with silt and pesticides. Now that all agricultural pesticides except round-up are banned and the vegetation restored this situation was expected to change.

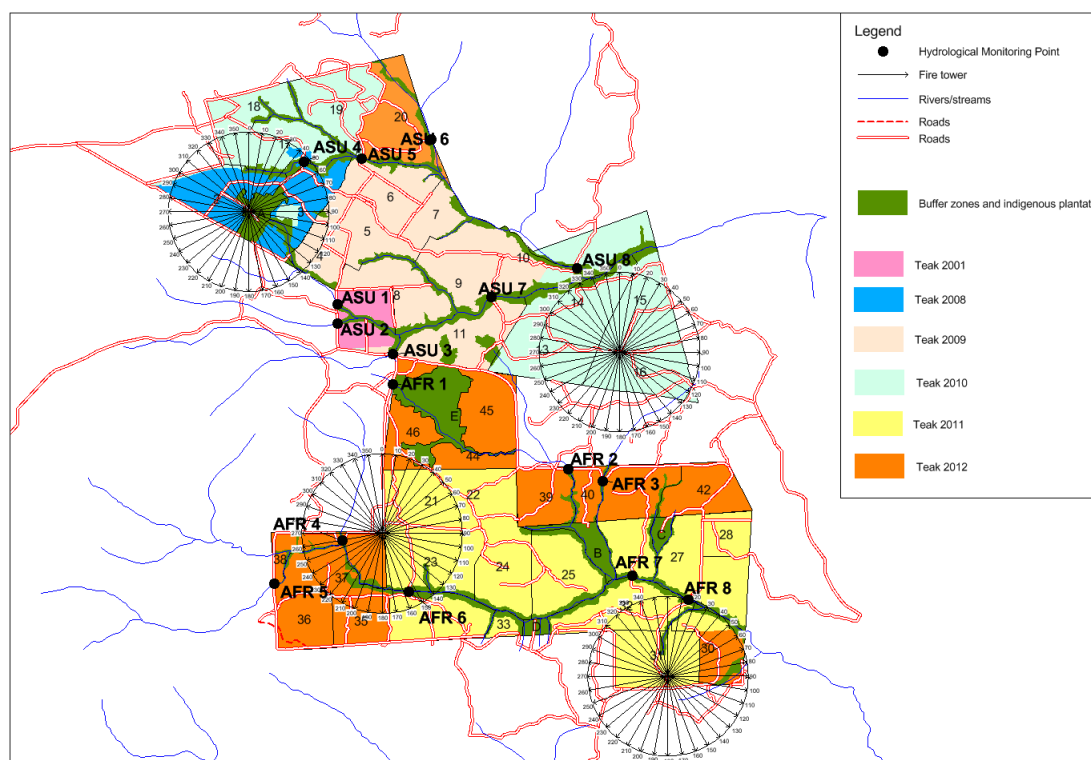
The water quality in Asubima FR was assessed again in 2011 at strategic points where streams enter and leave the plantation. The data showed that the water in the streams is of drinking quality (according to WHO standards) for all factors except iron, colour and turbidity. It shows that the contamination of the water is minimal.

Measurements of hydrological characteristics in streams in Afrensu Brohuma FR in 2013 show that nearly all streams are polluted quite severely. The restoration of the 30 meter buffer zones along the water courses is expected to reduce erosion and prevent chemicals from entering the water, as was observed in Asubima FR.

Measurements done in 2015 show there is quite a difference between Asubima and Afrensu Brohuma when looking at certain parameters of water quality. Water has a lower turbidity and lower total dissolved solids (TDS). Average temperature and pH were similar for both sites. Dissolved solids refer to any minerals, salts, metals, cations or anions dissolved in water.

Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulphates) and some small amounts of organic matter that are dissolved in water. TDS is an indicator of general quality of the water. High TDS values may be associated with influx of waste-water or agricultural run-off. According to WHO drinking water guidelines, the palatability of water with levels under 600ppm is generally considered to be good.

The measurements were taken at the point presented in the map below:



Points where water samples were taken

Results of the measurements per sample point

| Plot No. | Mean pH | Total dissolved solids mS | Mean Temp (C) | Standard deviation of Temp (C) |
|------------------------|------------|---------------------------|---------------|--------------------------------|
| Asubima | | | | |
| 1 | 7,0 | 0,031 | 24,8 | 0,1 |
| 2 | 7,1 | 0,044 | 25,1 | 0,2 |
| 3 | 7,2 | 0,027 | 26,4 | 0,3 |
| 4 | 6,0 | 0,040 | 26,3 | 0,4 |
| 5 | 7,0 | 0,040 | 26,0 | 0,2 |
| 6 | 7,1 | 0,027 | 27,1 | 0,1 |
| 7 | 7,1 | 0,034 | 26,2 | 0,4 |
| 8 | 7,3 | 0,030 | 26,2 | 0,6 |
| Mean | 7,0 | 0,034 | 26,0 | 0,8 |
| Afrensu Brohuma | | | | |
| 1 | 7,1 | 0,039 | 26,8 | 0,3 |
| 2 | 6,5 | 0,070 | 26,6 | 0,2 |
| 3 | 6,5 | 0,040 | 26,8 | 0,2 |
| 4 | 6,5 | 0,020 | 24,6 | 0,2 |
| 5 | 6,8 | 0,050 | 25,3 | 0,1 |
| 6 | 6,5 | 0,071 | 25,2 | 0,1 |
| 7 | 6,8 | 0,069 | 25,8 | 0,3 |

| Plot No. | Mean pH | Total dissolved solids mS | Mean Temp (C) | Standard deviation of Temp (C) |
|-------------|------------|---------------------------|---------------|--------------------------------|
| 8 | 6,9 | 0,051 | 25,3 | 0,2 |
| Mean | 6,7 | 0,051 | 25,8 | 0,8 |

1.2.7 Rainfall

The precipitation in the area was this year measured at 5 points:

- In the nursery
- At fire tower # 1 in the West of the Asubima plantation
- At fire tower # 2 in the Eastern corner of the Asubima plantation.
- At fire tower # 3 in the Afrensu Brohuma plantation
- At fire tower # 4 in the Afrensu Brohuma plantation

The data shows that the rainfall fluctuates around 1100 mm, with a peak in 2010 and low levels in 2012 and 2013. The average rainfall of 1192 mm for 2015 is normal for the area and the same as the rainfall for 2014 (1191).

Average rainfall in Akumadan.

| Nursery Site | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-------|
| 2009 | 0 | 0 | 43 | 110 | 125 | 222 | 138 | 25 | 112 | 125 | 64 | 0 | 964 |
| 2010 | 0 | 54 | 50 | 184 | 119 | 162 | 309 | 63 | 136 | 258 | 28 | 27 | 1390 |
| 2011 | 8 | 48 | 65 | 51 | 128 | 339 | 67 | 38 | 257 | 241 | 0 | 0 | 1241 |
| 2012 | 0 | 33 | 75 | 106 | 229 | 128 | 67 | 8 | 25 | 253 | 64 | 13 | 1000 |
| 2013 | 0 | 73 | 97 | 64 | 189 | 59 | 123 | 25 | 249 | 97 | 27 | 4 | 1005 |
| 2014 | 15 | 26 | 129 | 181 | 125 | 197 | 60 | 94 | 198 | 145 | 88 | 0 | 1256 |
| 2015 | 0 | 101 | 53 | 98 | 83 | 104 | 107 | 0 | 118 | 174 | 29 | 0 | 1258 |
| Tower 1 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| 2011 | 11 | 31 | 13 | 56 | 93 | 254 | 69 | 57 | 246 | 349 | 0 | 0 | 1178 |
| 2012 | 0 | 31 | 62 | 120 | 162 | 168 | 87 | 9 | 25 | 223 | 75 | 45 | 1007 |
| 2013 | 0 | 86 | 132 | 85 | 178 | 55 | 121 | 9 | 214 | 129 | 71 | 0 | 1080 |
| 2014 | 12 | 27 | 104 | 171 | 114 | 158 | 65 | 81 | 166 | 133 | 89 | 0 | 1118 |
| 2015 | 0 | 94 | 66 | 104 | 56 | 89 | 108 | 4 | 115 | 200 | 35.5 | 0 | 1120 |
| Tower 2 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| 2011 | 7 | 22 | 13 | 91 | 136 | 207 | 85 | 118 | 242 | 216 | 0 | 0 | 1137 |
| 2012 | 0 | 45 | 97 | 145 | 187 | 102 | 111 | 0 | 85 | 183 | 84 | 38 | 1076 |
| 2013 | 0 | 119 | 142 | 90 | 137 | 49 | 133 | 16 | 191 | 94 | 60 | 0 | 1029 |
| 2014 | 25 | 15 | 110 | 302 | 84 | 201 | 74 | 183 | 152 | 173 | 131 | 0 | 1448 |
| 2015 | 0 | 119 | 144 | 93 | 49 | 103 | 96 | 5 | 89 | 194 | 36 | 0 | 1450 |
| Tower 3 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| 2012 | 0 | 45 | 75 | 130 | 180 | 142 | 111 | 0 | 9 | 162 | 92 | 13 | 958 |
| 2013 | 0 | 72 | 102 | 101 | 138 | 59 | 200 | 5 | 236 | 95 | 57 | 0 | 1065 |
| 2014 | 26 | 24 | 62 | 235 | 110 | 130 | 72 | 109 | 112 | 117 | 101 | 0 | 1098 |

| | | | | | | | | | | | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-------|
| 2015 | 0 | 132 | 97 | 80 | 54 | 106 | 96 | 0 | 80 | 170 | 34.5 | 0 | 1098 |
| Tower 4 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| 2012 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 98 | 97 | 2 | 197 |
| 2013 | 0 | 35 | 183 | 197 | 196 | 92 | 199 | 21 | 307 | 82 | 102 | 0 | 1413 |
| 2014 | 24 | 27 | 114 | 162 | 66 | 167 | 26 | 71 | 171 | 136 | 73 | 0 | 1037 |
| 2015 | 0 | 73 | 99 | 112 | 58 | 138 | 79 | 0 | 104 | 203 | 54.5 | 0 | 1037 |

1.2.8 Forest production

In 2015 the 2010 area has been thinned. About 30 to 50% of the standing stems was removed during this operation.

In 2015 a start was made with the thinning of 2001 area. This area has a standing volume of about 160 m³ of which little under half the volume will be removed. A gross volume of between 3000 and 4000 m³ will be harvested

In 2015 no new monitoring and calculations have been performed to establish the carbon content of the plantations or in the buffer zones.

1.3 Economic aspects

Sales of the volumes harvested in 2015 are foreseen for 2016

1.4 Social benefits

Number of people (partially) dependant on the plantation

A social evaluation was conducted in the communities around the plantation. In these communities a total of 1038 people live (data 2014).

Number of people per community

| Community | Number of inhabitants | Off or On Reserve | Work at Form Ghana |
|---------------------|-----------------------|-------------------|--------------------|
| Yaa-Danso | 150 | Off | 5 |
| Atrensu | 35 | On | n/a |
| Nkubem | 90 | Off | 5 |
| Libya | 40 | On | 5 |
| Joe-Nkwanta | 350 | Off | 70 |
| Amponsakrom | 120 | Off | 50 |
| Atinga | 0 | On | 0 |
| Second Tower hamlet | 3 | On | 0 |
| Meta | 250 | Off | 35 |
| Total | 1038 | | 170 |

To see how the company is embedded in these villages the impacts, concerns and expectations of the communities were identified together with them in 2015.

Community impacts, expectations and concerns 2015

| Community | Positive impacts | Expectation | Concerns |
|---------------|---|---|--|
| Atrensu (fr)* | Reduction in bush fire occurrences that previously destroyed their crops. | Need School building, Need toilet facility | Over speeding of vehicles on road due to good nature of road |

| Community | Positive impacts | Expectation | Concerns |
|-----------------------|--|--|---|
| | Now have good road to transport food crops and other stuff Some of their inhabitants are employed by the company. | | |
| Nkubem (ofr)** | Employment for community members | Pipe borne water, electricity poor road network need to be fixed | - |
| Libya (fr)* | the company allowed farmers to farm when the trees were young employment during fire season, contract weeding | Wellington boot and cutlass as an incentive to motivate farmers Request to farm in open areas while taking care of young trees (beating up areas) | no land to farm some workers take the farm produce of farmers some workers also steal belongings from the farmers house |
| Joe-Nkwanta (ofr)** | Reduction in bush fires Climate change Employment for youth | Permanent employment for the youth Need school building Needs assistance to repair non-functioning bore hole | Farmers did not get any incentive from company No land to farm |
| Amponsakrom (ofr)** | employment for community members | poor road network to be fixed School building Need Pipe borne water or bore hole | No land to farm due to closure of tree canopy |
| Sreso/Konkomba (ofr)* | Reduction in bush fire Good road condition to transport food items | Need School building, Need Bore hole Need toilet facility | Due to the good nature of the road cars and motor bikes drive at high speed risking the lives of the children in the community. |
| Meta (ofr)* | Some of their inhabitants are employed by the company. Good road condition to transport food crops | Need clinic in the community pipe borne water since there is only one bore hole in the community | Farmers were not allowed to store their food produce on farm |
| Nsukuasua (ofr)* | The forest will help bring back animals (snails, etc.) | To be provided with good roads Need school building (school children walk long distances to school at Akumadan) Need pipe borne water/ Bore hole Need toilet facility, electricity Need clinic facility | No land to farm due to tree canopy closure Poor road network Poor nature of drinking water |

1.4.1 Information to the public

One stakeholder meeting was organised in Akumadan. The main subjects discussed were fire in the plantation, the possibility for people to do intercropping in Tain II Forest reserve and the public ablution facilities that Form Ghana want to construct at Akumadan.

Form Ghana has signed an intercropping agreement with 25 people in 2015. In 2014 the number was 28. This number is going down now as the plantation is maturing and most of the terrain is now under canopy cover.

1.4.2 Training and capacity building

Fire education was given in and around the Form Ghana areas. As the use of fire has become part of their lifestyle, all communities were advised to use fire with great caution. Loss of soil fertility due to fire is widespread as farmers are compelled to use chemical fertilizer to augment crop yields. Community members were advised not to leave any fire unattended, even before leaving farms for their homes. Recalcitrant members are to be reported to the appropriate authorities for sanctioning and redress. Farmers can ask for free assistance of Form Ghana on fire issues when needed during land preparation.

In general, the communities expressed great appreciation for the collaboration during the yearly fire education program in the communities and also promised to keep fire out of the communities and the forests.

Workers and management of Form Ghana have been trained on various subjects such as the use of phytosanitary products, the application of first aid, firefighting, nursery techniques, plantation techniques, use of the chain saw, monitoring, GIS mapping and FSC. The following trainings were provided in 2015:

Training at Form Ghana in 2015

| Training provided | date | Number of people trained |
|---|------------|--------------------------|
| PSP Monitoring | 4-2-2015 | 10 |
| Hydrological Monitoring | 6-2-2015 | 3 |
| Highway Code, Road Signs & Markings | 27-2-2015 | 8 |
| Mankar Training | 18-3-2015 | 12 |
| Training of Potential Plantation Managers | 23-03-2015 | 7 |
| Stump Cutting & Stump Uprooting | 19-4-2015 | 74 |
| Waste Management | 2-7-2015 | 9 |
| Highway Code, Road Signs & Markings | 15-7-2015 | 7 |
| Waste Management | 18-8-2015 | 11 |
| First Aid Training | 28-8-2015 | 39 |
| Chemical spraying | 22-9-2015 | 5 |
| Company Procedure Manual | 30-9-2015 | 11 |
| Relevant Protocols - Updating | 4-11-2015 | 10 |
| PSP Monitoring - Buffer Zones | 6-11-2015 | 6 |
| First Aid Training | 20-11-2015 | 134 |
| Waste Management | 23-11-2015 | 2 |
| Forest Fire Fighting and Prevention | 20-11-2015 | 120 |
| First Aid Training | 9-12-2015 | 1 |
| Fire training | 15-12-2015 | 16 |

1.4.3 Size of the work force

The number of people in permanent employment has reduced slightly. Less weeding is required which clearly translates in the hiring of less casual labourers. The number of permanent employees was 135 in 2014 and 134 in 2015 (see table 6).

Employees hired by Form Ghana

| Contract | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--------------|------|------|------|------|------|------|
| Permanent | 127 | 173 | 182 | 142 | 135 | 134 |
| Casual | 300 | 400 | 224 | 289 | 268 | 134 |
| Total | 427 | 573 | 406 | 431 | 403 | 268 |

1.4.4 Worker health / accidents on the work floor

Form Ghana has an agreement with the national Health Insurance Company of Ghana, insuring all permanent workers of free access to medical care. An onsite professional nurse assists people not feeling well or injured in the plantation. The nurse can assess the persons, treat them if it is a simple problem or forward them to the hospital in Akumadan or Techiman. The nurse is also responsible for the renewal of the first aid training and for checking the contents of the first aid boxes.

Dispensary use over the years and per person

| Year | 2011 | 2012 | 2013 | 2014 | 2015 |
|------------------------|------|------|------|------|------|
| Workers | 573 | 406 | 431 | 403 | 268 |
| Medical attention | 1352 | 1192 | 971 | 1163 | 934 |
| Interventions / person | 2,4 | 2,9 | 2,3 | 2,9 | 3.4 |

During 2015, medical treatment has been issued 934 times in Akumadan, which is less than the 1163 times in 2014 but similar to the 971 times in 2013. The number of treatments per person has risen to about 3.4 times per person. The main disease encountered on both locations is malaria. After malaria (184), most treatments were given to people with musculoskeletal pain (122), and cough (120). Typical work related injuries were reported 9 times which is down from 2014 (15 times reported).

1.5 Conclusions

- The annual rainfall was highest (1390 mm) in 2010, decreased in 2011 and decreased again (984mm) in 2012. In 2013, rainfall increased again to 1118mm and in 2014 to 1191 mm, which are about average for the area.
- Growth is better than was expected in some of the areas. However, some of the plots also fall in areas with lower performance than expected. The delay in growth is attributed to weed problems which have been dealt with. It can be seen that the growth is picking up speed.
- The activities of Form Ghana have a positive effect on the availability of paid employment in the region. It is perceived as aiding significantly to the restoration of the forest and its various services.
- The mean growth curve for Akumadan is currently between yield classes 3 and 4.

APPENDIX 1: FORM GHANA PLANTATION DEVELOPMENT

