
Monitoring report 2012

Asubima & Afrensu Brohuma Forest Reserves



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CONTENTS

1. INTRODUCTION.....	2
2. TYPES OF MONITORING.....	3
2.1 Plantation monitoring.....	4
2.1.1 Forest health.....	5
2.1.2 Soil protection.....	7
2.1.3 Water protection.....	7
2.1.4 Biological diversity.....	7
2.1.5 Rainfall.....	7
2.1.6 Forest production.....	8
2.2 Economic aspects.....	8
2.3 Social benefits.....	8
2.3.1 Social evaluation.....	9
2.4 Conclusions.....	10

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 report is the first of the annual reports on monitoring. It 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 Forest Reserve

FORM Ghana Ltd.

Willem Fourie

General Manager

2. TYPES OF MONITORING

The monitoring system consists of several activities aimed at the collection of different types of information. The monitoring methods used depend on what is best suited per type of information. The system is set up in a hierarchical manner to assure that the information collected provides information on the management goals. The hierarchy of the information is shown in the following table. Note that all indicators are monitored at least once every five years and specific indicators yearly or every two years.

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
	1.4 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 roundwood and carbon sequestration	2.1 Forest production	2.1.1 Harvest of round wood
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 employees and the surrounding smallholder community	3.1 Social benefits	3.1.1 Number of people (partially) depending on the plantation for their livelihood (employees, inter croppers, out growers)	Yearly report
		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

The system is set up in a hierarchical manner to assure that the information collected provides information on the management goals. The hierarchy of the information is shown in the table above.

2.1 Plantation monitoring

The objective set for the plantation is to 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. To know whether this objective is met, monitoring is undertaken in the plantation. It follows from Table 1 in that several subjects have to be checked regularly to see if things are progressing as planned. These subjects are treated in detail in the following paragraphs.

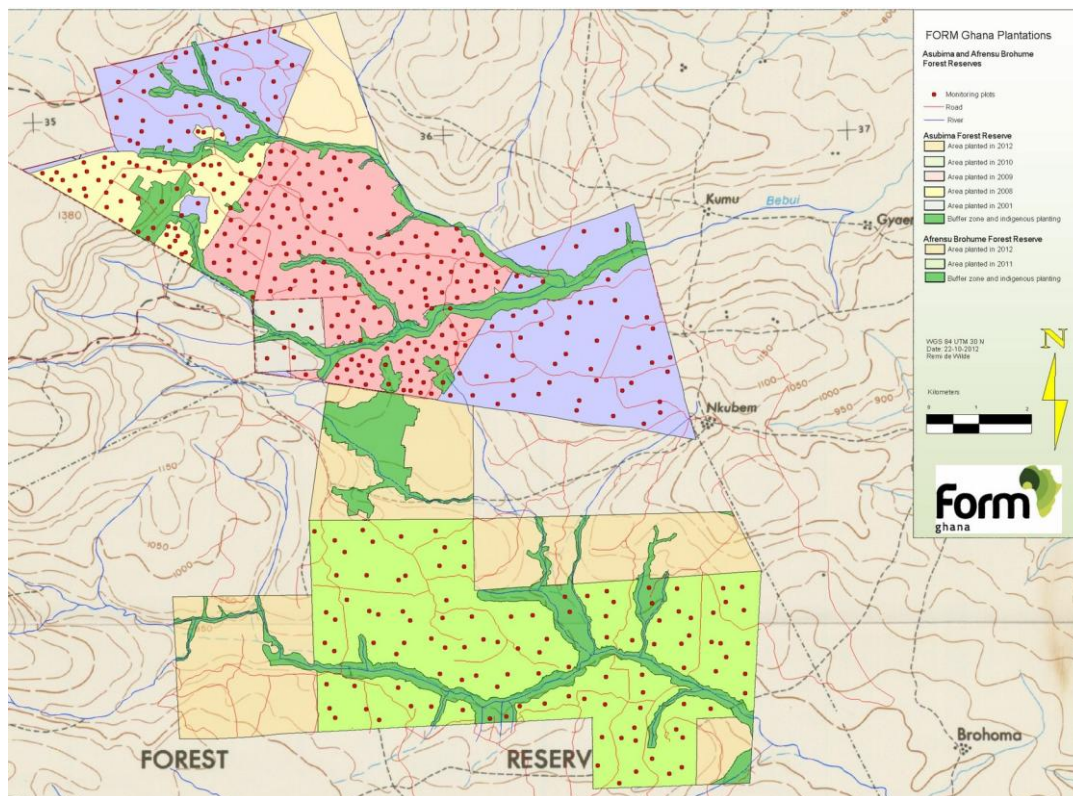


Figure 1: Form Ghana plantations

Up until the end of 2012 a total of 3,469 hectares has been taken under the management of FORM Ghana. See Figure 1 for the development of the plantation over time.

Table 2: Stratification of Form Ghana plantations

Planting year	Area (ha)	Portion	Species
2001	53	2%	Teak
2008	142	4%	Teak
2009	505	15%	Teak
2010	643	19%	Teak
2011	869	25%	Teak
2012	764	22%	Teak
<i>Subtotal teak</i>	2976	86%	Teak
2008 - 2012	493	14%	Indigenous trees and buffer zones
Total	3469	100%	

From the map and the table above it becomes clear how the plantation of FORM Ghana has evolved. Currently 14% of the area consists of indigenous vegetation and is actively being restored into its former state as productive forests.

2.1.1 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.

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 is the size is chosen so that a plot contains a sufficient amount of trees even after subsequent thinnings.

Annually, height and dbh (diameter at breast height) of the trees in the plots as well as overall health of the plantation is assessed.

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.

Table 3: Permanent sample plot sampling density in 2012

Forest type	Plant year	Plantation Area (ha)	PSP Area (ha)	# PSPs	Sampling density
Teak plantation	2001	53.4	0.14	7	0.3%
	2008	141.9	4.00	50	2.8%
	2009	505.4	12.16	152	2.4%
	2010	642.7	6.80	85	1.1%
	2011	869.2	8.00	100	0.9%
	2012	647.8			
	2012, block 20	116.0			
<i>Total Teak</i>	<i>Subtotal</i>	<i>2976.4</i>	<i>24.80</i>	<i>310</i>	<i>0.8%</i>
Indigenous plantation	2008-2010	43.1	0.72	9	1.7%
	2011	24.3	0.48	6	2.0%
	2012	78.3			
Buffer zone	2001-2010	183.8	*		
	2011-2012	163.4	*		
<i>Total Indigenous vegetation</i>	<i>Subtotal</i>	<i>492.9</i>			
Total		3469.3	24.80	409	1.6%

In the graph below the average height is compared to the height at various plantation ages taken from the yield table. This allows a comparison of growth speed. It must be noted that the height growth as presented in the yield table is a top height (highest trees from a plantation). This makes the comparison with averages difficult.

Table 4: Basic growth statistics

Plant year	(N/ha) ¹	Survival (%) ³	H (dom) (m) ¹	Avg DBH (cm) ¹	G (m ² /ha) ¹	V (m ³ /ha) ²
2001	443 (+-137)	* ³	18.2 (+-1.8)	19.8 (+-2.3)	14.3 (+-4.1)	85.5 (+-38)
2008	1096 (+-262)	66	8.7(+-1.6)	5.6(+-2.0)	3.5 (+-2.4)	8.9 (+- 7.8)
2009	911 (+-333)	82	6.9 (+-2.2)	4.2(1.9)	1.5 (+-1.5)	3.5 (+-4.3)
2010	887 (+-222)	80	4.6 (+-1.9)	2.7(+-1.1)	0.3 (+-0.3)	0.5 (+-0.7)
2011	857 (+-252)	77	2.1(+-1.4)	0.2 (+-0.3)	0.03 (+-0.07)	0.04 (+-0.2)

1: The values between brackets are standard deviations of the mean value.

2: V is calculated as $V=N \cdot H_{avg} \cdot G \cdot \text{formfactor}$. Form factors are based on the adapted Ivory Coast yield tables and on section analysis done in the 2001 plantation.

3: Not calculated because of thinning

When comparing the average growth with the data from the yield tables we see that the growth of the younger plantations seems low. It has to be noted however that estimating the growth of plantation at a very young age is not very accurate. When comparing the mean growth with data from the yield tables it becomes clear that the best performing sites are growing at a speed of 17 m³ / ha / yr. The worse performing parts are growing at a speed of 8 m³ / ha / yr. In a small portion of the plantation the growth can be lower.

2.1.2 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 erosions on our roads and in the plantation. Especially in older plantations, 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. In February 2012 no evidence of erosion was found in the plantation. Some evidence of erosion was found on the roads and this was stopped by building special culvert ditch runoff breaks.

2.1.3 Water protection

The forest along watercourse and streams is now degraded and the filtering and protection function of this forest is no longer optimal. Among the measures undertaken to maintain and improve the water quality are the efforts to restore these riparian forests. Further, road drainage systems are installed to prevent runoff from going into the streams.

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 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.

It is not expected that significant change can be measured on a yearly basis and therefore monitoring of water quality was not done in 2012. The next measurements are expected in 2016.

2.1.4 Biological diversity

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](#).

It is not expected that significant change can be measured on a yearly basis and therefore monitoring of biological diversity was not done in 2012. The next measurements are expected in 2016.

2.1.5 Rainfall

The precipitation in the area was this year measured at 4 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

The averages of the four points are shown in Table 5.

The data shows that the rainfall has decreased considerably again since the previous year: average 984 mm against 1185 mm in 2011.

Table 5 Average rainfall data in Akumadan

Month	2009	2010	2011	2012
January	?	0	9	0
February	?	54	34	39
March	43	50	30	77
April	110	184	66	125
May	125	119	119	190
June	222	162	267	135
July	138	309	73	94
August	25	63	71	4
September	112	106	248	36
October	125	258	269	205
November	64	28	0	79
December	0	27	0	0
Total	964	1390	1185	984

2.1.6 Forest production

The annual cut is determined by the yield models that have been developed for Form Ghana. To monitor whether thinning and harvesting go according to plan, every year a comparison is made between the planned volumes for commercial thinning and final felling and the realised volumes.

Due to constraints after the initial planting in 2001 of the first pilot piece of plantation, the first thinning which was due in 2004-2005 did not take place. The plantation has continued to grow and trees that could not support the stiff competition have died naturally. The density of the plantation went down from 1111 to a mean density of 790 trees per hectare. In 2012 a catch-up thinning has taken place to reduce the stem density to about 450 - 550 trees per hectare in the higher growth areas. An approximate average of 4.8 m³ per hectare was thinned.

2.2 Economic aspects

In 2012 commercial thinning has taken place in the 2001 pilot plantation and 4184 billets are sold with an approximate volume of 257 m³. 10 % of the standing tree value (STV) has been paid to the Forestry Commission and traditional landowners according to the benefit sharing agreement.

2.3 Social benefits

Workers and management of FORM Ghana have been trained on various subjects such as the use of phytosanitary products, the application of first aid, fire fighting, nursery techniques, plantation techniques, use of the chain saw, monitoring, GIS mapping and FSC. The number of people in permanent employment has risen from 172 in 2011 to 1181 in 2012. The number of people finding casual / contract employment was 400 in 2011 rising from 300 in 2010. In 2012 an average of 224 people were employed.

The local population and other interested parties have been kept up to date through the organisation of stakeholder meetings (3 times). Form Ghana has signed an intercropping agreement with 101 people in 2012, which is less than the 131 in 2011. This could be because the area of the cleared and planted land by FORM Ghana was smaller than in 2011.

FORM Ghana has signed 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.

During 2012 medical treatment has been issues 1192 times which is less than the 1352 times in 2010. The main disease encountered is malaria, which occurred 311 times. The next most frequent illness was muscoskeletal pain, which occurred 204 times.

2.3.1 Social evaluation

In 2012 a social and environmental impact assessment (SEIA) was done in Afrensu Brohuma. Form Ghana intends to plant at least 90% of the area with teak (*Tectona grandis*). Approximately 10% of the total amount of trees planted will be indigenous. These indigenous trees will be planted throughout the plantation and in the buffer zones bordering the waterways. Considering the highly degraded current state of the forest reserve, the consultants and relevant stakeholders concluded that these efforts are likely to have a positive impact on the environment as well as on the local society.

The intended forest cover has the potential to enhance water, soil, forest and general ecological integrity (biodiversity), and provide a sustainable source of income and other goods and services for local communities. The report and results can be found on the Form Ghana [website](#).

Fire education and informal evaluation was done in and around the Form Ghana areas. Elders of the communities recounted the original forest as being luxuriant with high wildlife population and even on the forest outside the reserved, but the activities of illegal logging, hunting and farming in the forest reserve and wildfires has totally degraded the forest to its present state. As the use of fire has become part of their lifestyle, all communities were advised to use fire with great caution. Over the years it has been observed elsewhere that wildfire has destroyed forest, wildlife, farms, including life and properties. 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 to, 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.

2.4 Conclusions

- The planting of Asubima & Afrensu Brohuma has gone quicker than initially planned and all the terrain allocated to Form Ghana has been planted. The area under natural vegetation or indigenous plantation has grown to 493 hectares (14%).
- The annual rainfall was highest (1390 mm) in 2010, decreased in 2011 and decreased again (984mm) in 2012.
- 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 plantation is in this stage still too young to make conclusions on growth expectations.
- The first commercial thinning has taken place in the 2001 pilot plantation. The timber was sold as billets and benefit sharing was paid to the Forestry Commission and local landowners.
- 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 it's various services.