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## Monitoring report

Asubima Forest Reserve

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# “Forests for the Future”



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Elaborated by

**FORM International**

Authors  
Address

T.H.V. Wanders  
Bevrijdingsweg 3  
8051 EN Hattem  
The Netherlands

Telephone  
Fax

+ 31 38 444 89 90  
+ 31 38 444 89 91

Email

[info@forminternational.nl](mailto:info@forminternational.nl)

Website

[www.forminternational.nl](http://www.forminternational.nl)

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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 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 it's activities has on the people and the environment in Asubima Forest Reserve

FORM Ghana Ltd.

Willem Fourie

General Manager

## 2. TYPES OF MONITORING

Monitoring and evaluation of forest conditions and management performance are necessary to assure the sustainability of forest management. FORM Ghana has established a monitoring system to be able to evaluate its performance and adapt its management when necessary. The monitoring system consists of several activities aimed at collecting different types of information, the method of monitoring used depending on what is best suited per type of information.

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 natural 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 Protected areas connected by biological corridors or stepping stones	Map
		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
	1.4 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
	2.2. 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)	Table
		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

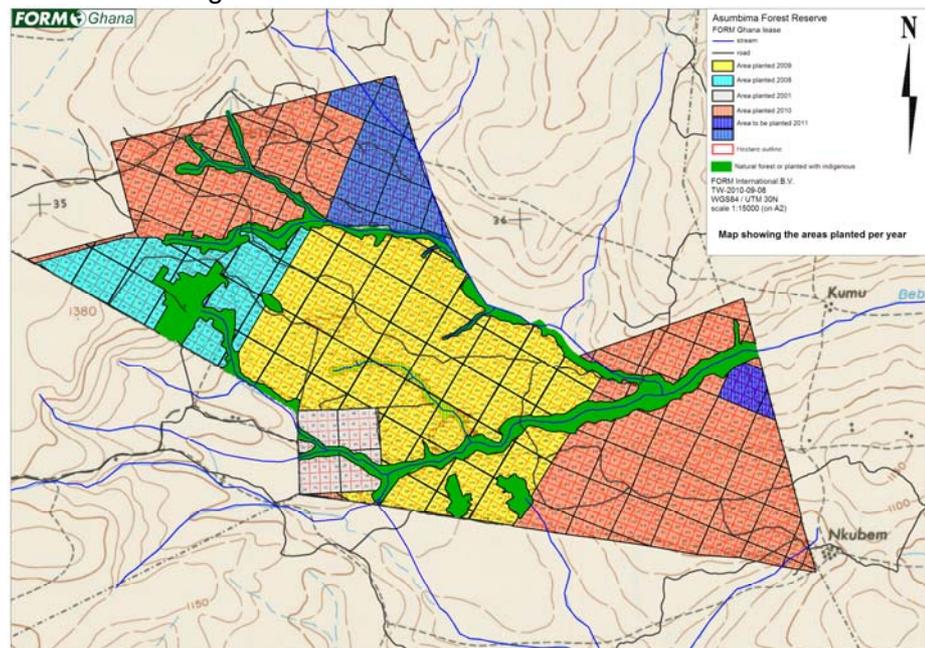
The system is set up in a hierarchical manner to assure that the information collected provides information on the management goals. The hierarchy of the information is shown in the table above.

## 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 the hierarchical table in chapter 2 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.

### 2.1.1 Extent and condition of the forest

Up until the end of 2010 a total of 1,566.4 hectares has been taken under the management of FORM Ghana.



These areas are distributed as follows:

Planting year	Area (ha)	Species
2001	56,40	Teak
2008	135,70	Teak
2009	516,00	Teak
2010	636,20	Teak
2008 - 2010	222,10	Indigenous trees

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Total	1566,40
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From the map and the table it becomes clear how the plantation of FORM Ghana is evolving. The planting speed has increased significantly.

### 2.1.2 Biological diversity

The monitoring of biological diversity has started with the research carried out within the scope of the Social and Environmental Impact Assessment. Because the activities done for that study proved difficult to replicate, a new method based on birds, frogs and vegetation in the buffer zones was initiated in 2010. The results of this study are reported in a specific report available on the FORM Ghana Website ([www.formghana.com](http://www.formghana.com)).

The main findings from this first assessment of biodiversity values are presented here below:

A total of 133 plant species has been found in the 21 vegetation plots established in the buffer vegetation. These species belong to 40 different families and represent trees, shrubs, lianas as well as herbs. The most common species are two invasive species called York (*Broussonetia papyrifera*) and Acheampong (*Chromolaena odorata*). The high presence of these species is indicative of severe degradation (by fire) of the vegetation in the area. The most common indigenous tree species is Kyenkyen (*Antiaris toxicaria*).

Eighteen frog and two toad species were found in Asubima Forest Reserve in November 2010. Of these species almost all were typical of open grassland vegetation, while only one species was typical of forest vegetation.

In total 77 species of bird were encountered in Asubima Forest Reserve. These species belong to 30 different families. Nearly all of these species are typical for savannah vegetation or open woodlands. Five bird species found are indicated as uncommon, thinly distributed or endangered. Those species are; the Bearded barbet (*Lybius dubius IUCN LC*), Black Faced fire finch (*Lagonosticta larvata IUCN LC*), Gambaga Flycatcher (*Muscicapa gambagae IUCN LC*), Ibadan Malimbe (*Malimbus ibadanensis IUCN En*) and Togo Paradise Wydah (*Vidua togoensis IUCN LC*).

From these data it becomes clear that species composition in Asubima is more representative for a savannah than for closed forest. With the restoration of the buffer vegetation along the water courses it is hoped this situation will change to a species composition representative for both high forest as well as savannah / teak forest. Through regular annual monitoring data will be collected to follow this development and to eventually change tactics if for example the vegetation in the buffer zones does not change.

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### 2.1.3 Forest health

Analyses of forest health as well as soil erosion are based on measurements taken in the plantation. These measurements are taken in permanent sample plots (PSP), which are established in every compartment. 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 to contain at least 20 trees. After each thinning the tree spacing changes, therefore the plot size is variable. A plot will have a size of 200, 250, 400 or 500 m<sup>2</sup>. These sizes are chosen for calculation purposes because they are easy to convert to a hectare.

Spread over the plantation a network of circular permanent sample plots will be laid out randomly. The plots will attain a cumulative surface of at least 0.2% of the plantation.

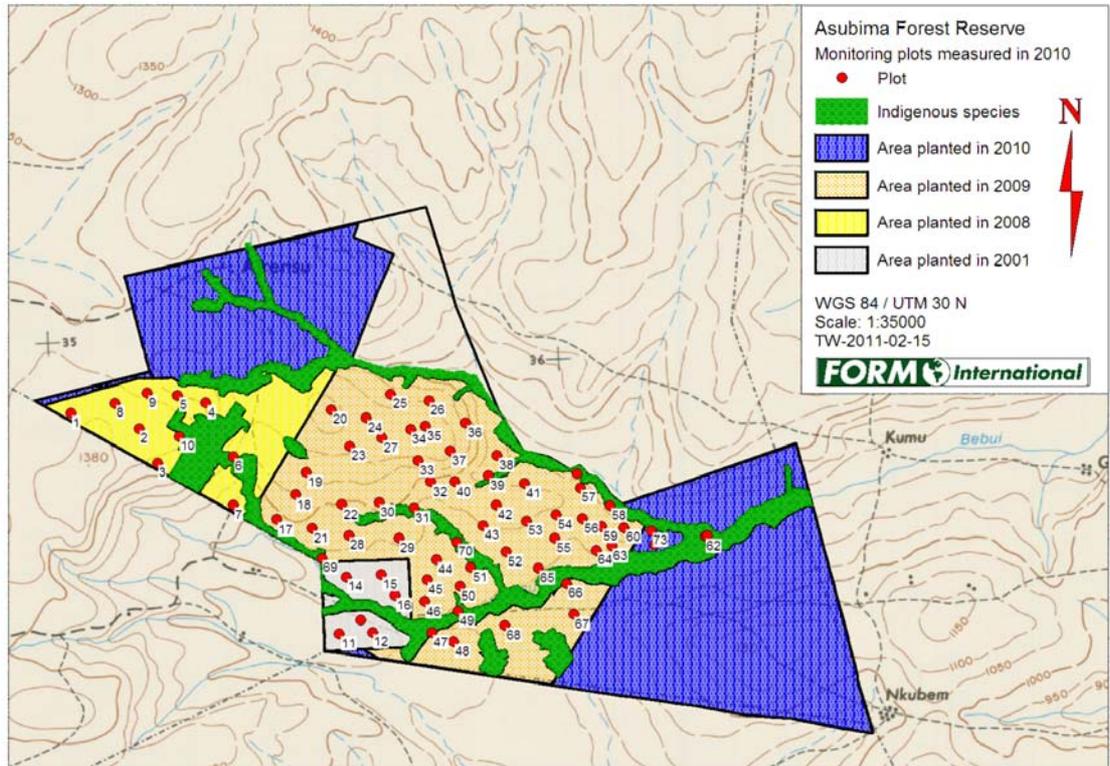
For other commercial species similar activities will be conducted, but the density of the plots will depend on the total surface planted per species.

The plots for the monitoring in February 2010 were spread over the plantation as shown in the map below:

Annually, height and DBH (diameter at breast height) of the trees in the plots as well as overall health of the plantation will be measured / assessed.

The measurements to be taken in these plots are:

- Date of measurement
- Tree girth: The circumference of each tree is measured **at breast height** with measurement tape.
- Height: The height of all trees is measured as accurately as possible with a clinometer 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.



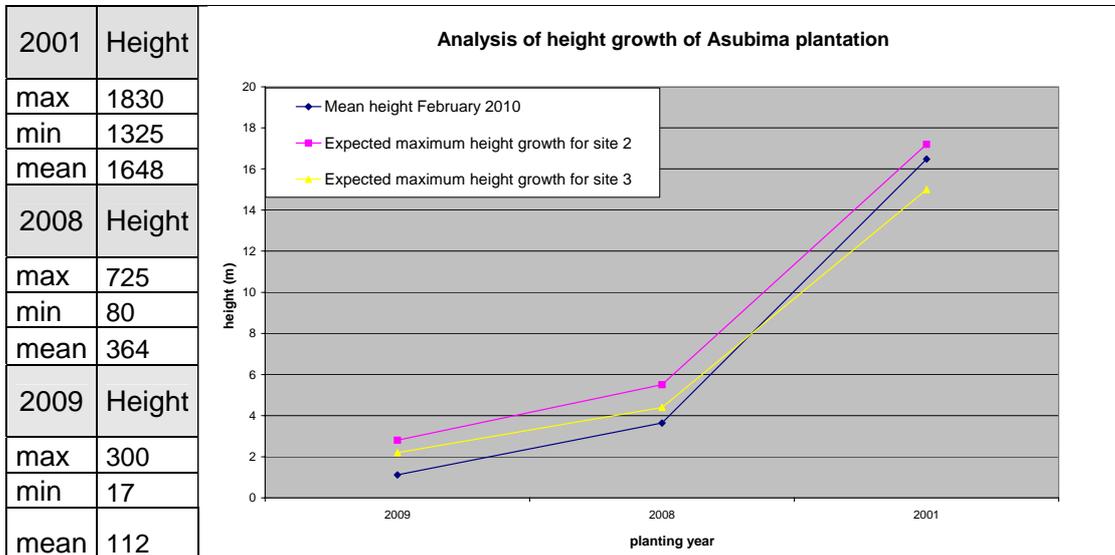
The data from these plots are entered in an Excel sheet.

A summary (per year) of the results from of this monitoring activity are presented below:

Plant year	species	Erosion	Health	size	radius	# trees	Av. Height	Av. Diam.	Trees/ha.
2001	Teak	None	Good	242	8,6	18	1364	14,7	791
2008	teak	None	Good	230	8,2	20	201	2,1	920
2009	Teak	None	Good	220	8,3	19	58	0,5	867

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.

In the little table next to the graph the maximum and minimum height are also presented.



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  $17 \text{ m}^3 / \text{ha} / \text{yr}$ . The worse performing parts are growing at a speed of  $10 \text{ m}^3 / \text{ha} / \text{yr}$ .

### 2.1.4 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 stimulated undergrowth.

In the permanent sample plots erosion is checked every time the plot is measured. In February 2010 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.

### 2.1.5 Water protection

An effort is made to restore the riparian forest. As this forest is now degraded the filtering and protection function of this forest is no longer optimal.

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In the table and on the map in paragraph 2.1.3 it is visible that the area managed as natural forest or buffer zone is now increased to about 222 hectares.

During the social and environmental impact assessment water samples were taken and analysed. These samples 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 is expected to change quickly.

According to our plans water will be analysed again in 2012 to be compared with the original data. Measurements are carried out by a specialist.

Water quality parameters that are measured are:

- pH, Turbidity (NTU)
- Dissolved Oxygen/(m/l)
- Conductivity ( $\mu\text{s/cm}$ )
- Nitrate (m/l)

Among the other measures undertaken to maintain water quality, are the upgrading of the old log bridges by replacing them with permanent concrete structures and the change of the road drainage to stop the runoff from going into the streams.

### *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 thinning and final felling and the realised volumes. Data for all species and quantities are gathered and analysed.

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 2010 a light thinning of misshapen trees has taken place and in 2011 a catch-up thinning will take place to reduce the stem density to about 450 - 550 trees per hectare in the higher growth areas. This way the shock of the thinning is not too big at once. The total volume harvested was about 30 m<sup>3</sup> in small logs (800 pieces).

In 2011 a catch-up thinning will be performed to further lower the tree density to between 450 and 550 stems per hectare. It is expected that the 2011 thinning will yield some 30m<sup>3</sup> of logs per hectare (so 1.692 m<sup>3</sup> of logs).

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## 2.2 Economic aspects

This year only investment has taken place. No sales of timber have been done.

### 2.2.1 *Social benefits*

The company has continued to improve the working conditions for the staff. This has resulted in the acquisition and adaptation of more trucks and trailers for the transport of personnel.

FORM Ghana has signed an agreement with the national Health Insurance Company of Ghana, insuring all permanent workers of free access to medical care.

The number of people in permanent employment has risen from 96 to 127 in 2010.

The number of people finding casual employment was 300 in 2010

FORM Ghana has contracted a professional nurse to assist 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 2010 medical treatment has been issues 1019 times. 119 times it was for injuries sustained while working, the rest was for diseases.

The workers 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 and monitoring.

FORM Ghana has signed an intercropping agreement for 2010 with 468 people.

The land lease was formally signed by the end of 2009. At the signature of the lease all dues have been paid. In total this means that 15399 cedis have been paid as land rent which is shared between the local landowners and the ministry of forestry.

The local population and other interested parties have been kept up to date through the organisation of stakeholder meetings at the nursery (3 times), the FORM Ghana website has been kept up to date and has been improved.

FORM Ghana has received the Ashanti Gold Award in the category best forestry company, which is great compliment to the efforts that have been put in to the creation of the company and the plantation.

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## 2.3 Conclusions

From the information provided it is clear that the planting of Asubima has gone quicker than initially planned and that nearly all of the terrain allocated to FORM Ghana has been planted. The area under natural vegetation or indigenous plantation has grown to 222 hectares

Monitoring results for biodiversity show that the vegetation in the buffer zones is quite severely degraded. The animal species found reflect this impression as they are more typical of savannah vegetation than of a forest environment.

The company has also put an enormous effort in improving the conditions for the workforce and in improving the relations with the local population.

The plantation is not growing completely as was expected. Some of the plots fall in an area that grows much better than was expected, but deviations for the worse are also happening.