



Project:  
**GEOCARBON**

Project full title:  
***Operational Global Carbon Observing System***

European Commission - FP7  
Collaborative Project (large scale integrating project) - for specific  
cooperation actions (SICA) dedicated to international cooperation partner countries  
Grant agreement no.: **283080**

**Del. no: 15.7**

**Deliverable name: Biomass estimates from selected plots in the Congo Basin**

Version: 1

WP no: 15

Lead beneficiary: CBCS

Delivery date from Annex I (project month): 24

Actual delivery date (project month): 24

---

## **1. Introduction**

*1.1 Short summary* During this phase, we made field trips during which new plots (15) were made and remeasurements were made in other (41). In total, data were taken in 56 plots. A first synthesis of available data on the plots was made. This synthesis is based on 259 plots available in our network plots. We report aboveground biomass (AGB), Basal Area (BA), stem density, and wood mass density estimates from 259 sample plots (mean size, 1.2 ha) in intact closed-canopy tropical forests across 12 countries. Mean AGB is 398.0 Mg dry mass ha<sup>-1</sup> (95%CI, 14.5), substantially higher than Amazonian values, with the Congo basin and contiguous forest region attaining AGB values similar to Bornean forests, and significantly higher than east or west African forests (433 Mg dry mass ha<sup>-1</sup>).

*1.2 Rationale for this deliverable* Comparative studies of the above-ground biomass (AGB) of tropical forests exist for South America and Asia, but not for Africa. Thus some ostensibly simple questions remain unanswered: how much AGB does an average structurally intact African tropical forest store? Where in Africa is biomass lower or higher than the mean? What controls this spatial variation? How do African forest AGB values compare to those on other continents? Here we collate standardised AGB data from across tropical Africa to answer these broad questions. We are trying to provide a novel constraint on the regional long-term biomass carbon balance, as well as distributed biomass data for better understanding of African biomass carbon stocks. Our deliverable is to contribute to the objective 15.7 of the project.

### 1.3 Problems encountered and envisaged solutions

-

## 2 Full description

2.1 In total, 56 plots were done (Fig. 1). In all plots tree diameter was measured at 1.3 m along the stem from the ground, or away from stem deformities if non-cylindrical at 1.3 m, or above buttresses (Fig. 2), if present. All trees were identified and marked with the paint (Fig. 3). Each tree has a label and is georeferenced in the plots.

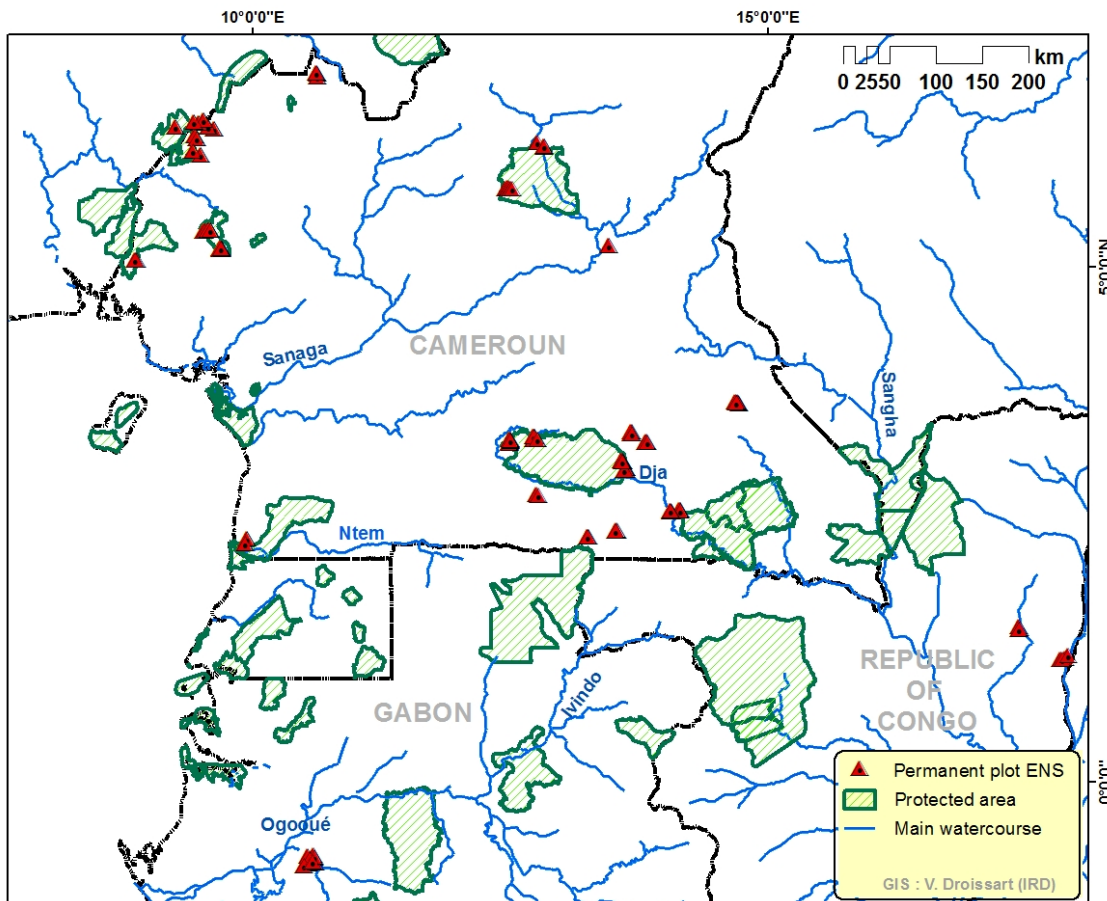


Fig. 1 Location of 56 plots



Fig. 2



Fig. 3

2.2 A first synthesis of available data on the plots was made. This synthesis is based on 259 plots available in our network plots. Differing forest types have different above-ground biomass (AGB) and other measures. Monodominant forests, dominated by *Gilbertiodendron dewevrei*, a common occurrence in central Africa ( $n=23$ ) have significantly higher AGB than non-*Gilbertiodendron* dominated forests (514.8 vs 386.6 Mg dry mass  $\text{ha}^{-1}$ ;  $p<0.001$ ), but not BA (32.2  $\text{m}^2$  vs 30.2  $\text{m}^2$ ). AGB is positively spatially autocorrelated over distances to  $\sim 700$  km, with similar values for BA ( $\sim 500$  km).

2.3 African tropical forests are characterised by relatively high AGB, at 398 Mg dry mass  $\text{ha}^{-1}$ , which in central Africa - the majority of the areal extent of African closed canopy forests - is higher at 433 Mg dry mass  $\text{ha}^{-1}$ , and statistically indistinguishable from the high AGB stocks of the forests of Borneo at 457 Mg dry mass  $\text{ha}^{-1}$ . These values are significantly higher than forest AGB reported from a synthesis across Amazonia at 289 Mg dry mass  $\text{ha}^{-1}$ . The results show that there is a broad high difference between high AGB paleotropical forest versus low AGB neotropical forest across

the tropics, which supports recent studies suggesting similar neo- vs paleo-tropical differences in stem allometry, basal area, and AGB based on much more limited African data. However, all such results should be treated cautiously because of a fundamental limitation: we are never measuring AGB directly, but are rather estimating it using imperfect allometric relationships. Improved future allometry plus improved sampling of tropical forests will refine future estimates. Additionally, care must be taken in extrapolating these to total biomass estimates because allocation patterns may vary.

### 3 References

#### **GeoCarbon publications of this deliverable**

Lewis S.L., Sonké B., Sunderland T., Begne S.K., Lopez-Gonzalez G., van der Heijden G.M.F., Phillips O.L., Affum-Baffoe K., Baker T.R., Banin L., Bastin J.-F., Beeckman H., Boeckx P., Bogaert J., De Canniere C., Chezeaux E., Clark C.J., Collins M., Djagbletey G., Djuikouo M.N.K., Droissart V., Doucet J.-L., Ewango C.E.N., Fauset S., Feldpausch T.R., Foli E.G., Gillet J.-F., Hamilton A.C., Harris D.J., Hart T.B., de Haulleville T., Hladik A., Hufkens K., Huygens D., Jeanmart P., Jeffery K.J., Kearsley E., Leal M.E., Lloyd J., Lovett J.C., Makana J.-R., Malhi Y., Marshall A.R., Ojo L., Peh K.S.H., Pickavance G., Poulsen J.R., Reitsma J.M., Sheil D., Simo M., Steppe K., Taedoumg H.E., Talbot J., Taplin J.R.D., Taylor D., Thomas S.C., Toirambe B., Verbeeck H., Vleminckx J., White L.J.T., Willcock S., Woell H. & Zemagho L., 2013. Aboveground biomass and structure of 260 African tropical forests. *Phil Trans R Soc B* 368: 20120295. <http://dx.doi.org/10.1098/rstb.2012.0295>