# ESTIMATIONS OF FOREST BIOMASS, CARBON POOLS DISTRIBUTION AND NET PRIMARY PRODUCTION OF A MOIST TROPICAL FOREST

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## INTRODUCTION

With increasing CO2 in the atmosphere, there is an urgent need of reliable biomass estimates and carbon pools in tropical forests, most especially in Africa where there is a serious lack of data. Information on net primary production (NPP) resulting from direct biomass field measurements is crucial in this context, to know how forest ecosystems will be affected by climate change and also to calibrate eddy covariance measurements.

## STUDY SITE

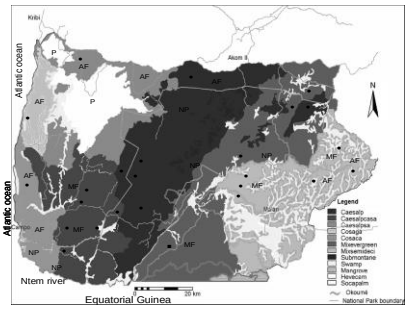


***Fig. 1.*** *Vegetation map of Campo-ma'an, 24 nested plots of 20 m × 250 m (●), one 100 m × 100 m plot (■) and different land uses (NP, MF, AF, P). NP: National Park; MF: Managed forests; AF: Agro forests, P: Industrial Plantations. For description of the different vegetation units, confer to text. (Source: Adapted Tchouto et al. 2009).*

## METHODS

- Biomass data were collected from 25 plots of 13 ha spread over the different vegetation types and land uses of a moist evergreen forest of 772 066 ha in Cameroon (Fig.1).
- 3 soil samples were collected at each layer (0 cm to 15 cm and 15 cm to 30 cm) with a cylinder of 5 cm of diameter and 5 cm of length. The collection was done 25 m from the centre of each plot.
- With site-specific allometric equations, we estimated biomass and aboveground and belowground carbon pools.
- We used GIS technology to develop a carbon biomass map of our study area (Fig 4).
- The NPP was estimated using the growth rates obtained from tree ring analysis.

***Fig. 2.*** *Picture of Terminalia Superba, a tree of our study site showing annual growth rings*.

## RESULTS

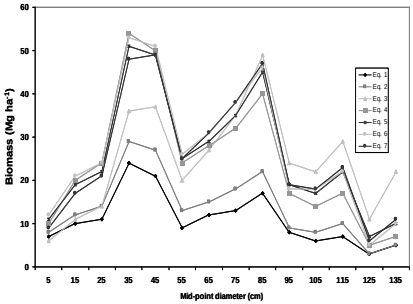


***Fig. 3.*** *Biomass distribution (Mg ha$^{-1}$) per diameter class using 7 different allometric equations.*

## RESULTS Contd..

***Table 1:*** *Carbon Net Primary Productivity (carbon uptake, kg ha$^{-1}$ year$^{-1}$) distribution in the various land uses and strata of Campo Ma'an forest.*

| Location | Agro forests | Managed forests | National Park | Average ecosystem |
|---|---|---|---|---|
| **1. Overstorey C uptake (Dbh ≥ 10 cm)** | | | | |
| Caesalpeasa | 2127±727 | 2232±771 | 2521±870 | 2293±782 |
| Cosaca | 2429±835 | - | - | 2429±835 |
| Caesalp | 2065±719 | 1556±540 | 2032±694 | 1958±667 |
| Mixevegreen | 1267±452 | - | 1581±546 | 1476±508 |
| Swamp forest | 1216±429 | 2386±821 | - | 1996±685 |
| Mixsemidec | 1159±414 | 1838±628 | - | 1668±570 |
| **Average C uptake** | **1852±631** | **2038±694** | **2041±695** | **1977±672** |
| **2. Understorey C uptake (5 ≤ Dbh < 10 cm)** | | | | |
| | **206±71** | **219±75** | **266±91** | **231±78** |
| **3. Belowground C uptake (fine and coarse roots)** | | | | |
| Caesalpeasa | 568±172 | 554±181 | 649±205 | 590±185 |
| Cosaca | 608±197 | - | - | 608±197 |
| Caesalp | 544±170 | 411±128 | 542±165 | 521±158 |
| Mixevegreen | 346±108 | - | 435±130 | 406±121 |
| Swamp forest | 322±102 | 657±196 | - | 545±163 |
| Mixsemidec | 307±98 | 470±148 | - | 429±135 |
| **Average Belowground C uptake** | **484±149** | **530±164** | **542±165** | **519±159** |
| **Total NPP** | **2542±652** | **2787±717** | **2849±720** | **2727±695** |

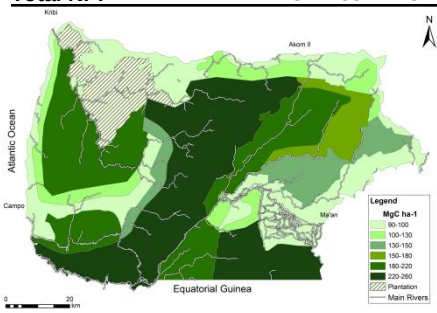


***Fig. 4.*** *Above and belowground carbon pools distribution in Campo-Ma'an (2009). The soil organic carbon (SOC) is measured up to 30 cm.*

## DISCUSSIONS

- Biomass, carbon and NPP estimations are always linked with uncertainties and it is important to consider and minimize them as much as possible.
- The potential sources of errors were: field measurements, environmental and physical factors, allometric equations selected and the log-transformation used, estimation of carbon content in woods. Our carbon biomass was estimated with an average error of 18% and NPP with 25%.

## CONCLUSION

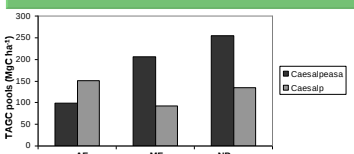


*Fig. 5. Total aboveground carbon pools (Mg ha$^{-1}$) in the three land uses (AF, MF, NP) and two vegetation types of Campo-Ma'an forest.*

Our NPP values do not include fine litterfall, carbon losses to consumers and emission of volatile organic compounds.
Our study provides not only appropriate estimate of biomass, carbon pools and NPP, but also an appropriate methodology to estimate these components and the related uncertainty.

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