



FACT SHEET

Project: Development of biomass estimation models for carbon monitoring in selected vegetation types of Tanzania

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Project description

The carbon benefits of any forest carbon project are estimated on the basis of changes of carbon stocks in different biomass pools and such changes may be determined through continuous forest inventories, possibly combined with growth estimates, and the use of models for biomass estimation, i.e. allometric biomass equations. At national and regional levels this requires, among others, good quality data from a detailed national forest inventory. At local levels simpler inventories may be sufficient. However, acquiring proper inventory data in general requires: the use of appropriate allometric biomass equations to estimate biomass/carbon for individual trees and plots/stands; objective inventory designs to yield reliable and sufficiently accurate estimates; and adequate resources for measuring and monitoring.

Tanzania has carried out its first National Forest Monitoring and Assessment (NAFORMA) which will provide data for the REDD process. The NAFORMA has specifically requested the Climate Change Impact, Adaptation and Mitigation (CCIAM) programme to include the development of biomass equations in its activities. In addition, Tanzania biomass equations are needed for a number of Norwegian Agency for Development Cooperation (Norad) supported REDD pilot projects that are being initiated and for general forest management planning.

Until recently, however, in Tanzania there were no appropriate allometric biomass equations developed for this purpose. Those that exist are deficient because they do not consider below ground biomass; are localized to limited sites; exclude small and/or bigger trees on equation development process; are developed from a limited number of samples trees; rarely take into account available information on wood specific gravity or are based on merchantable volume for the case of plantation forests.

The objective of the project is to develop equations and methods for assessing and monitoring carbon stocks in Tanzania required for implementing REDD at local and national levels. The project aims to cover all major forest vegetation types: miombo woodland, montane forests, lowland forests, acacia commiphora woodland, mangroves, thickets and plantation forests.

Description of the research

The study is carried out to cover selected miombo woodlands, montane forests, lowland forests and plantation forests. The miombo woodlands of eastern Tanzania regarding biomass equations will not be included as these have been covered in previous studies (Malimbwi *et al.*, 1994; Chamshama *et al.*, 2004). In this study miombo woodlands will cover Lindi, Rukwa, Tabora and Manyara regions. The regions with montane and lowland forests that will be considered are Tanga, Pwani, Morogoro, Iringa and Kagera. The plantations of softwoods, Eucalyptus and Teak will also be included. Specific sites will be selected to capture wide variations within the different vegetation types in Tanzania.

Both below ground and above ground (stem, crown) biomass equations will be developed through destructive sampling. Stem volume equations will also be developed. In each of the selected sites, 40 to 50 plots will be systematically distributed and conventional plot measurements (species and dbh for all trees and height for sample trees) to determine tree species compositions and stocking parameters for site descriptions will be done. For the destructive sampling, trees will be purposively sampled to cover different sizes and species. The development of growth models will involve the re-measurements of existing permanent sample plots (PSPs) from previous researches. The research will be implemented by researchers and postgraduate students recruited in the project as part of capacity building.

The following activities have been carried out to date:

- The project has recruited:
 - Three PhD students (Mr. Ernest Mauya- registered at UMB; and Mr. Abel Masota and Mr. Joseph Makero- both registered at SUA) while two PhD students are associated with and partly funded by the project (Mr. Wilson Mugasha through the Norwegian Quota Scheme registered at UMB and Mr. Marco Njana through another CCIAM-project and registered at SUA)
 - Four MSc students (Mr. Joachim Mshana, Mr. Emmanuel Mwasilu, Mr. Msalika Pastory and Mr. Juma Mwangi) fully sponsored by CCIAM programme; four MSc. Students (Mr. Edgar John, Mr. Haruna Luganga, Mr. Augustine Mathias and Mr. Humphrey E. Mlagalila) are associated with and partly funded by the project
- One MSc student (Mr. Mshana) has submitted a softbound dissertation for examination. The dissertation is on biomass equations for *Pinus patula* plantation forest
- A journal article on biomass equations in Miombo woodlands based on data from in Babati, Liwale, Tabora, Morogoro and Mpanda has been accepted for Forest Ecology and Management. Based on data from the same sites a journal article on volume equations is in the final stages.
- Data collection and analyses has been completed for developing biomass equations in montane and lowland forests. a journal article on biomass equations is in the final stages.
- Data collection has been completed for *Tectona grandis* plantations in Mtibwa and Longuza, acacia-commiphora woodlands in Kiteto, *Pinus patula* in Meru forest plantation and mangroves in Pangani, Bagamoyo, Rufiji, Lindi, and Mtwara.
- Data collection is in progress for thicket vegetation in Itigi
- Data collection has been completed for modelling and estimating forest biomass for Miombo woodland and montane forest using field inventory and airborne laser scanning
- The development of a research proposal for Cashewnuts (*Anacardium occidentale*) plantation in Lindi region and Acacia-commiphora in Same district has been finalized

Preliminary results

- Forest type specific and species group specific relationships between total tree height and diameter at breast height for natural forests in Tanzania have been developed
- Biomass equations have been developed for Miombo woodland for above ground, below ground and total tree. Evaluations of the equations indicate that they are applicable for most Miombo woodland in Tanzania
- Biomass equations have been developed for stem, branches and twigs, above ground, below ground and total tree for *Pinus patula* at Sao Hill
- Wood basic density, root to shoot ratio and biomass expansion factor (BEF) for *Pinus patula* for certain age classes at Sao Hill have been determined
- Biomass and carbon stocks for *Pinus patula* at Sao Hill for certain age classes have been determined

Preliminary recommendations

- The developed biomass equations for Miombo woodland has been accepted for publication in the Forest Ecology and Management Journal and we recommend stakeholders involved in estimating biomass and carbon stocks and carbon trading to start using the established equations
- The developed biomass equation for *Pinus patula* plantations may undergo minor changes since they are under review but we recommend stakeholders involved in estimating biomass and carbon stocks and carbon trading to start using the established equations
- Biomass equations will be developed for all main vegetation types in Tanzania and most of these are expected to be published in 2013 and 2014
- Work on volume equations, growth models, field inventory designs and airborne laser scanning inventories are in progress

References

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Existing Urls:

http://www.suanet.ac.tz/cciam/index.php?option=com_content&view=article&id=52&Itemid=63

(Conference Prodeeding)

http://www.umb.no/statisk/noragric/CCIAM/tron_eid_presentation_190912.pdf

(Presentation of summary of project)

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