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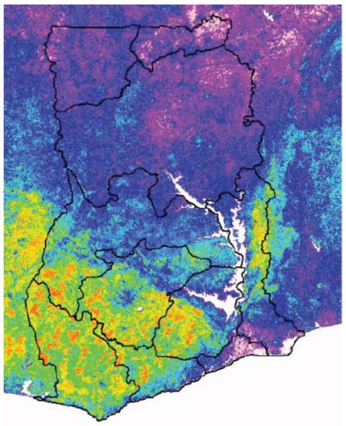

Biomass Map of Ghana

BACKGROUND

The outcome of negotiations in Cancun (COP 16) encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking REDD+ activities. While this progress strengthens the opportunity for many tropical nations to pursue carbon finance for ecosystem protection, it also presents the challenge of assessing national carbon stocks and monitoring change over time. To address this challenge, countries will need to identify the most precise and cost-effective methods for assessing and monitoring carbon stocks, and develop the necessary human capacity to undertake such efforts.

It was in light of these demands and challenges that the Ghana Carbon Map Project was initiated in December, 2009, as a joint initiative of the Katoomba Group's West Africa Incubator for Ecosystem Services, Nature Conservation Research Centre (NCRC), Oxford University, and Ghana's Forestry Commission. Technical support and guidance was also provided by the Jet Propulsion Laboratory at NASA. Financial support for the project was generously provided by the Gordon and Betty Moore Foundation. Additional support was also provided by the Rockefeller Foundation, the Global Environment Facility (GEF), and the Norwegian Agency for Development Cooperation (NORAD).

The map is available as pdf and jpg file at http://www.forest-trends.org/publications/ghanabiomassmap/pdf and http://www.forest-trends.org/publications/ghanabiomassmap/jpg.

THE NEED FOR "CARBON" MAPPING

The ability to estimate the distribution and total amount of carbon stored in woody biomass across the tropics poses tremendous challenges and is considered important for compensation mechanisms for Reducing Emissions from Deforestation and Forest Degradation (REDD) under the United Nations Framework Convention on Climate Change (UNFCCC). Hence, developing credible carbon or biomass[1] maps can help tropical nations meet these challenges and can provide a range of benefits to government agencies, project developers and research organizations. At the national level, carbon maps can improve reporting of carbon emissions and help identify areas where carbon stocks need to be conserved and/or enhanced; at the project level, carbon maps can provide a carbon stock baseline. This can help organizations to develop carbon offset projects and get carbon finance flowing to forest and farming communities. For research purposes, carbon maps can identify which land-use changes cause significant losses in biomass stocks and which systems are more effective at conserving carbon stocks. We therefore present the first state-of-the-art carbon map for Ghana (presented to government agencies and stakeholder organizations in February, 2011); one of only two such maps in all of Africa At its completion, two maps were constructed using 250 and 100 meter resolutions, with associated uncertainties of 3% and 5% respectively. The 250 meter map is presented with this overview.

[1] Biomass carbon stocks are roughly equal to half the total biomass.

FIELD MEASUREMENTS

Field measurements are an essential part of any effort to link carbon stocks in vegetation to satellite observations. Therefore, at the start of this process, we initiated an effort to collect existing field data from various researchers and institutions over a broad range of land use/land cover types in Ghana, which was complemented by targeted sampling at less researched geographical sites, particularly the northern regions of Ghana. This effort was facilitated by cooperative agreements with state agencies, research institutes and universities in Ghana and abroad. Approximately 150 “tie points” (data from individual sample plots) were used to validate the map.

SATELLITE MEASUREMENTS USEFUL FOR MAPPING

New approaches are critically needed to extend the role of field plots to capture regional variation and to bridge a major gap between field and satellite observations. One new approach is airborne light detection and ranging (LiDAR), which, when used with field calibration plots, is capable of estimating above-ground forest carbon densities (in units of Mg C ha−1). Combined with a strategic use of satellite data, airborne LiDAR may yield cost-effective, high-resolution maps of forest carbon stocks and emissions. This potential has had very limited application at large geographic scales that would be pertinent to an international REDD program. The carbon map of Ghana combined a range of satellite imagery, including radar from ALOS-PALSAR, optical imagery from MODIS, and Lidar estimates of canopy height from GLAS. This was calibrated with ground-based field measurements to arrive at a product with far-reaching and multiple applications in Ghana’s quest to mitigate climate change through forestry and agriculture.

APPLICATIONS OF THE CARBON MAP

The map will have extensive utility for a range of applications, not the least of which are the establishment of a baseline against which future stock changes (whether deforestation, degradation, or biomass enhancement) can be assessed, but also the basis for determining which regions or districts in Ghana have the greatest potential for preserving carbon and the extensive ecosystem services the nation’s forests provide. It also holds a potential, in combination with land-use modeling, in helping to establish a reference emissions baseline for REDD+ and related activities. The carbon stock map can also inform mechanisms for distributing incentive payments that account for carbon stocks, whether national or sub-national, thereby helping to ensure that effective, efficient, and equitable mechanisms are in place for reducing carbon emissions from deforestation and forest degradation. It is important to have a realistic understanding of uncertainty associated with the map: uncertainty is low at the national level, moderate at the project level, and high at the individual pixel level. Hence, the carbon map cannot give reliable estimates of biomass carbon stocks at a specific point, but can give useful estimates at the project or larger scales.

CONCLUSION

Basing REDD+ policies on a carbon stock mapping approach would have a number of benefits, not only in terms of improving estimates of carbon stored in forests for the emerging carbon markets by providing spatially explicit information on the location of carbon stocks, but also with respect to avoiding the ambiguities of land cover type classifications and uncertainties in assigning relatively few field measurements to large areas while assuming little spatial variability within those areas. Clearly, this is the first step. Efforts are underway to refine and improve on its limitations.

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