A first estimate of aboveground woody biomass in Africa using satellite imagery and forest inventories

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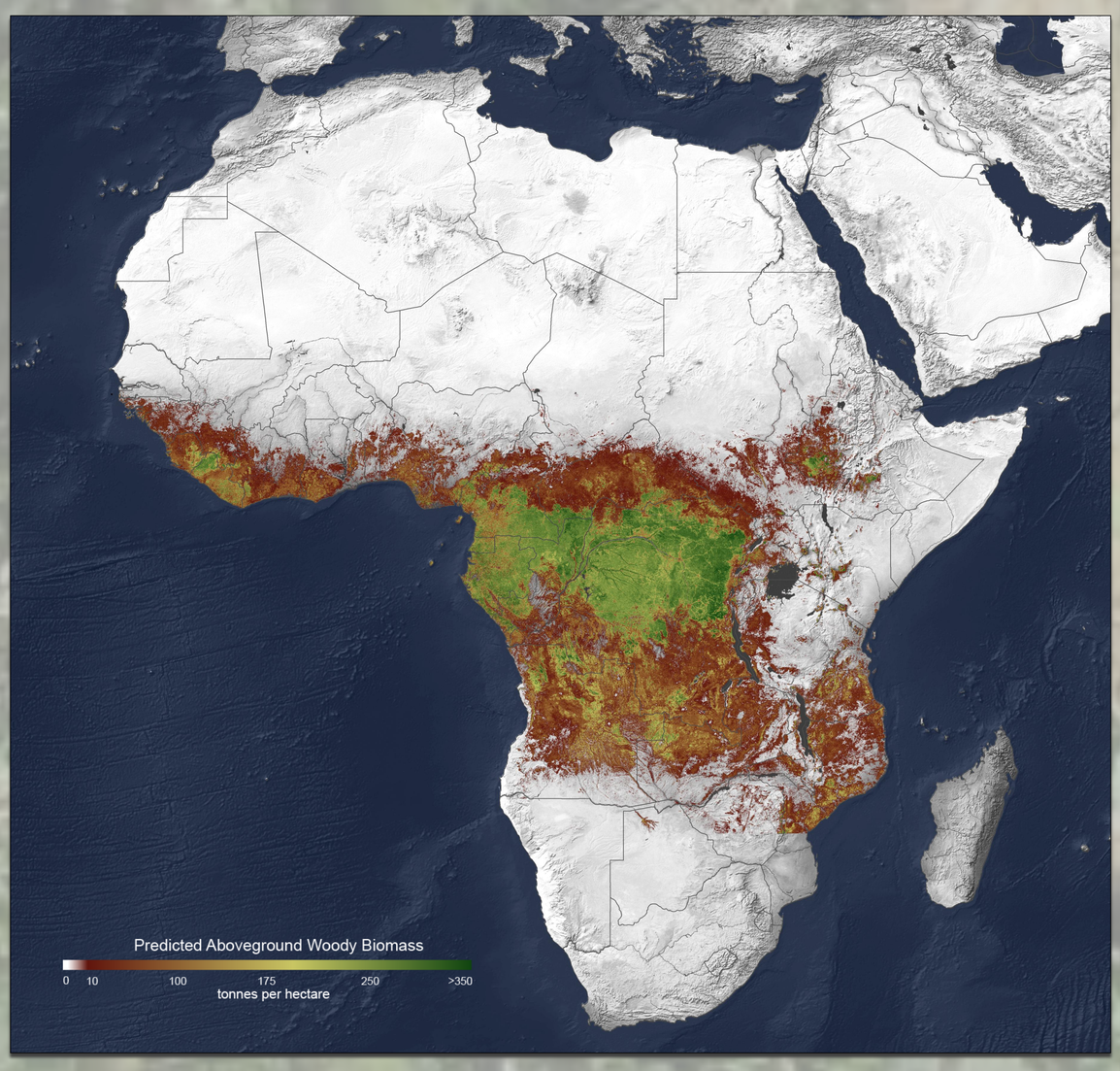
INTRODUCTION

Deforestation contributes about one fifth (~20%) of total annual anthropogenic CO_2 emissions to the atmosphere [*Houghton*, 2007]. Refining these estimates to reduce uncertainties requires improved knowledge of the density and spatial distribution of forest biomass and rates of changes. Utilizing a combination of observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite (1-km resolution) and forest inventories, we mapped aboveground woody biomass across tropical Africa for the year circa 2000.

METHODOLOGY

Biomass calibration datasets were derived from forest inventories carried out in Congo, Cameroon and Uganda for the time period 2000-2003. Allometric equations were used to convert trees measurements into aboveground biomass. The set of biomass training data was combined with MODIS observations to develop a regression tree model. Biomass predictions were then generated by applying the model for the entire tropics.



RESULTS

The model developed from the MODIS spectral reflectance proved to be effective for predicting aboveground biomass across the full range of biomass classes. The regression tree model explained 82% of the variance in aboveground biomass density, with a root mean square error (RMSE) of 50.5 t/ha. The predicted biomass, ranging from 0 to 356 t/ha, provides the first spatially explicit satellite imagery based carbon estimate across Africa (Baccini et al. 2008).

In an effort to make these data available for policy, science, and education, the national maps of aboveground biomass can be downloaded via our website at:

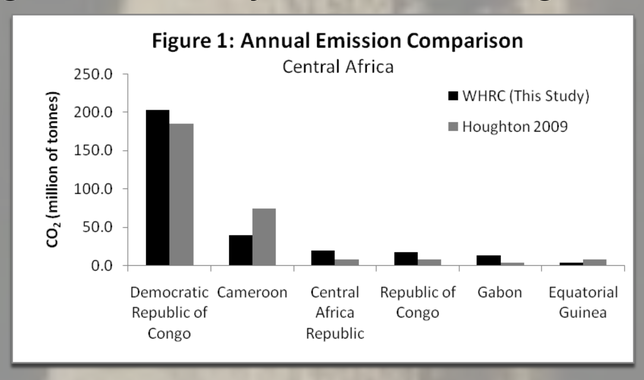
http://www.whrc.org/carbonmap2000

CONCLUSIONS

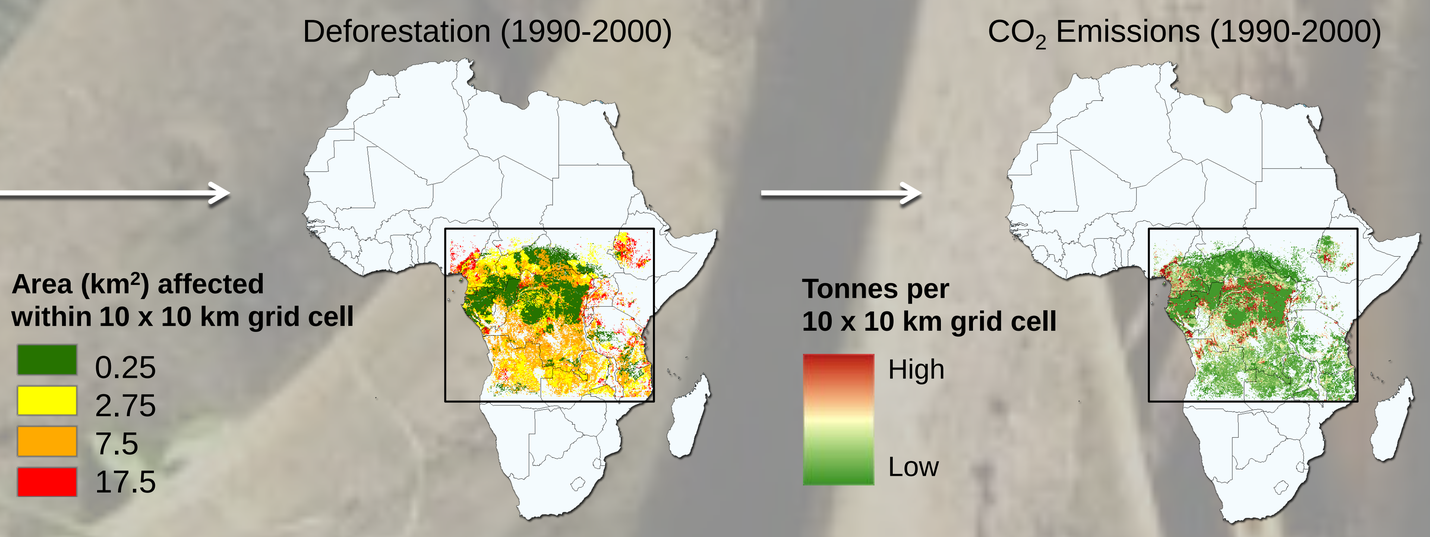
These results indicate that MODIS data, in combination with field measurements and used in a regression tree model, captured the amount and spatial distribution of aboveground biomass across tropical Africa and provide a step towards a better understanding of the density and distribution of forest biomass across the region.

FUTURE WORK

We are continually in the process of improving our biomass estimates by adding additional field plots throughout Africa and are soliciting/encouraging collaborations with research institutions and forest experts throughout the region. Currently, we are working to improve the resolution of the final data product using MODIS 500-m data and with 2.5-m SPOT satellite imagery for specific areas. Results from this approach can be found at http://www.planet-action.org.



In addition, by combining the biomass map with deforestation estimates, we estimated the distribution of CO_2 emissions throughout Central Africa for the 1990-2000 time period. A comparison of how our estimates compare with those of Houghton (2009) is shown in Fig.1.



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