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IJG> Vol.3 No.3, July 2012

OPEN ACCESS

## Terrestrial Ecosystem Carbon Fluxes Predicted from MODIS Satellite Data and Large-Scale Disturbance Modeling

PDF (Size: 1120KB) PP. 469-479 DOI: 10.4236/ijg.2012.33050

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### ABSTRACT

The CASA (Carnegie-Ames-Stanford) ecosystem model based on satellite greenness observations has been used to estimate monthly carbon fluxes in terrestrial ecosystems from 2000 to 2009. The CASA model was driven by NASA Moderate Resolution Imaging Spectroradiometer (MODIS) vegetation cover properties and large-scale (1-km resolution) disturbance events detected in biweekly time series data. This modeling framework has been implemented to estimate historical as well as current monthly patterns in plant carbon fixation, living biomass increments, and long-term decay of woody (slash) pools before, during, and after land cover disturbance events. Results showed that CASA model predictions closely followed the seasonal timing of Ameriflux tower measurements. At a global level, predicting net ecosystem production (NEP) flux for atmospheric CO<sub>2</sub> from 2000 through 2005 showed a roughly balanced terrestrial biosphere carbon cycle.

Beginning in 2006, global NEP fluxes became increasingly imbalanced, starting from -0.9 Pg C yr<sup>-1</sup> to the largest negative (total net terrestrial source) flux of -2.2 Pg C yr<sup>-1</sup> in 2009. In addition, the global sum of CO<sub>2</sub> emissions from forest disturbance and biomass burning for 2009 was predicted at 0.51 Pg C yr<sup>-1</sup>. These results demonstrate the potential to monitor and validate terrestrial carbon fluxes using NASA satellite data as inputs to ecosystem models.

### KEYWORDS

Carbon Flux; Deforestation; MODIS; Ecosystem Production

### Cite this paper

C. Potter, S. Klooster, V. Genovese, C. Hiatt, S. Boriah, V. Kumar, V. Mithal and A. Garg, "Terrestrial Ecosystem Carbon Fluxes Predicted from MODIS Satellite Data and Large-Scale Disturbance Modeling," *International Journal of Geosciences*, Vol. 3 No. 3, 2012, pp. 469-479. doi: 10.4236/ijg.2012.33050.

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