Geophysical Research Abstracts,
Vol. 11, EGU2009-5840, 2009
EGU General Assembly 2009

Net ecosystem exchange of two tropical ecosystems in Panama

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Land-use change, particularly in the tropics, has a significant impact on the global climate due to biophysical and biogeochemical feedbacks. With a changing climate, an improved understanding of changes in net primary productivity and carbon storage potentials of tropical ecosystems is needed. However, continuous measurements of ecosystem fluxes are sparse in tropical regions and only few localities exist in Central America.

Thus, our objective is to analyse the Net Ecosystem Exchange (NEE) of two tropical ecosystems in Sardinilla, Central Panama (9.3° N, 79.6° W, 70 m a.s.l.) and to assess their carbon storage potentials based on flux tower measurements using the eddy covariance method. Ecosystem CO_2 and H_2O fluxes of a native tree plantation (planted in 2001) and an adjacent, traditionally grazed pasture are measured continuously and simultaneously since June 2007.

Our results of nearly two years of continuous operation show clear seasonal and annual differences of NEE between a tropical pasture and a native tree plantation in Panama. Although midday photosynthetic activity of the pasture vegetation leads to high productivity of the dominating C_4 grasses, respiration losses exceed photosynthetic inputs and the pasture ecosystem is a carbon source on an annual scale. In contrast, our results indicate a clear carbon storage potential for the plantation ecosystem.

Since our measurements only provide an insight into the initial establishment phase of an improved afforestation project, it will be essential to investigate whether these differences already allow to estimate carbon sequestration potentials, or whether longer-term developments will reduce these differences of CO_2 uptake with increasing age of the plantation.