FLUXNET Agroecosystem Synthesis Paper Proposal

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Proposed title: Agricultural ecosystems as strong sinks for atmospheric CO_2: evidence from flux tower measurements

Rationale: Quantification of the role and significance of agricultural ecosystems in continental and global carbon budgets remains one of the most controversial problems of contemporary carbon cycle science. On the one hand, in the recent North American synthesis, the authors of the agricultural section (who made a decision not to use flux tower data) estimated the net annual CO_2 flux from agricultural lands as zero (Houghton, 2007; Conant et al. 2007). On the other hand, direct (and in a number of cases, really long-term: cf. Fig. 1) measurements of the ecosystem-scale CO_2 exchange of intensively managed agroecosystems in North America and Europe (Hollinger et al., 2005; Moureaux et al., 2006; Bernacchi et al., 2007) have clearly demonstrated the potential of agroecosystems (particularly, under conditions of irrigation and fertilization) to act as strong (often, strongest) CO_2 sinks in terrestrial biosphere, with gross primary productivity levels of more than 6000 g $CO_2/m^2/yr$ and net ecosystem production more than 2000 g $CO_2/m^2/yr$. At present, flux tower measurements are recognized as an adequate quantitative method of CO_2 exchange studies and were already used to quantify CO_2 sink activity in North American forests (Birdsey et al., 2007).

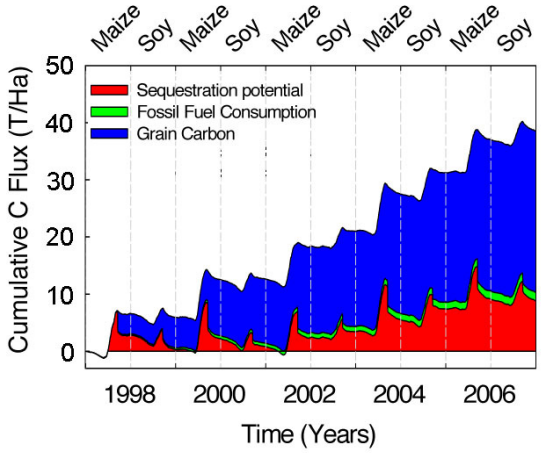

Fig. 1. Cumulative net ecosystem exchange of carbon over no-till maize-/soybean rotation crop in Illinois (modified after Bernacchi et al., 2007).

Our recent analysis of agroecosystem flux data from two dozens tower sites in North America and Europe performed using the light-response functions method (Gilmanov 2001; Gilmanov et al., 2003 a,b; Stoy et al., 2006) also indicated predominance of sink activity in sustainable agroecosystems (Gilmanov et al., 2007a,b).

While comprehensive review of the full cycle of production and utilization of agricultural products (including estimation of carbon/energy costs of fertilization, cultivation, irrigation, herbicide/pesticide, transportation, storage, processing and disposal) is currently recognized as an urgent task, particularly in the context of growing significance of biofuel energetics, the need for measurement-based estimate of the carbon budgets of agricultural fields *per se* remains a significant scientific and management problem in its own right, and the representative FLUXNET data set has to play a leading role in its solution.

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Co-authorship rules

The author list of the paper will include principal investigators of all sites used in the analysis and possibly other members of the research teams (recommended by the PI's) who made substantial contribution to the collection and analysis of the data sets.