Title of proposal: **High Frequency Measurements of CO_2 Efflux from Forest Soil**

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Total FY 2005-06 requested: $70,000 (equipment $0 travel $2540.00)

Project Abstract:

Estimates of net ecosystem exchange of carbon are being made in numerous forests around the globe using the eddy covariance technique. Considerable uncertainty persists about how well constrained these estimates are, however. Much of the uncertainty arises from two related aspects of soil respiration which we will address in this study, i.e. the causes of spatial and temporal variability. Reported changes in annual CO_2 exchange measured at Harvard Forest and other forested sites using eddy covariance, may have been the result of weather anomalies affecting soil respiration during times when the forest was under stress. Manual measurements of soil CO_2 efflux at Harvard Forest from 1995 through mid-2000 reveal significant interannual variation due primarily to changes in soil moisture and indicate that a long term effect on the direction of ecosystem CO_2 balance has not adequately been quantified. Soil respiration measurements within the tower footprint can capture episodes of changing CO_2 efflux that may account for some of the changes in net exchange if they are at high enough frequencies and are located in regions where this stress is most evident.

We are proposing to continue our pilot study of automatic chamber measurements of soil CO_2 exchange along a beaver pond to upland moisture gradient at the Harvard Forest Environmental Measurement Site (EMS).

Our measurements are intended to answer the following questions:

1) What are the controls on the diurnal and interannual variability of soil CO_2 efflux along a wetland to upland gradient?
2) Are the tower eddy covariance estimates of nighttime CO_2 fluxes accurate?

The principal product will be a multi year dataset of high frequency soil CO_2 efflux. The proposed measurements of fluxes, moisture and temperature will capture immediate responses to moisture changes in the soil, diurnal variation across the season and over a moisture gradient and the interannual variability not captured with a manual style campaign. Automated chamber flux systems also will provide an independent and simultaneous measurement of nocturnal CO_2 efflux, a means to quantitatively partition one component of the net efflux therefore providing a way to evaluate and constrain the eddy-flux measurements.