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A novel method for measuring trace gas fluxes from tall vegetation

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The nature of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) as greenhouse gases (GHGs) means that accurate measurement of their net ecosystem exchange (NEE) is extremely important to our ability to manage climate change. Manual static chambers are commonly used to measure soil fluxes of these trace gases, with landscape values extrapolated from point measurements of typically less than $1m^2$, at a weekly or monthly frequency. Moreover, due to the reliance upon manual sampling, data are typically biased towards day-time measurements, and use of opaque chambers halts photosynthesis. Automation of chambers, such as the Licor Li-8100 (Lincoln, NE) system, allows for measurement of soil respiration at a near-constant frequency, but does not solve the problem of measuring CH_4 and N_2O, neither does it allow measurements to be taken from over tall (more than 20 cm) vegetation. Eddy covariance (EC) techniques allow for high frequency measurements of CO_2 and CH_4 to be made at the landscape scale, and are increasingly available for N_2O. However, the inability of EC to resolve to the plot scale hinders its use for manipulative experiments, and replication is rare. Additionally, stratification of the boundary layer creates difficulty in measuring night-time fluxes and it is common to discard large parts of data sets due to unsuitable wind direction or other meteorological conditions. Here we present a new technique for measuring trace gas fluxes from over tall vegetation. The system is capable of simultaneously delivering NEE of CO_2, CH_4 and N_2O, automatically measuring at high temporal resolution (circa hourly) from replicated plots. We show the effect of green compost addition on trace gas fluxes from *Miscanthus x giganteus,* an important crop for bioenergy production. The ability to quantify NEE of GHGs from such crops forms an essential part of the lifecycle analysis of energy produced from biomass, which may play an important role in future mitigation of climate change.