LAND USE CHANGE AND RE-WETTING EFFECTS ON GHG EMISSIONS

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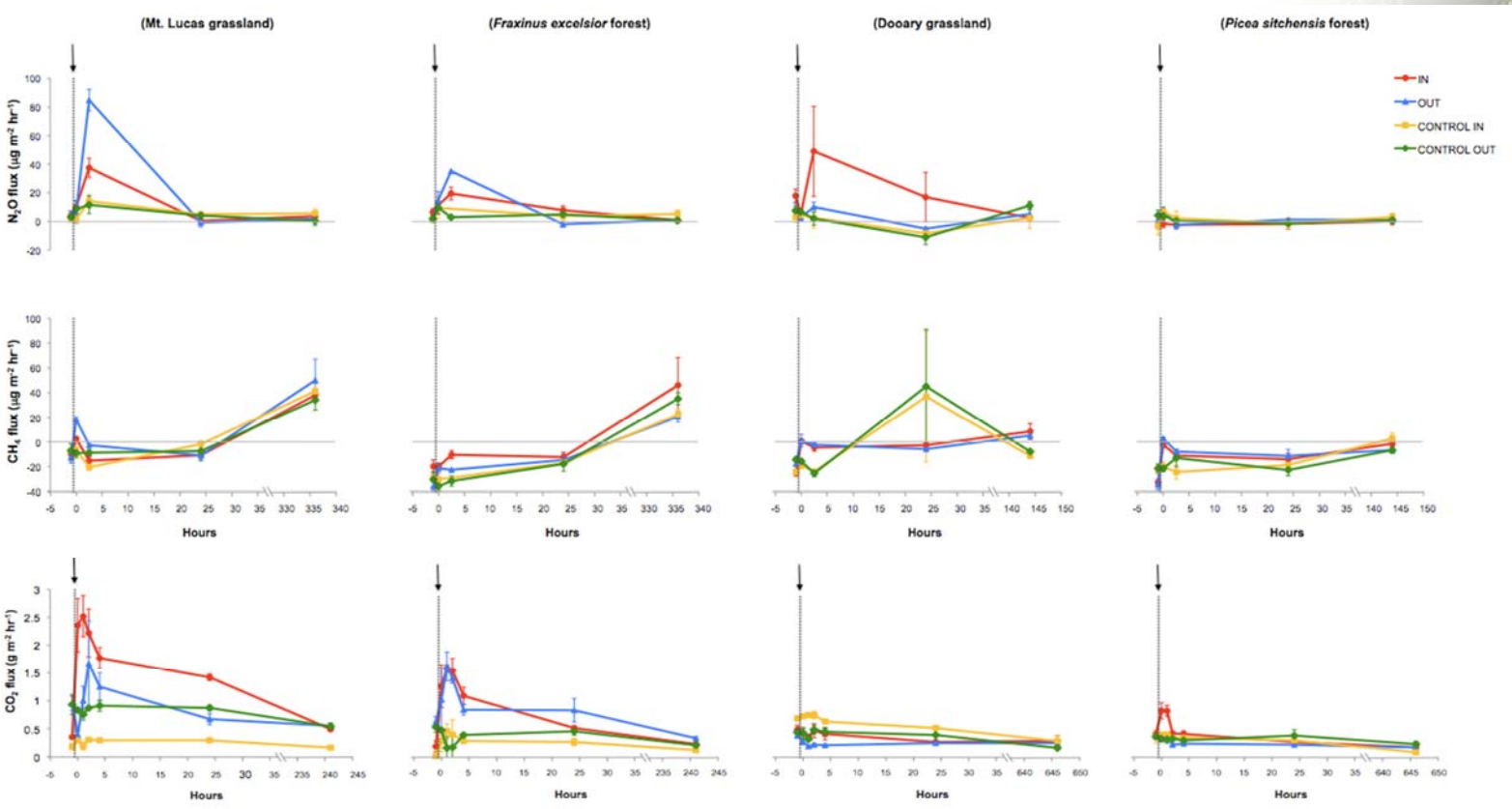
Future climate change projections indicate an increase in extreme weather events, with episodic droughts followed by periods of high rainfall. Earlier experiments indicated large and sustained emissions of carbon dioxide (CO_2) associated with such rewetting events that have been attributed to an increased decomposition rate, enhanced mineralization and release of inorganic N [1; 2]. Impacts on other greenhouse gases efflux, such as nitrous oxide (N_2O) and methane (CH_4), are, however, less clear. In the present study we investigated **the effect of long-term induced drought,** using field-deployed rain-out shelters, **followed by rewetting, on GHG emissions** from different forest ecosystems and associated grasslands (representing conditions prior to afforestation) in the Irish Midlands.

Figure 1: some of the sites under investigation. *Juncus effusus* dominated grassland (Dooary; 1A) and a 22 year old *Picea sitchensis* forest (1B) .

Figure 2: Effects of re-wetting on N_2O, CH_4 and CO_2 fluxes in different ecosystems (vertical bars represent the standard error; rewetting event indicated by arrow and dashed line).



The simulated summer drought and subsequent re-wetting experiment stimulated an increase in N_2O emissions from all sites with the exception of the 22 year old *Picea sitchensis* forest, while no effect of re-wetting was observed in CH_4 emissions from all sites. The increase in N_2O emissions in a single wetting event represented approximately **0.53 to 0.67% of the total annual N_2O budget** in the *Fraxinus excelsior* stand and grassland site respectively. The impact of re-wetting was much stronger in the grassland associated with the *Picea sitchensis* site where emissions increased from close to zero to approximately **786 µg N_2O m^{-2} d^{-1}** after the wetting event. In all ecosystems the observed increase in N_2O emissions lasted for the duration of one day. CO_2 emissions were higher in the *Fraxinus excelsior* stand and associated grassland site and the effect lasted for more than 10 days. **The impacts of extreme drying and re-wetting on individual GHG emissions are likely to be influenced by site, ecosystem and land use and will be dependent on the number of drying and re-wetting cycles under future climate scenarios.**

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[1] **Jarvis P, Rey A, Petsikos C et al. 2007.** *Tree Physiology* **27:** 929–940.

[2] **Fisher T. 2009.** *Soil Biology and Biochemistry* **41:** 1577–1579.