

The impacts of land use change on climate, data and model analysis

Supervisors

Main supervisor: Dr Joanna House (Geographical Sciences)

Co-supervisor: Professor Stephen Sitch (College of Life and Environmental Sciences)

Co-supervisor: Dr Andy Wiltshire (Terrestrial Carbon Cycle Group)

Project enquiries - Email: jo.house@bristol.ac.uk **Contact number:** +44 (0) 0117 33 17269

Host Institution: University of Bristol

Project description:

Land use and land cover changes (LULCC), such as deforestation, contribute around 10% of global anthropogenic CO₂ emissions, while approximately 30% of human emissions are sequestered in terrestrial systems, and thus act to mitigate climate change. Uncertainties in land fluxes are the largest in the global carbon budget (Le Quere et al., 2015). The uncertainty in the LULCC flux of around $\pm 50\%$ is due to data sources and to the inclusion of different components and processes among the various methods and approaches (Houghton et al., 2012). Improving estimates of LULCC emissions will enable a better constraint on the land carbon cycle within the carbon budget, and will provide a more robust evidence base for policy making.

The aim of this PhD is to elucidate the net land use flux, and to quantify component fluxes, including gross and net emissions from deforestation and forest management, legacy fluxes from past LULCC, and the relative attribution of land fluxes to anthropogenic LULCC versus environmental change. This will be done using the Joint UK Land Environment Simulator, JULES, the land surface model of the Met Office Hadley Centre. Results will be compared with other models and sources of data, e.g. forest statistics and remote sensing. Tropical South America and South East Asia are selected as two case study regions as these regions together account for over 60% of the contemporary emissions associated with LULCC. These are areas that have been data poor in the past but where increasing amounts of inventory and satellite data are becoming available. A better understanding the nature of land use and land cover changes in these regions and the timescales of ecological responses will directly lead to improved process representations in JULES. This will lead to more robust global emission estimates when JULES is run at the global scale.

This project will benefit from access to model protocols and results from an international multi-model synthesis activity under the umbrella of the Global Carbon Project, co-ordinated by the supervision team, and networking the candidate with many international partners. The candidate will have the opportunity to work direct with data providers and remote sensing experts on an internship in Brazil. The project will engage directly with the policy aspects, through the Met Office and through the supervisors' connections with the Government Office of Science and the Intergovernmental Panel on Climate Change (IPCC).

References

Le Quéré *et al.*, 2015, The global carbon budget 1959–2011, *Earth Syst. Sci. Data*, 7, 47-85, www.earth-syst-sci.data.

[net/5/165/2013/doi:10.5194/essd-5-165-2013](https://doi.org/10.5194/essd-5-165-2013)

Houghton R.A., House J.I., *et al.*, 2012, Carbon emissions from land use and land-cover change, *Biogeosciences*, 9, 5125-5142