



2014 PhD studentships

Department of Environment, Earth and Ecosystems

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Long-term impact of wildfire, deforestation and climate on pan-tropical ecosystems

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- **Make a vital contribution to climate-change science, feeding in to the next IPCC Assessment.**
- **Investigate the interplay of natural and anthropogenic change in Earth's most dynamic ecosystems.**
- **Research the connection between fire and climate with cutting-edge models and satellite data.**

Wildfire is a fundamental Earth System process, affecting most biogeochemical cycles, especially the carbon cycle, and all vegetated biomes. Fires are naturally rare in tropical forests, and tropical trees are generally killed by even low-intensity fires. However, fire in the tropics has increased markedly over the past few decades due mainly to human activity, with negative consequences for biodiversity conservation and emissions of greenhouse gases and aerosols. The Brazilian Amazon, Indonesia and central Africa are well-known examples. Carbon emissions from biomass burning are globally equivalent to about 20-30% of those from fossil fuels, and most fire emissions are caused by fire-driven deforestation in the tropics. The dependence of fire on climate is a particular concern given global warming. If climate change globally favours more intense fire regimes, this would result in yet more destruction of fire-sensitive tropical forests and emissions. The IPCC 5th Assessment Report predicts increased drought frequency in many ecosystems, including the tropics. Increased drought plus a forecast increase in population and land use pressures, imply there will be even more fires and emissions in future. The SPITFIRE (Spread and Intensity of Fires and Emissions) model is the most widely used fire model in DGVMs (Dynamic Global Vegetation Models), and has been applied at global and regional scales. SPITFIRE has been coupled to the LPJ-GUESS (Lund-Potsdam-Jena General Ecosystem Simulator) DGVM, which is predominately driven by climate and CO₂, and includes detailed eco-physiology, resource competition and representation of vegetation patch dynamics and canopy structure. Recent work with LPJ-GUESS-SPITFIRE has highlighted where the model performs well, plus some limitations due to poorly constrained parameters and missing processes.

The specific objectives of this project are:

1. Combine available Earth Observation (EO) and field data to test, constrain and improve LPJ-GUESS-SPITFIRE performance in tropical ecosystems.
2. Focus on how well the model simulates key components including vegetation cover and biomass, land use, fuel quantity and moisture, ignitions from human activity and lightning, fire spread, fire-induced vegetation mortality, and emissions from biomass burning.
3. Use the flexible range of components assessed to gain new insights by benchmarking the model and undertaking new studies.

The overall aim is an enhanced model that we can confidently use to forecast impacts of future climate and fire on tropical ecosystems, as well as emissions from tropical fires.

The Department has a thriving postgraduate community and the postgraduate training programme provides a full range of courses covering: research techniques, scientific methods, information technology, communication and interpersonal skills, which are tailored to the needs of each student. A successful applicant will become part of the international research environment and thriving postgraduate community within the department and the wider *Central England NERC Training Alliance* (CENTA). Comprehensive postgraduate training will be provided, including: research techniques, scientific methods, information technology, communication and interpersonal skills. Funding for this project is available on a competitive basis through the CENTA for further information visit www.centa.org.uk.

If you would like to apply or have any queries about this project please contact the first named supervisor either by email allan.spessa@open.ac.uk or by writing to the address above enclosing a brief letter of motivation, a full academic CV and the names and addresses of three academic referees.

References: Bowman D, Balch J, Artaxo P et al (2009). *Science* 324 (5926), 481-484. Pfeiffer M, Spessa A, Kaplan J (2013). *Geosci. Model Dev.* 6, 643-685. Thonicke K, Spessa A, Prentice C et al (2010). *Biogeosciences*. 7,1991-2011.

All information at:

<http://www.open.ac.uk/science/environment-earth-ecosystems/studentships-vacancies>