POSTER SESSION

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POSTER ABSTRACTS

Controls on the formation, transport and fate of charcoal from moorland wildfires

Gareth D CLAY
Geography, School of Environment, Education and Development, University of Manchester, Oxford Road, Manchester M13 9PL
Email: gareth.clay@manchester.ac.uk

During a wildfire event, above-ground living biomass is converted into a mixture of smoke, ash, unburnt vegetation and charcoal. This charcoal, enriched in carbon, can form a large part of the post-fire landscape. It is relatively simple to estimate the amount of charcoal present after a fire, but controls on the amount of charcoal actually produced are less straightforward. Furthermore, once the charcoal is created in the fire, the properties of the charcoal itself (density, porosity) will determine how it may be transported from a site and its ultimate fate within the environment.
This study first reports a range of experimental results looking at controls (eg fire temperature) on the formation of charcoal in moorland fires. Secondly, it reports on some properties of the charcoal that affect its transport after a fire ie density and porosity. Finally, it discusses how these properties may influence the charcoal's fate in the environment, and how it plays a role in the carbon budgets of wildfire events.

Assessing prescribed burning performance over a 25 year period: a case-study.

Pierre DENELLE, Katherine A ALLEN, Francisco M SÁNCHEZ RUIZ and Rob H MARRS
School of Environmental Sciences, University of Liverpool, Liverpool L69 3GP
Tel: +44 (0) 151 795 5172
Email: calluna@liv.ac.uk

Prescribed burning is a management practiced on many upland moors, primarily for sheep and red grouse production. This practice should be carried out in line with good practice guidelines, essentially providing a patchwork mosaic of small burns, implemented between October and mid-April. Normally, around 10% of a moor is burned in any one year. There is some concern from conservation policy-makers that when these burns are being carried out there is the potential for "escape fires", ie which get out of control and extend beyond their expected size (1500-2000 m^2) and hence form a wildfire.
Here we investigate the history of prescribed burning practice on a single moor between ca 1988 to 2010 using a combination of aerial photography and estate management records. We show that, for the most part, prescribed burning is in line with good-practice guidelines and we estimate the probability of producing a large fire.

Measuring vegetation canopy moisture content with dual-wavelength terrestrial laser scanning

F.M. DANSON[1], R. GAULTON[2], S. HANCOCK[1], & L.A. WALKER[2]
1. School of Environment and Life Sciences, University of Salford, Salford M5 4WT, UK
   Email: f.m.danson@salford.ac.uk
2. School of Civil Engineering and Geosciences, Newcastle University, UK
   Email: rachel.gaulton@newcastle.ac.uk

Vegetation moisture content is an important indicator of vegetation drought stress, tree and crop disease and wildfire risk (fuel moisture content). Moisture content can be measured using physiological approaches at the leaf level, though this is error-prone, difficult, and time-consuming given the spatial and temporal heterogeneity of canopy water content. Existing remote sensing techniques, such as estimation from satellite images, have limited ability to separate the influence of the canopy on the recorded signal from that of soil or understorey vegetation and are significantly influenced by the structure of the plant canopy. This paper describes a new method with potential to produce a three-dimensional record of leaf moisture content at canopy scales, using a novel, dual-wavelength terrestrial laser scanner. The Salford Advanced Laser Canopy Analyser (SALCA) makes active measurements of reflectance at two wavelengths (1063 nm and 1545 nm) providing information on the range to targets, as well as their reflectance properties. The system was designed to provide improved measurements of Leaf Area Index by allowing separation of laser returns from woody material and foliage. However, experimental results at a single-leaf scale have demonstrated the system to be sensitive to the water content of leaves, with a strong relationship between leaf 'equivalent water thickness' and a normalised ratio of return intensity in the two wavelengths. This paper extends this work to the canopy scale to evaluate potential for canopy based estimation of water content.

The Geography of vegetation fires in Greater Manchester: adding value to Fire and Rescue Service incident data.

Richard DONLAN
School of Environment, Education and Development, University of Manchester, Manchester M13 9PL
Email: richard.donlan@postgrad.manchester.ac.uk

The instigation of the Incident Recording System (IRS) in April 2009 has raised the level of data collection for vegetation fires, but what can it tell us about their geography? The poster reports on work in progress to analyse the 'where, when, and what' of vegetation fires attended by Greater Manchester FRS (GMFRS).

The project aims to show how value can be added to existing datasets on vegetation fires, highlight limitations and make recommendations for improving data collection. Management Information System (MIS) data is used to highlight relative distribution of vegetation prior to IRS and the first financial year 2009/10 of Incident Recording System (IRS) data will be used for fires within the GMFRS area. This will be compared against fires attended by GMFRS in neighbouring FRS areas, using data from GMFRS's management information system.

Vegetation fire incidents of various size classes will be analysed to show how the geography changes depending on how 'wildfire' is defined. Fire locations will be overlaid on with CORINE land cover maps to provide a breakdown by land cover type. The timing of incidents annually and seasonally will be studied and the location of these incidents in relation to the urban and rural environments.

Development of a mobile app for fire prediction, detection and monitoring

Philip E FROST and Derick SWANEPOEL
Council for Scientific and Industrial Research (CSIR), Meraka Institute, South Africa
Email: pfrost@csir.co.za

Most fire managers and operational staff require real time active fire and fire danger information that is accessible on a mobile device since they spend limited time in the office. Online web viewers that provide information in the form of the Advanced Fire Information System (AFIS) have been developed, but the fire community made it clear that they require mobile applications that provide information relevant to the current location of the individual and their regions of interest, as well as ubiquitous access to vital fire information. The AFIS Mobile smart phone application provides 5 day fire danger forecasting, near real time fire detections, fire reports as well as other value-added services such as alerting, asset tracking and user-driven fire danger calculation to the users on their mobile device. The application was developed for iPhone and iPad, while the Android version is currently being completed. It is unique in that it is the only application of its kind that combines such a wide variety of satellite data with sophisticated fire detection and alerting systems, as well as tools that offer value to both large customers and individuals.

The effect of drought on fire severity in heather moorland prescribed burning.

Roger GRAU-ANDRES[1], G Matt DAVIES[1]; Susan WALDRON[2] and Michael BRUCE[3]
[1] School of Interdisciplinary Studies, University of Glasgow, Dumfries DG14ZL, UK.
[2] School of Geographical and Earth Sciences, University of Glasgow, Glasgow G128QQ, UK.
[3] Firebreak Services Ltd., Glen Tanar Estate, Aboyne AB34 5EU, UK.
Email: r.grau-andres.1@research.gla.ac.uk

This study aims to investigate what changes in fire severity might occur under drought conditions, which are expected to become more common as a result of climate change, what ecological effects might follow in the ecosystem and whether, and in what ways, peat carbon dynamics are affected by those changes. "Drought shelters" are being used to simulate drought over small plots. Specifically, this study is looking at:

- Changes in fire severity between treated (rainfall deprived) and untreated plots under prescribed burning conditions.
- Differences in fuel layer responses to drought.
- Effect of altered fire severity on vegetation regeneration.
- Effect of altered fire severity on peat carbon dynamics (Dissolved Organic Carbon and CO_2 and CH_4 fluxes).

Preliminary results show a significant increase in peat heating and moss consumption in treated plots.
The study will produce useful information on whether or not peat carbon stores are at risk when prescribed burning is performed under drought conditions, as well as contributing to recommendations about where and when to burn to minimise carbon losses.

The International Wildfire Simulation Training Project: 3D serious game-based training and exercising of wildfire response professionals.

Philippe MERESSE[1], Eric TURPIN, et al[1]
Martijn BOOSMAN[2], Steven VAN CAMPEN, et al[2]
[1] ECASC Valabre, France
[2] E-Semble Delft, The Netherlands
Email: p.meresse@valabre.com

The French Wildfire School ECASC in Valabre has initiated the International Wildfire Training Simulation Project. The Project aims at improving proven 3D virtual reality training software to better support training and exercising of wildfire response professionals. A further key project objective is to exchange and share knowledge about simulation-based teaching methods between Partners. During the Project a state-of-the-art "Wildfire Behavior & Suppression" simulator will be developed which forms the basis for training and exercising in large scale 3D virtual environments in the XVR Simulation Platform. The Project is supported by Netherlands private company E-Semble. developers of the XVR Simulation Platform and current Project Partners include New South Wales Rural Fire Service (AUS) and GM and NOG Gelderland Fire Brigades (NLD). Other Partners are invited to join. For more information contact Project Leader Commandant Philippe Meresse.

rural development initiatives

Wildfire 2013
Vale of Glamorgan
22nd & 23rd October

Detecting moorland wildfire scars and their persistence in the landscape using Synthetic Aperture Radar (SAR); Peak District National Park*

Gail MILLIN-CHALABI[1, 2], Julia MCMORROW [2] and Clive AGNEW [2]
[1] Mimas, University of Manchester, Oxford Road, Manchester M13 9QH, UK
[2] School of Environment, Education and Development, University of Manchester, Manchester M13 9PL
Email: gail.millin-chalabi@manchester.ac.uk

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Synthetic Aperture Radar (SAR) images were evaluated for detecting the 18th April 2003 Bleaklow 7.4 km^2 wildfire burn scar. SAR's ability to penetrate cloud is a major advantage in this inherently cloudy area. In other parts of the world, SAR has been shown to provide burn scar boundary information, which is otherwise labour intensive to collect in the field using a Global Positioning System (GPS), and can provide information on vegetation recovery. This paper evaluates the potential of two properties of SAR images to detect a large peat moorland wildfire scar in the Peak District, northwest England: image brightness known as SAR *intensity*; and the degree of change between a pair of images at two dates, known as Interferometric SAR (InSAR) *coherence*.

A time-series of SAR images from the ERS-2 and ASAR sensors were pre-processed to produce geo-referenced greyscale images of intensity and coherence for pre-fire conditions, immediately post-fire and

up to two months later. A CORINE land cover class map and precipitation data were used to investigate how much weather and pre-fire land cover influence detectability.

SAR intensity images detected burnt peat well after a precipitation event; intensity (brightness) increased most inside the fire scar on areas where peat was already exposed (largely from previous fires). This combination of pre-fire land cover and precipitation is also a key factor in explaining changes in the InSAR coherence. Peat exposed from earlier fires had lower post-fire coherence than grassland and heather moor; the more change in image pairs was observed for peat (ie difference between a pair of images at time 1 and time 2 pair was greatest for peat). The peat bog class was therefore more responsive to the rainfall event in radar terms than vegetated classes. A smaller 0.1km2 fire on the Kinder Plateau at Grinsdbrook was examined using a higher resolution SAR sensor called PALSAR on the ALOS satellite, but was more difficult to detect.

Overall, SAR was effective for detecting the Bleaklow moorland wildfire burn scar and its persistence in a degraded peat landscape up to 71 days later, but less so for the smaller fire at Kinder. A heavy rainfall event following the fire – as commonly happens in UK moorlands – interacts with land cover in this degraded peat moorland to make the burn scar more detectable. This has important implications for being able to detect and measure the burned area of wildfires in degraded peat moorlands, and to monitor vegetation recovery, even in cloudy conditions.

Flammability properties of British moorlands and heathlands vegetation: models for predicting fire ignition and spread.

Victor M SANTANA, Rob H MARRS
School of Environmental Sciences, University of Liverpool, Liverpool L69 3GP
Tel: +44 (0) 151 795 5172
Email: vm.santana@ua.es

British heathlands and moorlands are predicted to experience an increase in severe summer drought and wildfire frequency over the next few decades. The development of fuel moisture models that incorporates the probability of fire occurrence is fundamental to develop fire-danger rating systems and predict fire outbreaks.

Here, we assessed the flammability properties of the fuel complex of British moorlands as a function of their moisture content under laboratory conditions. Specifically, we:

(1) Developed predictive models of the probability of fire ignition and spread in peat/litter fuel-beds.
(2) Measured flammability properties in terms of their ignitability, sustainability, consumability and combustibility.
(3) Measured the probability of ignition in *Calluna vulgaris* (heather) - as a function of its dead-fuel proportion.
(4) Measured the efficacy of standardized smouldering and flaming ignition sources in developing self-sustaining fires.

The flammability properties in peat/litter fuel-beds were influenced by fuel moisture content. There were small differences in moisture thresholds where fuels start to ignite into a flame (35-59%), however, the probability of fire spread varied across a much wider range (19-55%).

The probability of ignition in the upper *Calluna*-vegetation layer was influenced by both the proportion of dead fuels and their moisture content. Smouldering sources were more efficient in igniting peat/litter fuel-beds but not in the *Calluna*-vegetation layer.

This work can assist in improving the predictions of fire-rating systems implemented in British moorlands. They may provide better warnings of the critical periods when the different fuel beds drop in fire-prone moisture conditions.