# Wildfires 2015

The UK Wildfire Prevention Conference

## WILDFIRES: PREVENTION BETTER THAN CURE

# Presentation and Poster Abstracts

SFRS College, Cambuslang, Glasgow
10 & 11 November 2015

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**CHAIRMANS INTRODUCTION**

Welcome to the UK Wildfire 2015 conference, the fifth in a series of biannual wildfire conferences that have been held since 2007. The interest keeps on growing and I am confident that this is going to be the best conference in the series so far.

This year's conference title is Wildfires: Prevention Better Than Cure. We have managed to attract a wide range of interesting and challenging speakers and it has proved to be popular with exhibitors and delegates with record attendances of both.

Please enjoy this chance for all of us to share our knowledge and experience, to network and develop friendships with people from all the different and diverse interests involved in wildfire issues.

On behalf of the organising committee my thanks go to the Scottish Fire and Rescue Service for offering to hold the conference at their new training facilities at Cambuslang, to the sponsors and supporting organisations, to all the staff and volunteers who have worked so hard to make it all happen and most of all to you, the delegates.

Thank you for supporting this event and I look forwards to meeting you all.

Yours sincerely,

Michael Bruce
Chair
Conference Committee

## *Appendix A Posters*

## ‘WILDFIRE PREVENTION: THE ROLE OF THE COUNTRYSIDE RANGER’

Eric Baird, Head Ranger

Glen Tanar Charitable Trust Ranger Service, Braeloine Visitor Centre, Glen Tanar, Aboyne, Aberdeenshire, AB34 5EU

The presentation will examine the various roles of the Countryside Ranger in wildfire prevention, including: fire risk assessment, education, media liaison, and direct intervention with the public. A specific case study, from Glen Tanar Estate, Aberdeenshire/Cairngorms National Park, will be used giving examples of interventions and a range of common behavioural responses.

However, general principles will also be discussed to give broad relevance. The impact of policy/regulatory contexts will be considered, as will specific communication techniques. Site managers, and all those with a direct wildfire prevention role, can use this as a basis to discuss and develop effective strategies.

## NATIONAL OPERATIONAL GUIDANCE FOR WILDFIRES

Alex Bennett, Chief Fire Officer, Northumberland FRS (Project Executive)

Paul Hedley, Deputy Chief Fire Officer, Northumberland FRS
Andy Bowers, Assistant Chief Officer, Hampshire FRS
Simon Thorp, Director, The Heather Trust
Janet Guthrie, National Operational Guidance Programme
Robert Stacey, Project Officer, Northumberland FRS

The guidance project is supported by fire and rescue services and other organisations across the UK, including Scottish FRS, Northern Ireland FRS, South Wales FRS, Hampshire FRS, Dorset FRS, Northumberland FRS, the Forestry Commission, North Yorkshire FRS, Merseyside FRS and Lancashire FRS

Funded by the devolved administrations, government and UK fire services, the National Operational Guidance Programme is working with fire services and other experts across the country to deliver new online operational guidance that will be consistent, easily accessible and can be quickly revised and updated if necessary. In time, the work will deliver a one-stop shop of best practice operational policies and procedures for UK fire and rescue services that align with those of emergency service partners, can be easily tailored to local needs and form a solid foundation for local operational training and development.

Operational guidance for wildfires is currently being developed that will support fire and rescue services in identifying appropriate wildfire planning and preparedness. Taking forward the best practice contained in the Scottish Government's "Wildfire Operational Guidance", the new guidance centres around the development of control measures to mitigate the impact of fires and firefighting and will support future policy making in the subject.

The conference will be taking place during the consultation period for the draft guidance.

## THE ORGANISATION OF INITIAL ATTACK AND PREVENTION IN CALIFORNIA

Greg Bertelli, Battalion Chief, CAL FIRE (USA),

The Valley Fire (Northern California) started September 12th 2015. This occurred during a four year drought. Multiple major fires were currently happening in the region prior to the start of the Valley Fire. Fire Indices were at an all-time critical level. Resources were prepositioned throughout the State.

My presentation will look at the elements prior to and during this day. Fire Indices, Firewise Communities, Resources, Command Structure and common training. All of these elements played a role to help evacuate civilians while providing direction to fire fighting resources.

This is currently the 3rd most destructive wildfire in California's history. This quick moving fire has destroyed over 1,200 homes and has currently claimed four lives. In addition my helitack crew was overrun by this fire within the first half hour. Andy Elliott was with me that day and he will be assisting me during the presentation.

The details of that day ties in to the importance of fire prevention and how it can save homes but more importantly lives

# FIRE INTENSITY, THE THRESHOLD OF CONTROL AND FUELS MANAGEMENT.

Michael Bruce, Managing Director,

Firebreak Services Ltd, Glen Tanar, Aboyne, Aberdeenshire, AB34 5EU

As wildfires burn and spread they consume fuel and release heat energy, through radiation, convection and light, seen as flames. Fire intensity, measured in kilowatts per metre fireline, is the rate of heat released and is the product of the amount of fuels burned and the rate of fire spread. Fire intensity is difficult to measure in the field, so flame length is often used as an indicator of fire intensity.

Fire intensity is influenced by a variety of factors, known as the fire environment. These include the elements needed for a fire to exist: heat, fuel and oxygen (the fire triangle) as well as fuel characteristics, weather and topography. The type, quantity, continuity and condition of fuels have a major influence on ignition potential, spread and intensity of wildfires in the UK.

There is an upper limit on the ability of any tool, technique or tactic to break the fire triangle and suppress a wildfire. These suppression limits and the productivity of fire suppression are related to fire intensity. Fire-fighter safety considerations also create constraints. All of these issues combined create thresholds of control.

Risk assessment and mitigation includes the identification and elimination or avoidance of hazards and risks. While a variety of measures can be taken to reduce risks of the ignition of wildfires, a number of ignitions are likely to continue. Management interventions are therefore needed to control the hazards created by wildfires, through fuel load reduction and measures to break up the continuity of fuels in key parts of the landscape.

Fuel loads, through the growth in vegetation, are increasing with land use changes and land abandonment. Fuel load reduction is one of the few ways that fire hazards can be reduced and specific fuel load hazard interventions by fire and land managers may need to be considered.

Thresholds of control based on fire intensity can be used as parameters for safe working practises during fire suppression, in wildfire prevention, embedded in Fire Danger Rating Systems, and as guides for fuel management interventions. The relationships between fire intensity, thresholds of control and fuels management are examined, along with techniques of fire suppression

**Key Words**

Fire intensity, fire environment, threshold of control, fire suppression, fuels management.

## INSURANCE ASPECTS OF WOODLAND & MOORLAND FIRES

James Campbell, Account Executive,

Lycetts Insurance Brokers james.campbell@lycetts.co.uk

The presentation will look at the insurance of woodland and moorland against the fire risk including:

What insurance cover is available, including important exceptions?

What sum should be insured?

Fire fighting costs, including the use of helicopters

Public and Property Owners Liability implications – first and third party

Claims and the role of the Loss Adjuster

# MAPPING THE EXTENT AND TRENDS OF PRESCRIBED BURNING FOR GAME MANAGEMENT IN THE UK UPLANDS

David J.T. Douglas[a], Graeme M. Buchanan[a], Patrick Thompson[b], Arjun Amar[a1], Debbie A. Fielding[c], Steve M. Redpath[d] and Jeremy D. Wilson[a]

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In the UK, moorlands are routinely burned as management for game bird shooting and to a lesser extent for livestock grazing. There is little detailed information on the spatial extent or temporal trends in burning across the UK. This hinders formulation of policies for sustainable management, given that upland ecosystems are highly sensitive to the effects of burning. Using remotely sensed data, we mapped burning for game bird management across c45 000km2 of the UK. Burning occurred across 8551 1-km squares, a third of burned squares in Scotland and England were on peat ≥0.5m in depth, and the proportion of moorland burned within squares peaked at peat depths of 1-2m. Burning was detected within 55% of Special Areas of Conservation (SACs) and 63% of Special Protection Areas (SPAs) assessed, and the proportion of moorland burned was significantly higher inside sites than on comparable squares outside protected areas. The annual numbers of burns increased from 2001-2011 irrespective of peat depth.

**Keywords:**
Blanket bog, Calluna vulgaris, designated sites, heather moorland, peat land, red grouse

## WILD PURBECK NATURE IMPROVEMENT AREA – WILDFIRE MITIGATION

Andy Elliott, GIS Manager

Dorset County Council,

Wild Purbeck, on the UK south coast, is one of twelve Nature Improvement Areas in England chosen to test a new conservation approach, specifically including the projected effects of wildfire in planning for the environment. It is supported by several UK government agencies: Defra, DCLG, Environment Agency, Forestry Commission and Natural England.

A Wildfire Mitigation Plan was created in recognition that a landscape scale plan was required to help manage the increasing wildfire risk in the Purbeck area as a result of climate change and planned changes to the habitat. The Forestry Commission plan to return 194.7 hectares of coniferous plantation to lowland heath over the next 15 years. Within this same time frame the climate is expected to change to give hotter drier summers and wetter winters. Lowland heath is an extremely flammable habitat whereas, at present, mature coniferous plantations are not. It is therefore fair to assume that the wildfire risk will increase as a result of this habitat change unless a coordinated set of mitigation measures are put in place.

The mitigation plan follows a 'Civil Contingencies' approach to emergency management: anticipate, assess, prepare, prevent, respond and recover.

Anticipate – An already very successful Urban Heaths Partnership (UHP) will be extended to cover the Purbeck area. It will use its skills to monitor changes and to help coordinate all future work that might have an impact on wildfire management.

Assess – A variety of spatial and database techniques were used to assess the current risk, but it was agreed that a more robust system was required to assess the future risk. The project is working with Manchester University and the Forestry Commission to develop a Wildfire Threat Analysis that is appropriate for use in the UK. A research project is also being prepared to investigate the conditions required for wildfire ignitions, both accidental and deliberate, to be successful in UK vegetation types.

Prepare – Spatial analysis of the landscape is essential in helping to prepare for wildfires. Fuel, access, assets, water supplies etc. all had to be mapped. Wildfire response or 'Site Specific Risk Information' (SSRI) plans have been created for each of the key sites.

Prevent - The land managers and firefighters have formed a partnership to manage the fuel, access etc. to ensure that the impact of any wildfire is minimised. The UHP already delivers wildfire education and it is hoped that this will be extended into the Purbeck area. Firewise Safer Communities principles will be adopted throughout the area.

Respond – Land managers and firefighters have received training in wildfire management and have invested in improved equipment and PPE. The Forestry Commissions Incident Management System (IMS) has been developed to integrate with the Fire Service Incident Command System (ICS) to ensure the response is appropriate and seamlessly joined up.

Recover – The UHP uses a unique GIS recording system which greatly assists the recovery process. It is the only UK wildfire system that records the spatial extent of the incidents along with causes, habitat types, weather conditions etc.

By making use of good practice with sound risk assessment supported by research, the partnership is confident that it will continue to meet the stated aim of the project well into the future.

***Keywords:*** *fire severity, mitigation, Civil Contingencies, Firewise*

## RISICO: FIRE DANGER INDEX FOR THE MEDITERRANEAN ENVIRONMENT

Paolo Fiorucci, Project Leader

CIMA Research Foundation Paulo.fiorucci@cimafoundation.org

The RISICO system provides the Italian Civil Protection Department (DPC) with daily wildland fire risk forecast maps relevant to the whole national territory since 2003.

The core of RISICO consists of a module which is very similar to the FFMC of FWI, suitably resized and adapted to the vegetation cover of the Mediterranean. Given the characteristics of the Mediterranean vegetation, the only dynamic component of the system is represented by dead fuel moisture adapted to different types of vegetation cover. In the areas most frequently affected by fire, dead fuel moisture can go from saturation values, following precipitations, to values below 10% in less than 12 hours. For this reason, we thought that — starting from the first version of the system — feeding the system with weather forecasts, although subject to uncertainty, was the only way to provide useful information for the alert system. The ability to forecast the risk for the next 72 hours, with constant use of observations to correct the state of the system in real time thus reducing the uncertainty of the forecast, allows relocation of aircraft, on a national scale, from low risk areas to high risk areas, reducing the response time and optimizing the scarce resources available.

The application of RISICO over the whole Italian territory for the last 10 years shown that the system is characterized by good performances as regards its capabilities of correctly identifying areas with higher or lower risk and minimizing the number of false alarms. Specifically, RISICO is able to predict fire danger with a lower number of false alerts with respect to FWI. RISICO can be easily run automatically and accessed thanks to a web service with password-protected access at http://dewetra.cimafoundation.org.

The implementation of RISICO has been extended in the last years to Albania and Lebanon where every day it is provided a fire danger bulletin by the local civil defence.

The framework of RISICO allow the implementation of the model everywhere a meteorological model, a vegetation cover map and a DEM is available. Since 2014 an experimental implementation of RISICO is available both at European level and a Global level and it is currently daily operational.

From the operational point of view the implementations of RISICO at regional level are the most efficient in terms of fire risk reduction. In these cases (Liguria, Sardinia, Puglia) the fire danger bulletin is operationally used in order to organize preventive activities aimed to reduce the ignition causes, by patrolling and monitoring the high risk areas, and to support rapid intervention operations. In Liguria where the system is used since 2000 the number of fires has been reduced to hundreds of fires per year with respect to the thousands of fire of the ’80 and ’90, but most important even if the number of fires is quite constant, the burned areas are reducing year by year reaching their minimum value in the last years.

In this time, the discussion with the operational and institutional stakeholders is focused to the communication flow. This aspect has been identified has the most critical. Most of the worst fire risk scenarios originated by suddenly changes of the meteorological conditions in period out of the severe fire season when the fire fighting activities are not organized. In this case communication represents the main tools in order to reach both the operational stakeholders, the subject involved in ignition of fire by negligence and the people living in the wildland urban interface most subject to fire risk. This is main aspect where

# STAKEHOLDER PRIORITIES FOR MANAGING WILDFIRE RISK IN THE RURAL-URBAN INTERFACE: WIDENING THE CONSULTATION

Rob Gazzard
Adviser, Technical Guidance, Forestry Commission England

Julia McMorrow
Senior Lecturer in Remote Sensing, NERC Knowledge Exchange Fellow (Knowledge for Wildfire) The University of Manchester, School of Environment, Education and Development

Robert Stacey, Project Officer, Northumberland Fire and Rescue Service

Wildfires in Rural-Urban Interface (RUI) are small in size compared to those in Scotland and other UK moorlands, but their increased impacts require significant Fire and Rescue Services resource due to the life and property at risk in surrounding areas. A cross-sector workshop on wildfire in the RUI was held in Greenwich on 10th April 2015. The starting point was the 2011 'Swinley Forest' fire, but discussion extended to other RUI types. Sectors represented included research, Fire Services, emergency planning, spatial planning, forestry, conservation and other land management. Discussion was organised around three phases of response: prevention and preparedness, response, and recovery. Nine priorities for managing fire in the rural-urban interface were agreed at the workshop, three from each phase, and later revised to ten.

The aim of this paper is to widen consultation to other types of RUI, and to other sectors. We will briefly present the ten draft priorities. The dience will then be invited to suggest refinements or additions and to indicate their priorities*. The aim is to provide a mandate from the wildfire community on management priorities for RUI fires, which the England and Wales Wildfire Forum and the Scottish Wildfire Forum can use in discussions with government.

**Key Words:**

Stakeholder consultation; Rural-Urban-Interface, Fire and Rescue Service, Land Management, Emergency Planning, Forestry, Conservation.

## MOISTURE CODES OF THE CANADIAN FIRE WEATHER INDEX SYSTEM COULD BE USED TO FORECAST THE FLAMMABILITY OF KEY MOORLAND FUELS

Roger Grau[1], G. Matt Davies[2], Susan Waldron[1] & Colin Legg[3]

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The Canadian Fire Weather Index System (FWI) underlies the Met Office Fire Severity Index and uses daily weather data to model the fuel moisture content (FMC) of: litter and fine dead fuels (Fine Fuel Moisture Code, FFMC); loosely compacted, organic matter (Duff Moisture Code, DMC); and deep layers of compact organic matter such as peat (Drought Code, DC). There has been little research on how well these codes predict the FMC of U.K. fuels. We measured the FMC of peat, and live and dead heather moorland fuels in Scotland. Peat FMC was measured in a raised bog and a dry moorland. Live heather, dead heather, and moss and litter FMC were measured at six upland moorlands.

DC was a good predictor of peat FMC though but was more sensitive to changes in dry peatlands. FFMC performed tolerably for moss and litter but none of the codes captured changes in dead or live canopy fuels. Assuming conservative FMC ignition thresholds of 125% for peat and 70% for moss/litter, we recommend caution when DC exceeds 400, DMC exceeds 10 and FFMC exceeds 80 as ignition of these fuels is related to damaging and difficult-to-control fires.

Keywords: fuel moisture content, prescribed burning, Calluna vulgaris, peat, fire behaviour

## CHANGES IN MOORLAND MANAGEMENT AND IMPLICATIONS FOR ECOSYSTEM SERVICES

Dr Alistair Hamilton, Programme Director, SRUC

It is increasingly common for habitats or land uses in the UK to be valued not only in terms of their simple production or conservation value, but in terms of a much wider range of values. These ecosystem services encompass not only the relatively straightforward production costs and benefits, but also values connected with (for example) carbon sequestration or protection, water purification, flood risk, wildfire risk, and more social values such as amenity or landscape value.

In this paper, the possible impacts of moorland management (decreased grazing, decreased muirburn) are explored in the context of impacts on key ecosystem services. GIS modelling is used to explore such impacts on a local as well as a landscape scale.

## RECENT WILDFIRE PREVENTION ACTIVITIES CARRIED OUT BY THE SCOTTISH FIRE AND RESCUE SERVICE

Area Manager Scott Hay, Local Senior Officer for Highland

Scottish Fire and Rescue Service

Wildfire and the resultant outcomes can create many challenges for the Scottish Fire and Rescue Service (SFRS) and its partners across many areas of Scotland. Combined with the demands of accessing and managing incidents in remote and rural part of the country, there has never been a greater need to bring many of the key elements together to reduce and limit these types of incidents and the impact they have on the communities in Scotland.

An example of this was during 2012/13 where there was a significant increase in wildfires across Scotland. SFRS operational costs ran into a figure of approximately £250,000, with mobilisations of around 618 appliances and having 2500 fire fighters actively involved at various incidents.

With the ever increasing demand on resources as well as the impact on local communities, SFRS has been working very closely with our partner agencies and organisations through the re-energised Scottish Wildfire Forum (SWF). This close working has created a new strategic action plan focusing on prevention, protection and preparation.

This session highlights many of the key areas of partnership working to improve awareness, preparation and pre-planning as well as prevention and protection activities. These areas include:

- Wider Partnership Engagement and supporting the increase in Wildfire Groups
- Fire Danger Rating - Warning and Informing
- SFRS Thematic Action Plans
- SWF and Wildfire Scottish Users Group (WSUG)
- The Future Direction?

## DEVELOPMENT OF AN OPERATIONAL GLOBAL WILDFIRE INFORMATION SYSTEM - AFIS

P. E. Frost, CSIR Meraka Institute

A. Held, European Forest Institute

The Council for Scientific and Industrial Research (CSIR) in South Africa lead by the Meraka Institute developed the Advanced Fire Information System (AFIS) to provide near real time fire information to a variety of operational and science fire users including disaster managers, fire fighters, farmers and forest managers located across the globe.

The AFIS combines satellite data with ground based observations and statistics and distributes the information via mobile phone technology. The system was launched in 2004, and Eskom (South Africa' and Africa's largest power utility) quickly became the biggest user and today more than 300 Eskom line managers and support staff receive cell phone and email fire alert messages whenever a wildfire is close to a transmission lines.

The AFIS uses Earth observation satellites from NASA and Europe to detect possible actively burning fires and their fire radiative power (FRP). The polar orbiting MODIS, VIIRS and Firebird satellite sensors provide data at various intervals during the day and night, while the European Geostationary MSG satellite provides 15 minute updates at lower spatial resolution.

The AFIS processing system ingests the raw satellite data and within minutes of the satellite overpass generates fire location and FRP based fire intensity information. New functionalities include an incident report and permitting system that can be used to differentiate between prescribed burns and uncontrolled wild fires, and the provision of other information including 5-day fire danger forecasts, vegetation curing information and historical burned area maps.

A new AFIS mobile application for IOS and Android devices as well as a fire reporting tool are showcased that enable both the dissemination and alerting of fire information and enable user upload of geo tagged photographs and on the fly creation of fire reports for user defined areas of interest.

**Keywords**: Fire monitoring, AFIS, Fire Danger, VIIRS, MODIS Mobile app, forecasting

## GAMEKEEPERS, MUIRBURN AND WILDFIRES, THE PRACTITIONERS VIEW ON "GOOD" AND "BAD" FIRES

Iain Hepburn, Head Keeper

Dunmaglass Estate, Inverness, IV2 6UD

The presentation will look the various roles of the Gamekeeper in wildfire prevention, including: fire risk assessment, fuels management, skills development and training, maintenance of equipment, liaison between estates and direct intervention with the public.

Good Muirburn techniques will be illustrated using examples, along with "watchout" situations that can lead to wildfires. The way that Muirburn can be used to manage fuel loads, create firebreaks and develop higher level burning skills such as backburning that can be used to combat wildfires, will be discussed.

Land managers, will be able to use the ideas shown to discuss and develop effective fuel management and training strategies.

## WILDFIRE – WHAT IS THE LANDOWNER'S ROLE?
## - Estates assets at risk are Society's assets at risk.

Lord David Johnstone, Chairman,

Scottish Land and Estates (http://www.scottishlandandestates.co.uk), Stuart House, Eskmills Business Park, Musselburgh, East Lothian, EH21 7PB

The presentation will look at the role of landowners, working with neighbours and fire and rescue services to prevent and mitigate damage from wildfires to a wide variety of environmental, economic and social assets.

We will examine how landowners engage with neighbours, local communities, agencies and the fire and rescue services to assist education, engineering, enforcement and the administration of wildfire prevention activities.

We will look at positive work in the field along with challenges and opportunities for future work, including training, registers of assets, and communications.

## STUDY ON THE USE OF ULTRA HIGH PRESSURE FOGGING SYSTEMS TO APPLY6 WATER TO DEEP SEATED PEAT FIRES

Simon Land, Senior Design Engineer,

Primetech (UK) Ltd., 2 Travail Business Park, Normandy Way, Bodmin, Cornwall. PL31 1EU

The Cold Cut Systems, Cobra product has the ability to deliver 30 or 60 litres per minute at 280 bar and 30 or 60 litres per minute at 80 bar. This is classed as Ultra High Pressure (UHP) water. Both systems can be mounted on to medium sized 4x4 prime movers to allow fire fighters to tackle many different types of fire. Little has been done to establish the effectiveness of UHP water in tackling wild fires in remote areas.

This study was limited to the 30 litres per minute system at 280 and 80 bar which is fitted into a small pickup vehicle with limited water carrying capacity whilst still offering a reasonable amount of fire fighting time between tank fills. Both options were tested delivering water into deep peat systems to establish how far into the peat the water can be delivered,

Deep seated Peat fires can burn for long periods, smouldering at low burn levels within the peat where oxygen levels are at a minimum. The smouldering peat will occasionally burn close to the surface and flair where oxygen levels increase. This causes a large amount of damage to usually fragile ecosystems. Due to the irregular reappearance of the fire, large amounts of fire fighters time is taken up with multiple visits to the same area.

**Key Words**: Deep seated peat fires; Cold Cut Cobra; Ultra High Pressure water

## WILDFIRE AND PRESCRIBED BURNING

Richard Luxmoore, Senior Nature Conservation Adviser

National Trust for Scotland

Prescribed burning is a recognised management technique for heather moorland and helps to improve the habitat for sheep, deer and grouse. It is also used to reduce the fuel load and therefore the risk of wildfire.

Wildfires in the uplands can be extremely damaging to habitats and can result in extensive damage to property, especially forestry plantations. They can also ignite the underlying peat where they are difficult to extinguish and cause the large-scale release of greenhouse gasses from the carbon stored there. They result from a number of causes including lightening, campfires, and arson, but a significant number, particularly of the larger fires, result from prescribed burning that has got out of control.

This paper examines the relationship between wildfire and prescribed burning, drawn from published research and experience on the estate of the National Trust for Scotland. It evaluates methods for reducing the risk of wildfire, balancing the benefit of prescribed burning in reducing fuel load against the danger of causing wildfire.

**Keywords:** Wildfire, heather burning, risk management

# WHAT ARE THE BENEFITS AND CHALLENGES OF USING SAR DATA TO DETECT AND MONITOR WILDFIRE BURN SCARS IN PEAT MOORLANDS?

Gail Millin-Chalabi
Lecturer in Remote Sensing & PhD Researcher, University of Manchester, School of Environment, Education and Development

Julia McMorrow
Senior Lecturer in Remote Sensing, NERC Knowledge Exchange Fellow (Knowledge for Wildfire)
University of Manchester, School of Environment, Education and Development

Clive Agnew
Professor of Physical Geography, Vice President Teaching and Learning, University of Manchester, School of Environment, Education and Development

A systematic, landscape-scale method of detecting wildfire burn scars in peat moorlands would improve recording of burned area and monitoring of regeneration and restoration. Cloud cover means that optical satellite data is often unavailable in the UK. Thermal sensors can only map burn scars whilst they emit heat. Synthetic Aperture Radar (SAR) sensors on satellites (e.g. ASAR, ERS-2, PALSAR) are an alternative, all-weather remote sensing method for detecting and monitoring burn scars in a degraded peat moorland environment like the Peak District National Park (PDNP).

SAR sensors send out pulses of microwave energy which are scattered by the ground back towards the same sensor to generate an image. Burn scars in peat moorland can be detected because fire changes the surface roughness and wetness, which affects image brightness (intensity of backscattered energy).

We studied how these changes in intensity relate to environmental variables such as precipitation and land cover, and different radar wavelengths, in order to recommend optimum conditions for imaging. The Bleaklow 2003 and Edale 2008 burn scars are used to show the benefits and challenges of using a time series of radar data.

SAR can detect peat moorland burn scars several months after a wildfire event, especially when post-fire images are acquired during a wet period.

**Keywords:** Wildfire; peat; moorlands; burn scars; burned area; vegetation regeneration; ecological; restoration; radar; remote sensing; detection; persistence; landscape-scale; precipitation; land cover; Peak District.

## NORTHERN IRELAND WILDFIRE INITIAIVE 'OUR JOURNEY TO FIND A SHARED SOLUTION TO A SHARED PROBLEM'

GC Randy McComb - Northern Ireland Fire and Rescue Service

Matthew Bushby – Mourne Heritage Trust

Colum McDaid – Northen Ireland Environmental Agency

The 2011 wildfires burnt large areas of the NI landscape including European designated habitats, agricultural land, water catchments, forests and recreational areas. In response, the Eastern Mournes Wildfire Initiative piloted innovative analysis of the wildfire risk across a 7000ha upland heath, identification of strategic management areas within the landscape, the need to develop a wildfire group and wildfire plan, and better support for emergency response. The project is informing a wider NI Initiative, and is aligned with approaches in the Republic of Ireland and across Europe.

This has necessitated the commitment of key players to a shared approach, gradually building understanding of the problem, finding potential solutions and carrying out practical actions including prescribed burning and training within a climate of limited resources. The experience of three of the lead partners will be profiled: the Northern Ireland Fire and Rescue (NIFRS); Northern Ireland Environment Agency (NIEA); and Mourne Heritage Trust.

NIFRS will describe its journey to meet the challenges of moving outside its traditional approach to firefighting, which like most of the UK Fire and Rescue Services, was primarily focussed on training and equipping its personnel to deal with structural fires.

NIEA began a programme of community outreach projects working closely with farming unions, land managers and emergency services, to raise awareness of the problem and identify good practice to help mitigate the risk of wildfire, including practical demonstrations on prescribed burning, and target group meetings.

Mourne Heritage Trust facilitated the Eastern Mournes Wildfire Initiative, and brought its knowledge of the landscape and mountain skills and equipment to the table, partnering NIFRS on prescribed burns, training and wildfire response, and participating in European wildfire initiatives.

# WILDFIRE RISK IN COMMUNITY RISK REGISTERS, IRMPS AND IRS: HOW WELL DO THEY MATCH?

Julia McMorrow

Senior Lecturer in Remote Sensing, NERC Knowledge Exchange Fellow (Knowledge for Wildfire)
University of Manchester, School of Environment, Education and Development

Using maps and diagrams, this paper compares relative risk of wildfire as assessed in Integrated Risk Management Plans (IRMP) and Community Risk Registers (CRR), with the actual occurrence of wildfire from the Incident Recording System (IRS). We aim to show and explain why these three data sources convey different pictures of wildfire risk, and how IRS data could help quantify the likelihood of vegetation fire of different magnitudes within and between areas.

CRRs are prepared for emergency planning purposes by Local Resilience Forums (LRF). LRFs rate likelihood, impact and overall risk of any hazards affecting local communities within their area. A survey of the 38 CRRs available online for England, Scotland and Wales in February-April 2015, showed that three-quarters included 'moorland and forest fire'. Also in 2015, Fire and Rescue Services were surveyed to determine whether they had considered and identified wildfire within their IRMPs. Like CRRs, they assess wildfire risk relative to other local risks. In contrast, IRS data gives a quantitative estimate of the actual number of wildfire incidents, how this varies within areas, and allows comparison nationally between areas. Different magnitudes of fire can be mapped, ranging from all vegetation fires regardless of size, duration or appliances deployed, to 'wildfire' as defined in the Scottish Wildfire Operational Guidance (2012).

**Keywords: Fire** and Rescue Authorities, Contingency Planning, Risk Management Planning, Local Resilience Forum, Community Risk Register, Incident Reporting System, GIS, mapping.

# IMPORTANCE OF INVESTIGATING THE CAUSALITY OF FOREST FIRES: THE CATALAN EXPERIENCE.

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Senior Agent in Prevention and Investigation of Forest Fire s o f the Generalitat of Catalo nia.

In 1994, wildfires burnt around 80,000 hectares of forest in Catalonia (Spain). This triggered a reassessment of both wildfire extinction and wildfire prevention policies. One of the main issues identified was the lack of information regarding the causes of wildfire ignition. Knowing what caused the wildfires was considered key for a good prevention policy. The so-called Rural Agents brigades were created to tackle this problem. In addition, the decision was made to investigate all wildfires affecting vegetation in forests (and surrounding areas, up to 500m), no matter how small the fires were.

In this way, reliable information on the causes of wildfires was obtained:

1% reignitions; 11% natural causes; 23% arson; 12% accidents; 41% negligence; 12% unknown.

This data was used to regulate the use of fire and any activity that could potentially start a wildfire. Legislation was also introduced regarding the treatment of vegetation surrounding power lines and at the sides of margins, roads, railways and urban areas. The result was the creation of low combustibility strips.

In addition, specific campaigns were carried out:

- Prescribed burning in upland pastures campaign.

- Grain harvest campaign.

- Poplar (Populos sp) bloom campaign.

## ADAPTATION AND INTEGRATION OF THE CANADIAN FIRE DANGER RATING SYSTEM INTO WILDFIRE PREVENTION ACTIVITIES IN NEW ZEALAND

H. Grant Pearce, Senior Fire Scientist

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New Zealand adopted the Canadian Fire Weather Index (FWI) System in 1980, and over the past three decades has gone about adapting and implementing this and other components of the Canadian Forest Fire Danger Rating System to better suit the New Zealand fire environment.

Grant will describe key lessons learned during development of New Zealand's present operational fire management systems, with particular emphasis on how these are being utilised to prevent wildfires and reduce fire impacts.

## ‘WILDFIRE ORIGIN AND CAUSE DETERMINATION’

Winand Sitsen, Senior Forensic Crime Scene Investigator

Dutch Police Forensics Team , Unit East Netherlands , Area Nord and East Gelderland , PO Box 618, Europaweg 79, Postal code 7336 AK, 7300 AP Apeldoorn, City of Apeldoorn, Netherlands

This presentation will give you a quick view on the relevance and of the results due to investigation at the origin area. The presentation shows the possibilities of arranging the FI210EU course, in your own country where you can learn and practice in your own backyard to get the skills to start a wildfire investigation.

The way this is done (in the Netherlands 2011,2012,2015) is by learning to recognize and interpret / analyse the physical indicators that where left behind by a wildfire. The investigator will, in the end of the 5 day’s course, recognize micro-scale indicators pointing towards the point/object of origin.

As example of use of European cooperation in using each other’s knowledge we show the wildfire investigation that was done in cooperation with the local authority’s in Killarney Republic of Ireland, Dutch Fire department and Police and FRISK-GO - Towards a European Forest Risk Facility and European Forest Institute.

There will also be physical evidence of real case material to, see, feel and smell the results of wildfire investigation.

# FIRE DANGER RATING SYSTEM WORKSHOP

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## 1 Introduction

1.1 Discussion has taken place over many years about how a Fire Danger Rating System (FDRS) could be developed for the UK.

1.2 It has been proposed that the Scottish Wildfire Forum, the England & Wales Wildfire Forum and the Chief Fire Officers' Association Wildfire Group (CFOA WG) should work together as the 'customer' to produce the specification for a FDRS.

1.2.1 After the specification has been agreed, delivery options will be addressed to assign costs to the various options for which funding can then be sought.

1.2.2 A range of options will need to be considered that will cover the use of existing products, adaptation of systems to meet the specification, through to commissioning a completely bespoke solution.

1.2.3 To ease the provision of funds, a phased approach has been proposed.

1.3 This workshop will review the current situation and seek to develop a way forward.

1.4 Grant Pearce, a keynote speaker at the conference, was instrumental in establishing a similar system in New Zealand and his first hand experience will help us to tease out the options during the workshop.

## 2 Workshop Aim

2.1 To consider the development of a specification of requirements for the development of a Fire Danger Rating System for the UK.

## 3 Key Issues

3.1 A key component of an effective would be to provide early warning of increasing wildfire threat to allow planning and preparation within the FRS.

3.2 The FDRS information should be made available to landowners and managers so that they can be informed about increasing risk and so they can plan their management activity and preparations accordingly.

3.3 The ideal conduit for FDRS information to reach land managers is a fire group. In conjunction with the development of a FDRS, the formation of such fire groups should be encouraged across the whole wildfire risk area. They can either be stand-alone organisations, or could work in conjunction with other functions, for example: deer management groups.

3.4 An effective FDRS will allow for an increase in efficiency and effectiveness of the Fire & Rescue Services, agency and land management fire suppression resources.

3.5 The FDRS should provide a forecast facility to allow the owners and managers of land to obtain information about weather windows that would be suitable for prescribed burning.

## 4 Workshop Plan

4.1 The workshop will be more interactive, and the aim will be to generate discussion with all who attend being given the opportunity to provide their views about this important topic.

4.2 The experience of setting up the FDRS in New Zealand will be a valuable case study for the workshop to consider. Grant Pearce has been invited to provide a short presentation on the lessons learned and how these might be applied to guide the process in the UK.

4.3 After a short discussion to expand on any issues of interest from New Zealand, a panel discussion will take place. The panel will be asked to comment on a range of issues that will need to be addressed as part of the development of a FDRS in the UK. Issues will cover:

4.3.1 What are the advantages offered by a FDRS;

4.3.2 Who are the potential customers and what do they want from a FDRS;

4.3.3 What is the range of existing systems and what criteria should be used to choose between them;

4.3.4 Can a UK-wide system be established;

4.3.5 What are the required steps to setting up a UK FDRS?

4.4 The workshop will be asked to agree a process to be followed to develop a UK FDRS.

# DESIGN OF AN EFFICIENT MULTI-HAZARD EMERGENCY MANAGEMENT SERVICE PLATFORM

Oriol Vilalta

Helena Ballart, Pau Costa Foundation

Thomas Ladoire, Avanti Communications Group plc,

Javier Mulero,^ DLR GVierman Aerospace Center

The project focuses on developing a sustainable, pre-operational open service platform, which integrates space, based observation, communications and navigation technologies to provide innovative services for a wide variety of users (e.g. authorities, command and control centres, first responders) in multi-application domains, such as the prediction/early detection of emergencies, population alerting, environmental monitoring, crisis management and risk assessment are managed through a single, user friendly interface, targeting several users.

While the service platform is designed to be multi-hazard, the specific developments for the pre-operational system and pilot demonstration are focused on the forest fire scenario. In this regard, the platform provides highly efficient tools and enhanced services to support the whole emergency management cycle, thus improving resilience of the population by monitoring critical variables during the mitigation and preparedness phases.

The targeted user profiles are as follows:

- Core user profile: civil protection and emergency management entities for environmental monitoring, risk assessment as well as detection, monitoring and management of emergency situations

- Secondary user profile: academic/research, insurance companies, operators of critical infrastructure for environmental monitoring and risk assessment.

**Key words** (3-5): Forest fires, emergency management, multi-hazard platform, space assets, civil protection, earth observation, satellite communication

# REDUCING WILDFIRE RISK ACROSS 650KM2 OF PENNINE MOORLANDS IN ONE PROJECT THAT INTEGRATES LAND MANAGEMENT, INNOVATIVE COMMUNICATIONS AND SCIENCE

Jonathan Walker, Science Programme Manager
Moors for the Future

Matt Buckler, Louise Turner, Sharon Davison, Chris Dean, Kate Morley.

Wildfire is a significant issue across South Pennine and Peak District Moorlands and represents a major threat to the internationally important habitats and wildlife they support.

We present a five year, EU LIFE funded, project that the Moors for the Future Partnership have just embarked on to reduce the risk of wildfire and improve the ecological condition of moorland across the 650 km2 South Pennine Moors Special Area of Conservation. Focusing on Water Safeguard Zones, priority catchments for securing the provision and quality of potable water, the project will reduce fuel loadings and 'rewet' 50 km2 of moorland at high risk of wildfire.

These 'concrete actions are accompanied by a comprehensive programme of engagement with landowners and managers about mitigating the threat of wildfire; wildfire awareness campaigns and events with the general public; support for the two Fire Operation Groups that cover the region; development of wildfire 'watch' initiatives including innovative resources for effective and efficient communication of wildfire incidents and the collection (and collation) of key data on these incidents; plus a programme of supporting scientific work including mapping fuel loadings and wildfire incident boundaries.

# REMOTE SENSING AND A WILDFIRE SPREAD MODEL; BEFORE, DURING AND AFTER A WILDFIRE

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Jan Slakhorst,

Nienke Brouwer

Dutch Wildfire Team, IFV, Institute for Safety, Netherlands

The Dutch wildfire spreadmodel is operational in use in the Netherlands since 2012. This spreadmodel is a derivative of the Northern American spreadmodel Farsite, adapted for the use in the Netherlands. So far a basic top10 NL map has been used in the model. In order to be able to use all the fuel models applying for the Netherlands a more detailed map is needed. A solution for this would be remote sensing. By using remote sensing images and making a translation to fuelmaps the model is able to calculate by more up-to-date detailed data then before. Hereby an even more accurate calculation can be made. This data can be used, besides during a wildfire, for management and validation purposes.

**Keywords:** wildfire, remote sensing, fuel mapping, wildfire spreadmodel

**APPENDIX A: POSTERS**

## CHECKING THE ABILITY OF THE K-LINE METHOD TO DISCRIMINATE BETWEEN SMOULDERING AND FLAMING ACTIVITY IN CASE OF HEATHER DOMINATED VEGETATION

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Biomass burning affects the land and atmosphere through the combustion of vegetation and organic soils and transferring chemical constituents directly into the lower atmosphere. Understanding the impacts of global biomass burning on the terrestrial biosphere, atmosphere and their change over time are the main scientific questions.

At local scale, fires are a major security hazard which affect vegetated resources and settlements. Within Europe, Mediterranean countries are the most affected by vegetation fires, with an average of almost 50 000 between 1980 and 2008 and an estimated total cost of around 1% of Domestic Product (WFC 2009). This includes the cost of firefighting organisations, fire insurance administration and the protection to buildings .

It is important to be able to detect small fires that may be important as precursors to larger burns, and as predictors of fire spread when incorporated into operational fire models. Data collected remotely by sensors on satellites or aircraft at shortwave infrared and thermal infrared wavelengths are traditionally used, although such instruments are often costly and difficult to operate from traditional airborne platforms. Until now, the use of hyperspectral techniques (imaging using many very narrow wavebands) has been limited by the cost and weight of instruments. The recent growth in the unmanned aerial vehicle (UAV) market has led to the development of light and relatively cheap instruments, including hyperspectral sensors in the visible to invisible near infrared (VINIR).

Hyperspectral sensors can be used to detect small active fires, and especially to discriminate between flaming and smouldering combustion. They can also be used to monitor the regeneration of vegetation on burn scars. In this study we investigate the suitability of a technique called Potassium (K)-line emission to distinguish between flaming and smouldering combustion for an experiment fire in heather.

# WILDFIRE DISTRIBUTION IN SCOTLAND; A COMPARISON OF THE FIRE SERVICE'S INCIDENT RECORDING SYSTEM AND MODIS – DETECTED VEGETATION FIRES

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Incident Recording System (IRS) data for Scotland over four financial years, 2009/10–2012/13, show that 80% of 'IRS-based wildfires' (vegetation fires meeting 2013 Scottish Wildfire Operational Guidance IRS-based criteria) occurred in spring. Similarly, 92% of vegetation fire hotspots detected by MODIS thermal sensors on Terra and Aqua satellites also occurred in spring (data from NASA's FIRMS Web Fire Mapper). Both occurred mainly in the Highlands and Islands. Attempts to match these datasets revealed that MODIS detected only 1 in 10 (53) of IRS-based wildfires because of cloud cover, timing of satellite overpasses, fire size and intensity. Approximately 47% (206) of MODIS vegetation hotspots had near-matches to IRS-based wildfires. The mismatch occurs partly because MODIS detects active fire fronts, with >1 detection for large or long-lasting fires, whereas IRS records the ignition or fire service rendezvous point, sometimes several kilometres away.

Matching would be easier if IRS recorded fire perimeters, especially since cloud means that very few MODIS Burned Area perimeters are available. The remaining 53% of MODIS hotspots may not be real fires (although those on non-vegetated land cover were excluded), or were real, unreported fires. Both datasets therefore have different benefits and limitations as tools for monitoring wildfires in Scotland.

**Keywords**
MODIS; satellite-detected vegetation fires; thermal remote sensing; Incident Recording System (IRS); Fire and Rescue Service (FRS); Scotland; spring wildfires; spatial distribution.

# FIRE AS A LAND MANAGEMENT TOOL – THE RISKS AND BENEFITS OF PRESCRIBED FIRE USE IN NEW ZEALAND

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Fire has played a significant role in the evolution of New Zealand's vegetation cover and continues to be a widely used and cost-effective land management tool (e.g. for clearing and preparing land, and removing excess vegetation and fuel loads). New Zealand averages some 3000 vegetation wildfires each year which burn a total of around 6000 hectares. About 20% of these wildfires, and almost half of the area burned, are the result of land clearing burns escaping or becoming out of control.

Despite this widespread use of fire and prevalence of escapes from burns, the risks and benefits of using fire in New Zealand are not well understood or quantified. Interviews with key stakeholders informed a national survey that has investigated where, when, how, and why fire is used to manage land in New Zealand. The survey identified differing perceptions of risks from prescribed fire use by land-based sectors, and public attitudes to the use of fire for land management.

Results from the survey, together with reviews of literature on impacts of fire in New Zealand ecosystems and current best practices on fire use, are being used to better understand the risks and benefits of using fire as a land management tool in New Zealand's rural landscapes, and to provide best-practice guidelines and policy recommendations for prescribed fire use.

# SCOTLAND SHOULD USE THE FINE FUEL MOISTURE CODE TO FORECAST PERIODS OF POTENTIALLY HIGH WILDFIRE ACTIVITY

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Scotland currently lacks a fire danger rating system to help managers and firefighters organize their resources. The Canadian Fire Weather Index System (FWI) is used to provide the Met Office Fire Severity Index for England and Wales but there has been little research to examine how well the FWI predicts fire activity in Scotland.

We modelled wildfire probability using 9000 wildfire records provided by the former regional Scottish Fire and Rescue Services (FRS) and Met Office 10km2 NWP weather data. A number of screening methods were used to identify the best predictors for different regions, seasons and for high magnitude wildfires.

Logistic regression showed the Fine Fuel Moisture Code and Initial Spread Index are able to distinguish between fire and non-fire days tolerably well. The indices performed poorly in summer, but did indicate that wildfires are able to occur in more marginal burning conditions during winter and spring, and in urban areas.

Patterns of fire magnitude across different regions raise suspicions that there was some variation in recording practices. Managers and the Scottish FRS could plan for periods of potentially substantial fire activity using our models in conjunction with the freely-available European Forest Fire Information System FWI forecasts.

# RELATING THE CANADIAN FIRE WEATHER INDEX SYSTEM TO VARIATION IN WILDFIRE SEVERITY AND FUEL CONSUMPTION

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Temperate peatland wildfires are of significant environmental concern but information on their environmental effects is lacking. Little data has been collected to quantify differences in fire severity and carbon release due to variation in fuels and fire weather.

We assessed variation in fire severity and fuel consumption within and between British peatland wildfires. We adapted the Composite Burn Index (pCBI) to estimate fire severity, estimated pre- and post-fire fuel loads, and assessed fire weather using the Canadian Fire Weather Index System (FWI System). pCBI varied 1.6 fold between, and up to 1.7 fold within, wildfires. pCBI was higher where moisture codes of the FWI System indicated drier fuels.

Spatial variation in pre- and post-fire fuel load accounted for a substantial proportion of the variance in fuel loads. Average surface fuel consumption was a linear function of pre-fire fuel load. Average ground fuel combustion completeness could be predicted by the Buildup Index. Carbon release ranged between 0.36 kg C m-2 and 1.00 kg C m-2. The flammability of ground fuel layers may explain the higher C release-rates seen for wildfires in comparison to prescribed burns.

We caution that significant monitoring effort is needed to accurately quantify emission factors from peatland wildfires.

# FIREWISE PRINCIPLES IN ACTION: APPLYING FIRE SCIENCE AND SOCIAL SCIENCE TO PROTECT COMMUNITIES IN THE UNITED KINGDOM

Andy Elliott

Community-based fire management takes many forms throughout the world. In the US and Canada, research beginning in the 1980s has focused on how homes ignite from wildfire and what can be done to transfer this knowledge to residents living and working in fire-prone areas. The National Fire Protection Association (NFPA) Firewise program was developed to translate key fire science findings into actionable, easy-to-understand messages that residents would embrace. Its national recognition program for communities started in 2002, providing a simple process for neighbourhoods to take action to reduce potential damage and home destruction from wildfires. In 2006, South Africa successfully adopted a Firewise program that tailored the concepts of the community action program, demonstrating that application of both the fire science principles of home ignition and the social science principles of human behaviour change were effective in communities very different from their US counterparts.

During the last International Wildland Fire Conference in South Africa in 2011, a number of UK delegates attended the Firewise workshop delivered by NFPA and Firewise South Africa partners. Shortly afterward, a significant wildfire on Upton Heath in Dorset prompted the evacuation of many residents from their homes. Although no homes were damaged, this incident provided an opportunity to introduce Firewise principles. Andy Elliott of the Dorset County Council created a leaflet with basic information and delivered it to affected residents, also offering one-to-one advice. This was the first time that Firewise was used in the UK. Since then, the Chief Officers Association of the UK (CFOA) have negotiated a formal partnership with NFPA and have officially adopted Firewise into the UK.

The village of Thursley, in the County of Surrey, became England's first Firewise community on 11th October 2014. Other villages are showing an interest, and CFOA and local fire and rescue authorities are working to spread the concepts across the UK. Fire officials recognize the value of Firewise in protecting communities into the future by engaging residents to develop local solutions and take collective action. The UK is experiencing an increase in fires and with that a growing interest in wildfire management. Compared to other places, one might say that the UK has a "mildfire" problem currently. Its fires are relatively mild and rarely cover large areas due to the fragmented nature of natural habitats. However, climate change predicts an increase in both the severity and intensity of vegetation fires. Communities will start to see genuine "wildfires," and those people living near natural areas will be at risk unless we start to take action now. Firewise is the way to safer communities in the UK.

**Keywords:**
Firewise, mitigation, community, behavior change, home ignition

# THE GLOBAL WILDLAND FIRE NETWORK AND THE UNISDR WILDLAND FIRE ADVISORY GROUP: ACTIVITIES 2011-2015

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The UNISDR Wildland Fire Advisory Group and the UNISDR Global Wildland Fire Network, a global voluntary network that is providing policy advice, and science and technology transfer to enable nations:

- to reduce the negative impacts of vegetation fires ("wildland fires") on the environment and humanity; and

- to advance the knowledge and application of the ecologically and environmentally benign role of natural fire in fire-dependent ecosystems, and sustainable application of fire in land-use systems.

Under the UNISDR Global Platform for Disaster Risk Reduction the GWFN is serving as a "Thematic Platform". The Global Fire Monitoring Center (GFMC) is serving as secretariat and coordinator of both institutions. The GFMC is an institution of the Max Planck Institute for Chemistry, Max Planck Society for the Advancement of Science, and an Associated Institute of the United Nations University (UNU).

The core activity between 2011 and 2014 was the organization of the UNECE/FAO Regional Forum on Cross-boundary Fire Management, which was held at the United Nations in Geneva in November 2013. As a follow up of the Forum the International Wildfire Preparedness Mechanism (IWPM) was launched. The IWPM is a non-financial instrument serving as a broker / facilitator between national and international agencies, programmes and projects to exchange expertise and build capacities in wildland fire management and particularly in enhancing preparedness to large wildfire emergency situations. The IWPM has been developed in tandem with the International Fire Aviation Guidelines and the International Manual of Common Rules for Fire Aviation.

**Key words:**

Wildfires, Global Wildland Fire Network, Wildland Fire Advisory Group, Global Fire Monitoring Center (GFMC), Cross-boundary Fire Management Cooperation, International Wildfire Preparedness Mechanism (IWPM)

# THE UNISDR REGIONAL EURASIA WILDLAND FIRE NETWORK ACTIVITIES 2011-2015 – PROGRESS AND PROSPECTS

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The UNISDR Regional Eurasia Wildland Fire Network is one of seven Regional / Subregional Wildland Fire Networks of the Global Wildland Fire Network, which include the Member States of the United Nations Economic Commission for Europe (UNECE). The Eurasia Wildland Fire Network emerged from the core region of engagement of the UNECE/FAO Team of Specialists on Forest Fire. Under the lead of the Global Fire Monitoring Center (GFMC) between 1993 and 2014, the Team and the Regional Network were primarily active in the temperate-boreal region of Central, Southeast and East Europe (including the Russian Federation), and the Caucasus and Central Asia. Main inter-regional cooperation has been accomplished between the Regional Networks of Eurasia, Southeast Europe / Caucasus, Central Asia and the Euro-Alpine Subregional Wildland Fire Network – the reason for forming the Euro-Siberian Cluster within the Global Wildland Fire Network.

Key activities over the last four years included the introduction of advanced standards and competence-based wildland fire management training systems (Level 2) for European fire services. By 2015 the EuroFire Competency Standards are available in 14 languages for the use in Eurasia and Latin America. Furthermore the guidelines “Defence of Villages, Farms and Other Rural Assets against Wildfires Guidelines for Rural Populations, Local Communities and Municipality Leaders in the Balkan Region” have been developed with support of the Council of Europe through its European and Mediterranean Major Hazards Agreement (European Open Partial Agreement – EUR-OPA). Several conferences, congresses and outreach work addressed advanced fire management and fire polcy developments, e.g. the “International Congress and Trade Fair on Forest Fire and Climate Change: Challenges for Fire Management in Natural and Cultural Landscapes of Eurasia” (hosted by the Russian Federation in partnership with the GFMC; Novosibirsk, Russia, 2013), or the 2012 and 2013 First and Second International Fire Management Weeks (Krasnoyarsk Region, Russian Federation). The Organization for Security and Cooperation in Europe (OSCE) is now a key player in advancing fire management in Eastern Europe and the South Caucasus.

**Key words**:

Wildfires, Regional Eurasia Wildland Fire Network, Regional Eastern European Fire Monitoring Center, Global Wildland Fire Network, Transboundary Fire Management Cooperation, Global Fire Monitoring Center (GFMC)

# USING THE INCIDENT RECORDING SYSTEM (IRS) TO DEFINE WILDFIRE IN GREAT BRITAIN

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The Scottish Wildfire Operational Guidance (2013, p10) defines wildfire as ‘any uncontrolled vegetation fire which requires a decision or action regarding suppression’. Professional judgment is used to distinguish between minor vegetation fires and wildfire events. However, a consistent definition is needed for recording purposes, so wildfire events are also defined as vegetation fires meeting any one of five criteria. Three of these use Incident Recording System (IRS) data: geographical area ⍰ 1 hectare; committed resource of ⍰ 4 Fire and Rescue Service (FRS) appliances; resources committed for ⍰ 6 hours. Such IRS-based criteria could provide a consistent GB-wide spatial evidence base on wildfire. The CFOA Wildfire Group have proposed IRS-based criteria to further sub-divide wildfire into five categories.

This research therefore applied the IRS-based criteria and proposed categories to four financial years of IRS data (2009/10–2012/13) for England, Wales and Scotland. GIS software was used to map how the geography of wildfires changes between categories. With some exceptions, annual average number of category 1 (most minor fires) is highest in metropolitan areas, but shifts to more rural areas at category 5. The maps and graphs are intended to encourage discussion on how to refine the criteria and categories.

**Key Words**:
Incident Recording System (IRS); geographic information system (GIS); mapping; wildfire definition; wildfire categories; fire size; fire duration; FRS resources; Chief Fire Officers’ Association (CFOA)

# FIRE IN THE UK RURAL URBAN INTERFACE: ESTIMATING AVOIDED COSTS TO RESIDENTIAL PROPERTY ASSETS AT RISK

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Wildfire is already a significant problem in parts of the UK's rural-urban interface (RUI). With escalating demand for housing, urban areas will continue to expand into the countryside, bringing sources of ignition closer to the fuel.

This research aims to develop a method for mapping and costing residential property assets at risk for wildfire threat analysis in the RUI and estimating avoided economic losses under different fire spread scenarios. Types of RUI around Crowthorne Wood (Swinley Forest, Berkshire) will be mapped by adapting a GIS-based Wildland-Urban Interface (WUI) model. House prices prior to the 2011 fire will be used to assign monetary values. Overlaying IRS wildfire locations will highlight ignition-prone RUI types.

Fire footprints simulated for different weather scenarios using Prometheus fire spread modelling and the actual surveyed footprint (courtesy of Dr Thomas Smith, Kings College London, and the Forestry Commission, respectively) will be overlaid on the costed RUI map. Avoided costs are estimated by comparing costs of the property affected in actual and simulated fire footprints.

Many assumptions are required, but a monetary estimate of what might have happened (costs avoided) would raise awareness of wildfire risk, help target prevention and help quantify the economic benefits of good wildfire risk management.

**Key Words:**
Rural-urban interface (RUI); wildland-urban interface (WUI); forest fire; residential property; house prices; assets at risk; GIS; Prometheus fire spread modelling; fire footprint; Swinley Forest.

# EFFECTIVE COMMUNICATION: KEY TO RAISING AWARENESS, MINIMISING RURAL FIRES, AND WILDFIRE IMPACT ON NEW ZEALAND COMMUNITIES

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Effective communication is the key to minimising human-caused fires and hence the impact wildfires hold for New Zealand communities. It is essential that fire agencies target their audience, messages and methods of communication to be most effective.

Scion has analysed communication strategies within three New Zealand rural and rural-urban interface communities as part of the Bushfire CRC's Effective Communication: Communities and Bushfire project. This research has shown that a simple one size fits all approach is not effective in communicating fire messages. Communication must target both the audience (type of fire user), and the message (awareness, information, fire prevention, preparedness).

Most New Zealanders do not use fire or pose any risk of starting a fire; hence communication with this group needs to focus on increasing levels of awareness and preparedness should a wildfire occur. The largest group of fire users are those who light fires for vegetation clearance on their rural and semi-rural properties. They generally have good levels of awareness and knowledge around fire practice, which they term 'common sense', and primarily want information around fire restrictions. However they need to be kept aware of fire risk, prevention and preparedness. Recreational users of fire, such as those lighting campfires and using fireworks, tend to be visitors to rural areas and pose considerable risk as they often lack awareness or knowledge. Often overlooked currently, this group require tailored communication concentrating on awareness and fire prevention.

The research has shown that fire agencies should also carefully consider their method of communication, and that there is a place for both traditional broadcast approaches (one-way communication), and face-to-face communication which allows two-way dialogue. It is important that fire agencies pay attention to the best type of communication for the messages they are trying to convey to different audiences.

# DESCRIBING NEW ZEALAND'S CURRENT FIRE CLIMATE SEVERITY

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Understanding likely changes in fire risk across New Zealand is important for the country's rural fire agencies. This study aimed to provide an improved description of current fire climate severity across New Zealand.

An analysis of station fire weather records was conducted using historical data. In total, 77 stations had continuous weather data capturing 15 full fire seasons from October 1995 to September 2010. Fire climate severity was compared using two measures of severity derived from the Canadian Fire Weather Index (FWI) System used in New Zealand – the Daily Severity Rating (DSR), and the frequency of days of Very High and Extreme (VH+E) Forest fire danger. Both these measures describe the influence of weather on fire danger levels. Values of the six FWI System components, as well as the DSR and Forest fire danger class, were calculated for each station. These were then averaged over fire season months as the basis for comparison and mapping of fire climate severity across the country.

Spatial patterns for values of the two fire climate severity measures were very similar. Patterns for FWI System components were similar to those reported in previous studies. Regions of the country with the highest values of the DSR and days of VH+E were Marlborough, the inland South Island (Mackenzie Basin & Central Otago), Canterbury, and eastern North Island (Hawkes Bay and Gisborne). The regions of the country with the lowest values were the South Island's West Coast, Fiordland, Southland, the west of the North Island (Taranaki), and central North Island (inland Wanganui/Manawatu).

# EFFECT OF CLIMATE CHANGE ON NEW ZEALAND'S FUTURE FIRE DANGER

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Knowledge of potential changes in future fire risk across New Zealand is important for the country's rural fire agencies. This study aimed to provide improved estimates of the effects of climate change on future fire danger for New Zealand.

Fire danger ratings for the 2040s and 2090s were estimated using changes from current climate (based on the 1980s baseline) of the four key weather inputs that determine fire danger – temperature, humidity, wind speed and rainfall. These changes were obtained from statistical downscaling of 16 of the IPCC's 4th Assessment Global Climate Models for the A1B emissions scenario. Changes were applied to daily weather station observations from 20 sites across New Zealand.

Results indicate that fire climate severity is likely to rise significantly with climate change in many parts of the country, especially to the 2040s, primarily as a result of higher temperatures and lower rainfall. Areas most likely to increase from current levels are the east and south of the South Island, especially coastal Otago and Marlborough and south-eastern Southland, and the west of the North Island (Wanganui). However, in other areas fire danger may remain unchanged, or in fact decrease by the 2090s, due mainly to increased rainfall. These areas include the West Coast of the South Island and western areas of the North Island (Taranaki) where fire dangers are already low.

Through the use of improved climate models, modelling approaches and outputs not previously available, this study has substantially extended previous work to provide a more comprehensive evaluation of future fire climate and likely impacts. Results have highlighted the likelihood of increased fire risk in many regions of New Zealand with climate change, and this improved knowledge is assisting fire management agencies, landowners and communities to develop appropriate future fire management and mitigation strategies.

# WHO DOES WHAT RESEARCH? KFWF SURVEY OF UK VEGETATION FIRE RESEARCHERS

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The Natural Environment Research Council (NERC) has funded almost £15 M of research on vegetation fire-related topics since 2004, of which £1 M was on the UK. Members of the England and Wales Wildfire Forum (EWWF), the Scottish Wildfire Forum and others who manage wildfire risk in the UK could make better use of this research if information about it was more accessible and they knew who to contact for further advice. Potential end-users tend to contact a selected few individuals, or someone like the Knowledge for Wildfire (KfWf) Knowledge Exchange fellow, who can recommend the right person.

There is a need to continue this signposting role after KfWf ends. We describe a new NERC-funded project to develop a 'Who does What' database and an interactive map on UK-based researchers who have relevant interests in vegetation fire, both wildfire and prescribed fire. Keywords devised from an earlier survey conducted for EWWF in 2012 were revised in consultation with the EWWF. Researchers indicate their primary and secondary research interest from the keywords. The resource will be hosted initially on the Knowledge for Wildfire website www.kfwf.org.uk and will go live during the conference.

The aim of poster is to publicise the resource and seek feedback from potential users.

**Keywords**
Wildfires, vegetation fire, research, knowledge exchange, end-users