

The history and development of Wildfire Danger Rating in Scotland

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Vice-Chair
Scottish Wildfire Forum
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Introduction

- Declaration of interests:
 - Director of Firebreak Services Ltd.
- Introduction to the Scottish Wildfire Forum (SWF)
- Key Wildfire Danger Rating System developments 2004 – 2018
- Assessment of systems

The Scottish Wildfire Forum

Multiple wildfires Easter 2003



Scottish Wildfire Forum

- Established in 2004
- Wide range of stakeholder interests:
- Chair - Scottish Fire and Rescue Service ,
- Vice-Chair M Bruce representing Confederation of Forest Industries (ConFor)
- Small Executive Committee
- Full Forum - wider group of mainly rural stakeholders

Fire Danger Rating Systems

“A fire danger rating system (FDRS) is an assessment of both fixed and variable factors of the fire environment which determine:

- ease of ignition,
- rate of spread,
- difficulty of control
- and fire impact.”

(Alexander & Merrill 1987)

Key FDRS developments in Scotland

- Choice of Canadian Fire Weather Index (FWI) system to underpin Met Office Fire Severity Index (MOFSI) 2005
- Scottish Government fire research and assessment of FWI system – “the Firebeaters Project” Edinburgh University (Colin Legg & Matt Davies) - 2006 – 08,
- Case studies, collaboration with Karl Kitchen (Met Office) - 2011
- Analysis of European Forest Fire Information (EFFIS) fire statistics / Fine Fuel Moisture Code, NW Highlands - 2013
- Firebreak Services Ltd – Wildfire Danger Assessments using EFFIS - 2014

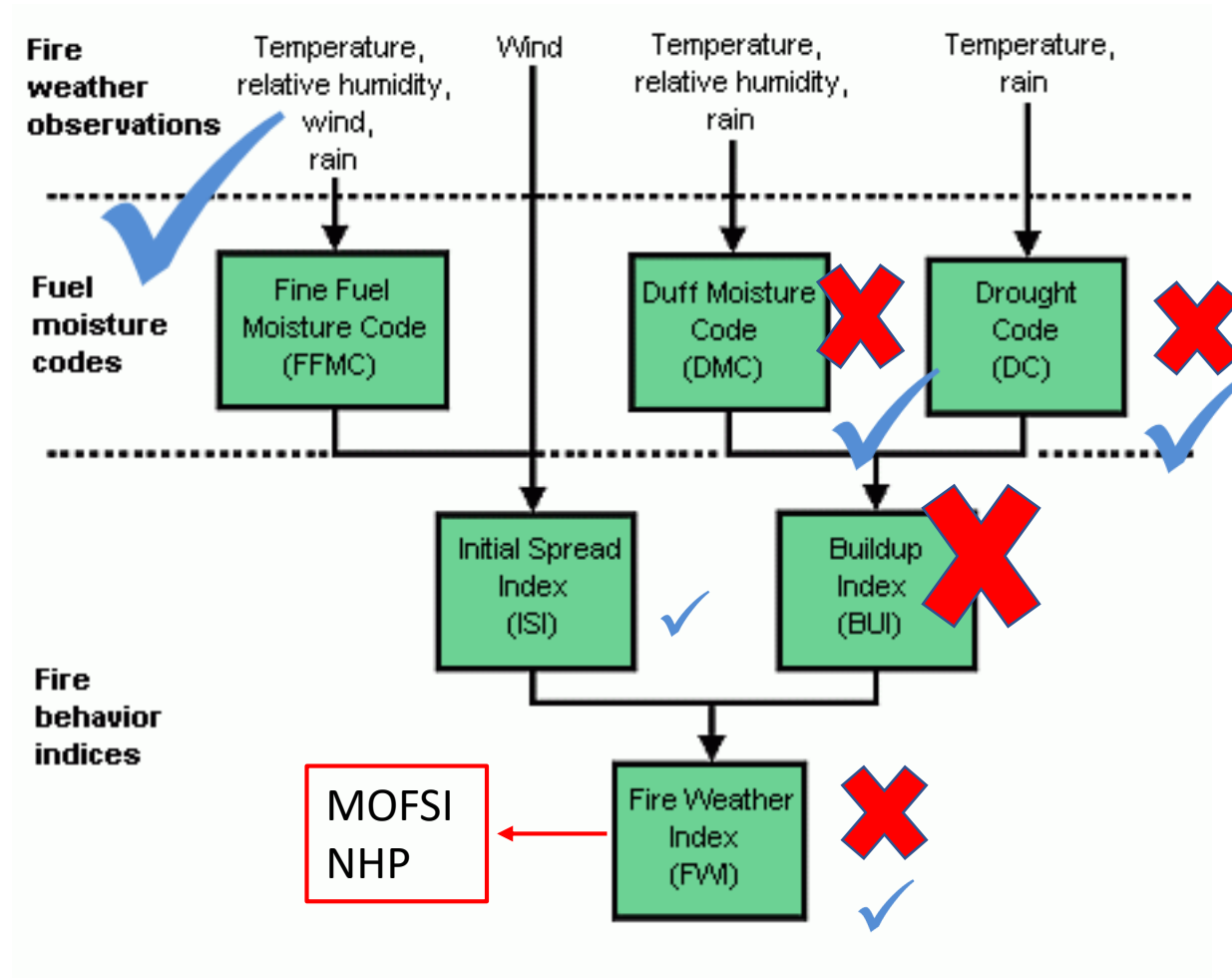
Firebeaters research - key results

- Unique fire behaviour of heather, a shrub fuel
- Problems correlating heather fire behaviour with Canadian FWI system – it doesn't!
- Correlation was found between wildfires occurring & FWI sub-index the Fine Fuel Moisture Code (FFMC)

Fire Danger Rating Errors & Validation

	Danger Rating	
True State of Nature	Low Danger	High Danger
Low Danger	No error	<i>Type I error— false positive</i>
High Danger	<i>Type II error— false negative</i>	No error

Canadian FWI system – so what works in UK?



Key issue - FWI system not designed for shrub fuels

Fuels comparison

– structural and seasonal differences

Canadian Jack Pine forest fuels



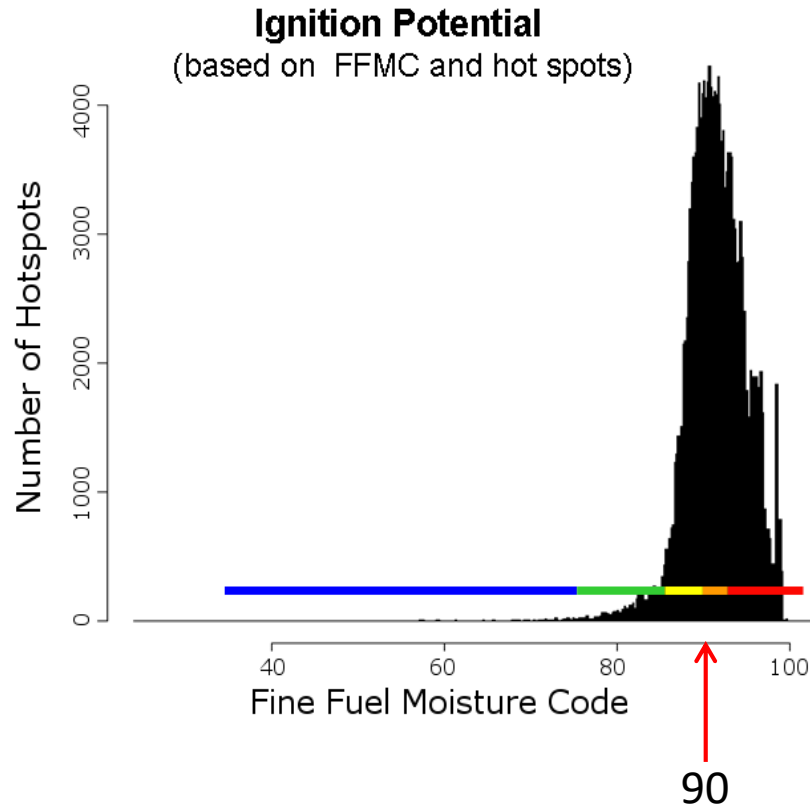
Heather shrub fuel



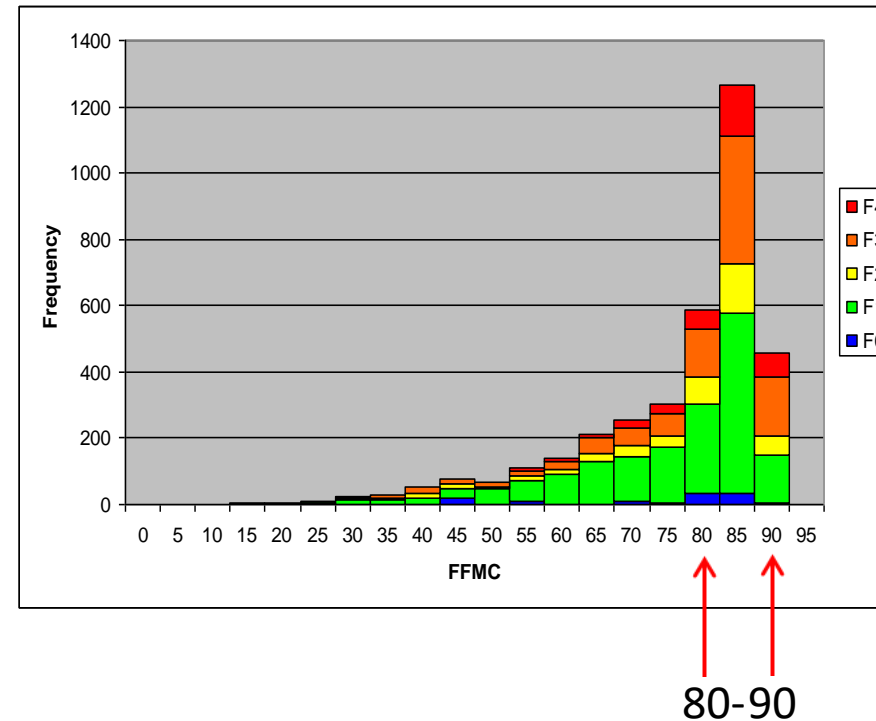
Firebeaters research 2006-08

- Fine Fuel Moisture Code

Global wildfire ignitions

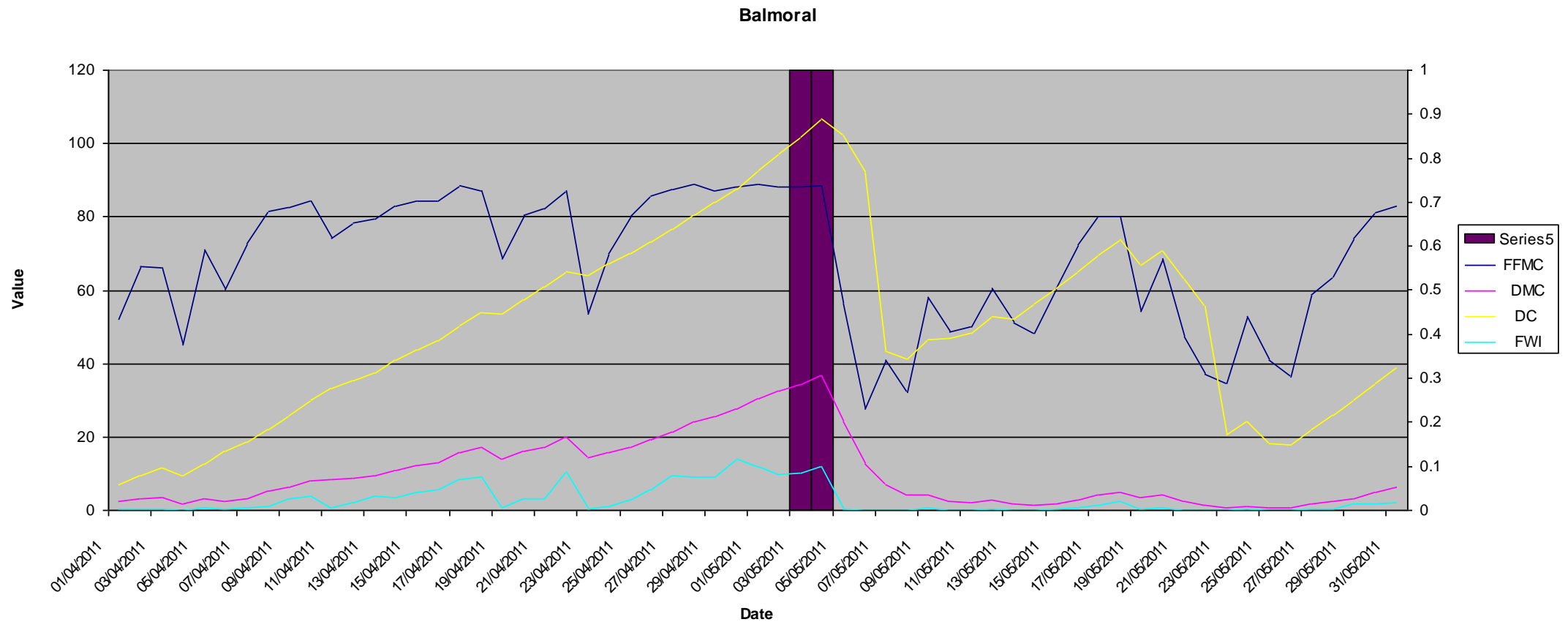


Scotland wildfire ignitions Spring 2003



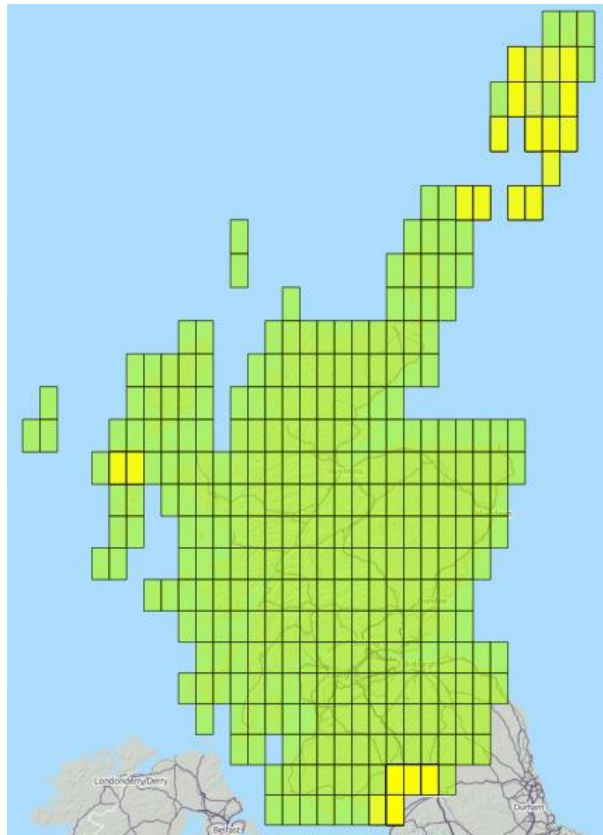
Case Studies, with Met Office, 2011

(Karl Kitchen)

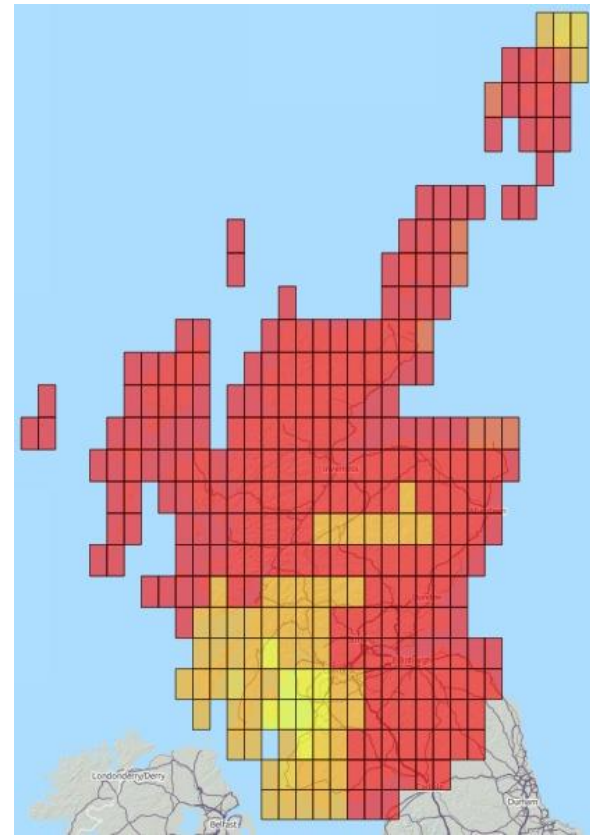


2nd April 2013 – Fire Danger Classes

EFFIS –fire danger classes

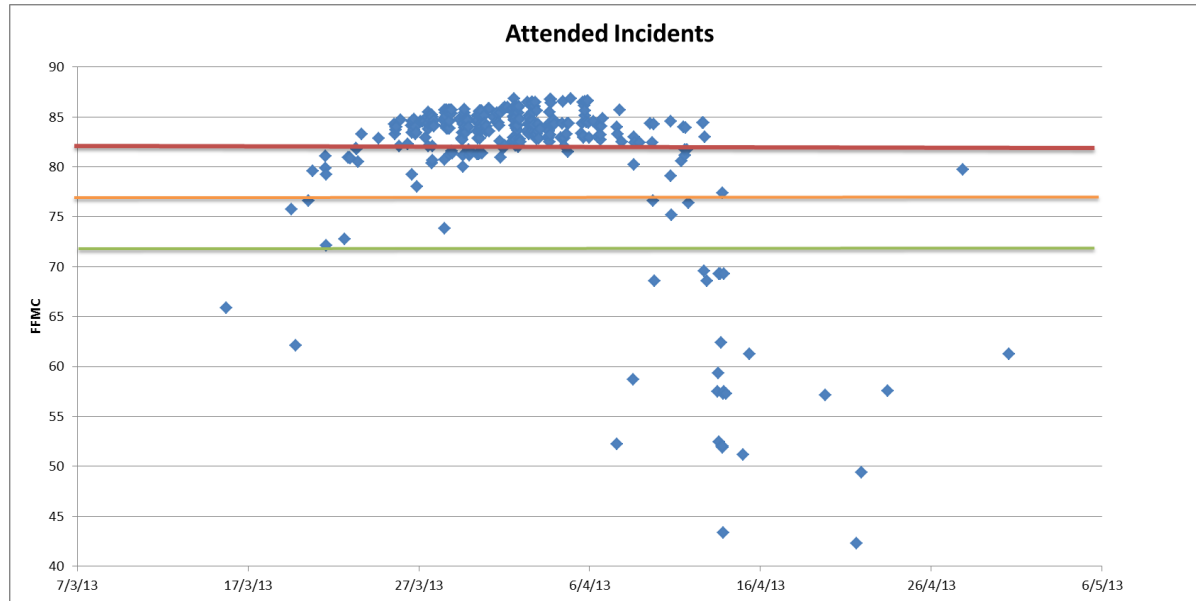


- adjusted fire danger classes

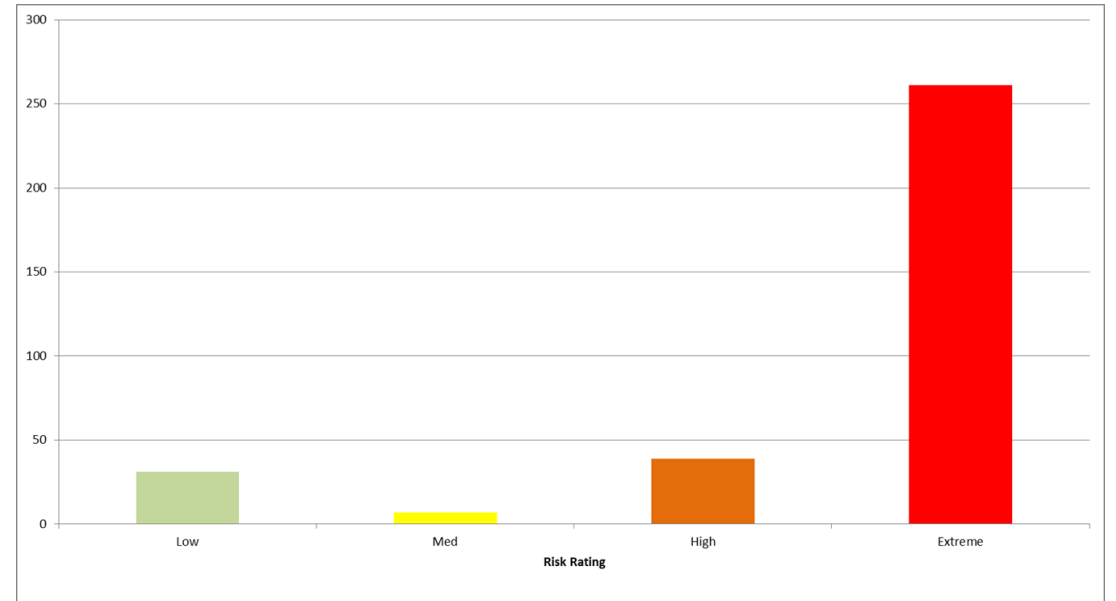


NW Highlands fires spring 2013 & adjusted EFFIS FFMC fire danger bands

Adjusted fire danger classes



Captured the significant incidents



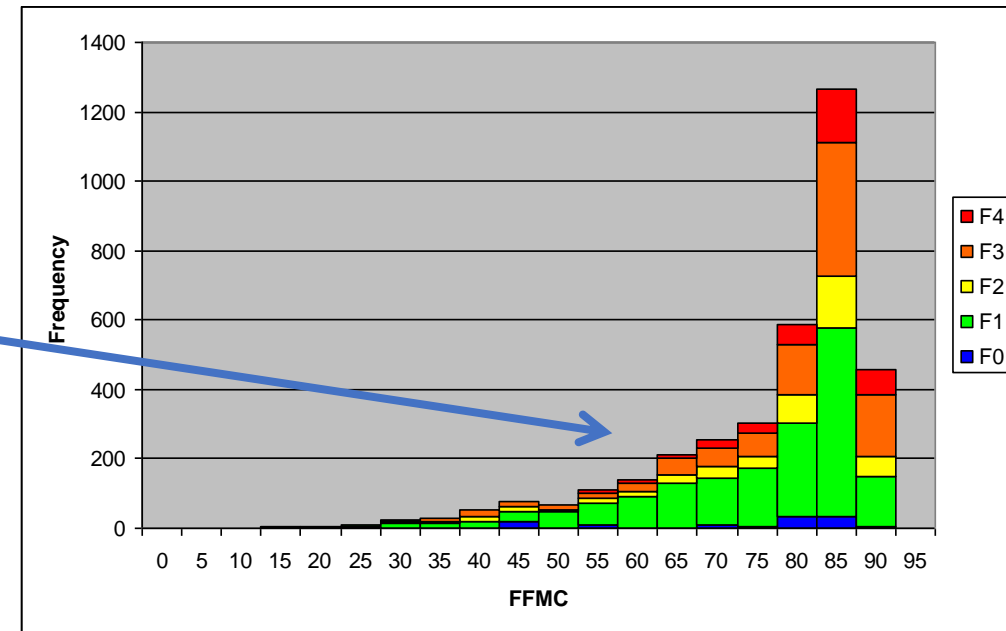
Natural Hazard Partnership Wildfire DHA

– issue is the calibration of fire danger classes & descriptors?

Daily Hazard Assessment FFMC

Fine Fuel Moisture Content (FFMC)	FFMC Index Values
1 - Ignition is unlikely	< 63
2 - Ignition is possible	$\geq 63, < 84$
3 - Fires able to spread	$\geq 84, < 88$
4 - Fires spread easily	$\geq 88, < 91$
5 - Extreme fire behaviour	≥ 91

Scotland 2003 wildfires - FFMC

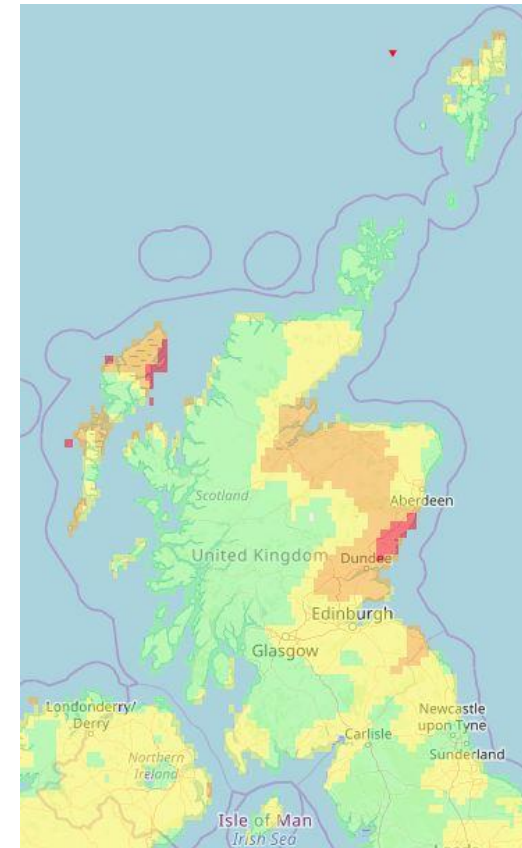


Wildfire Danger Assessments 2014 -

Firebreak Services WDAs

- Criteria applied:
 - Fine Fuel Moisture Code (FFMC) > 80
 - Initial Spread Index (ISI) > 2
 - Duff Moisture Code (DMC) > 20
 - Drought Code (DC) > 300
- Using European Forest Fire Information System (EFFIS)

Current assessment 29th March 2019



Insufficient functionality for a full FDRS

- but enough to provide some fire intelligence

- Preparedness planning
- Fire prevention activity
- Fire prescriptions (controlled burning)

FRS Preparedness



- Limited resources - specialist kit and wildfire skills (improving rapidly)
- Needs to be in the right place at the right time and properly prepared
- Pre-determined attendance (PDAs) need accurate fire intelligence (forecasts) to work efficiently

Land Management / Private Sector - Preparedness



- **3 key resources**
 - **Helicopters**
 - **ATV fire fogging units**
 - **Experienced Staff**
- Helicopters are on 3 day schedule
- ATV refuelling/checks
- Staff: weekend rota's

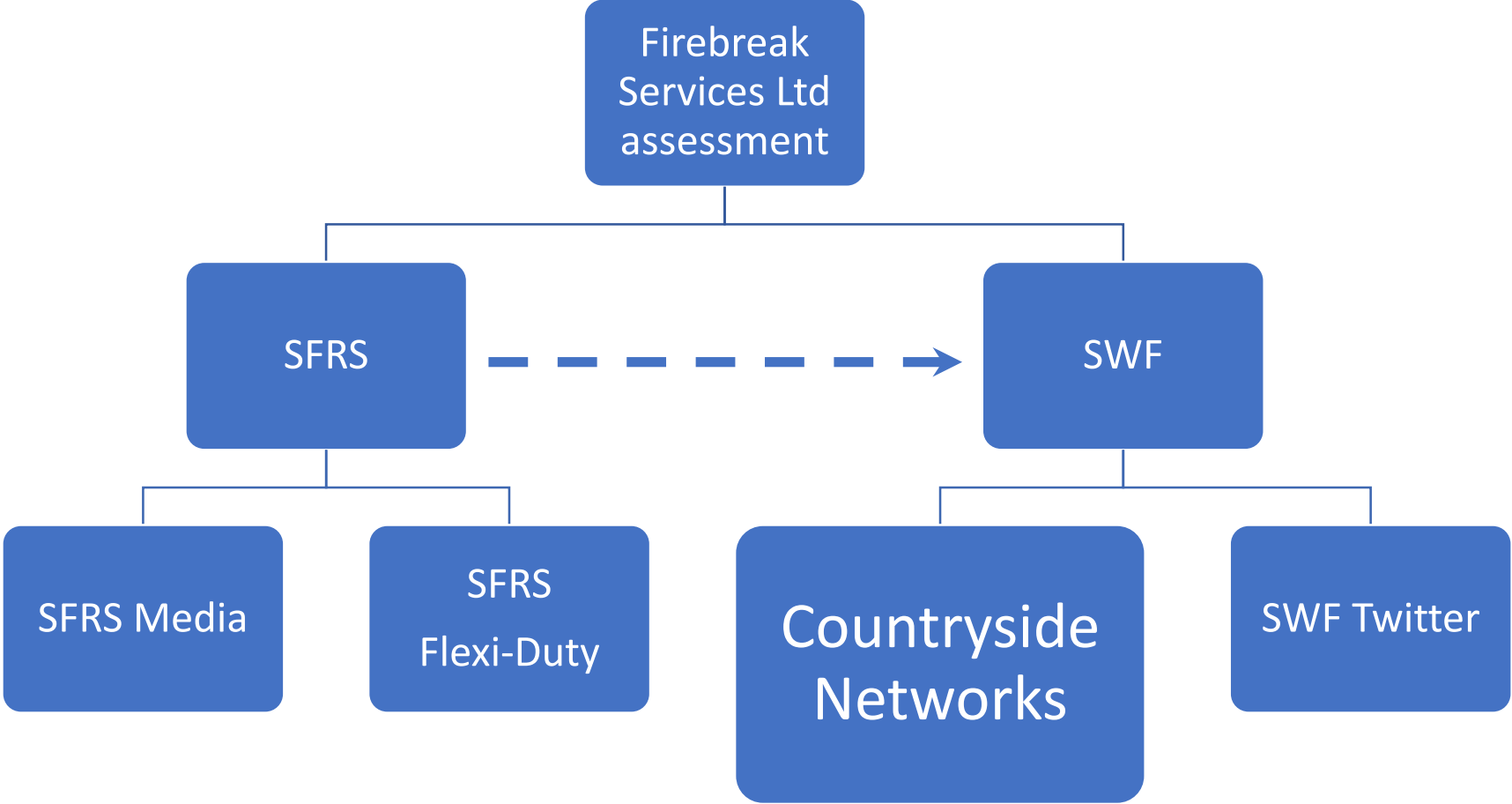
Prescribed burn planning – land managers

- avoiding high hazard periods



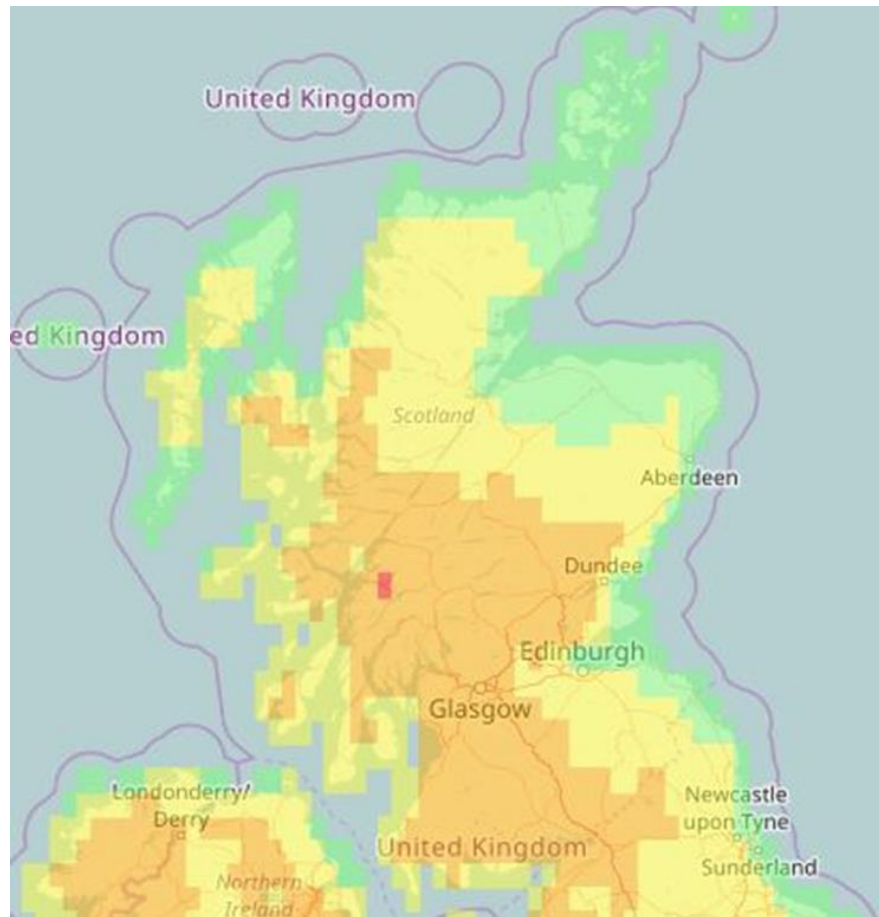
- Firebeaters Phase 2 research (data collected by prescribed burn staff / gamekeepers):
- Median burning conditions
 - 50% FFMC < 55 ISI < 0.3
 - 80% FFMC < 80 ISI < 1.4
- These are fairly low index values

Distribution of Wildfire Danger Assessments

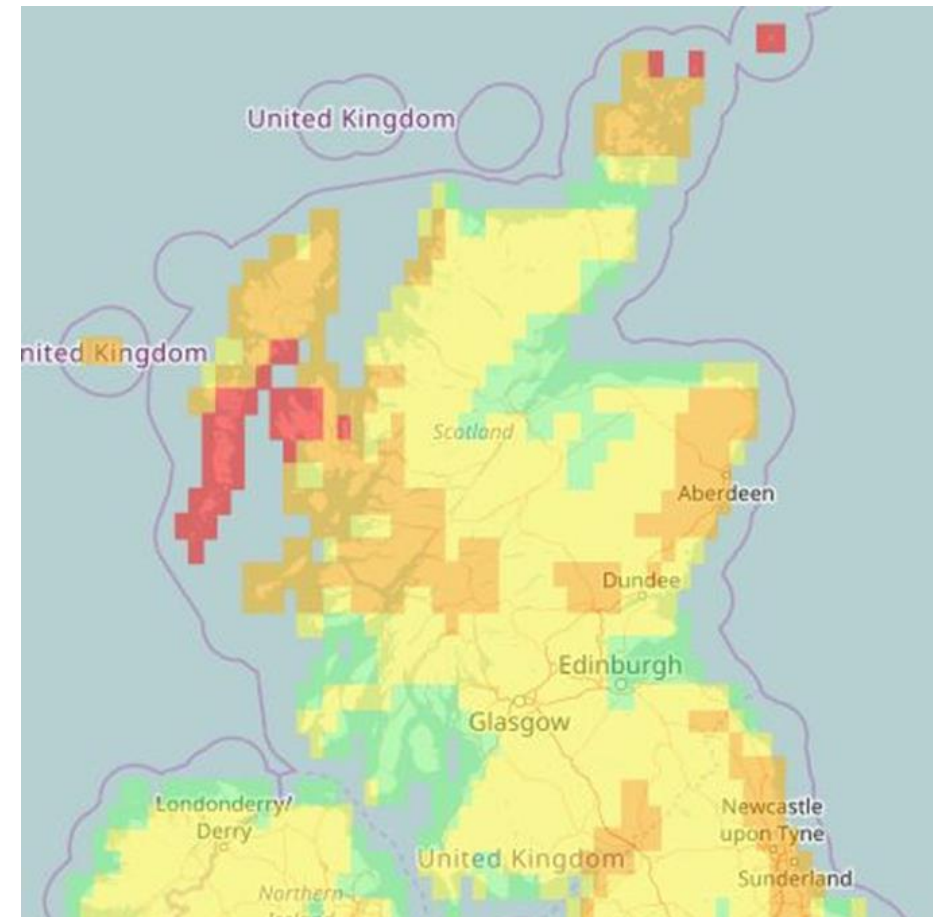


FBS wildfire danger assessment issued 2/5/17

Fine Fuel Moisture Code (FFMC)

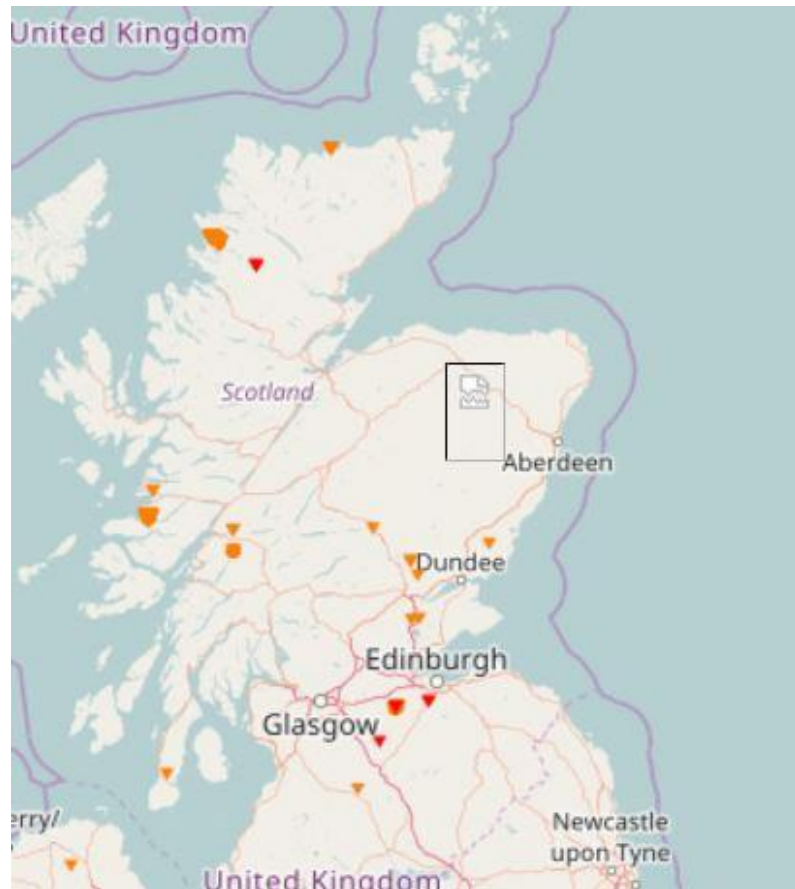


Initial Spread index (ISI)



Large fires 2 – 9 May 2017

Scotland



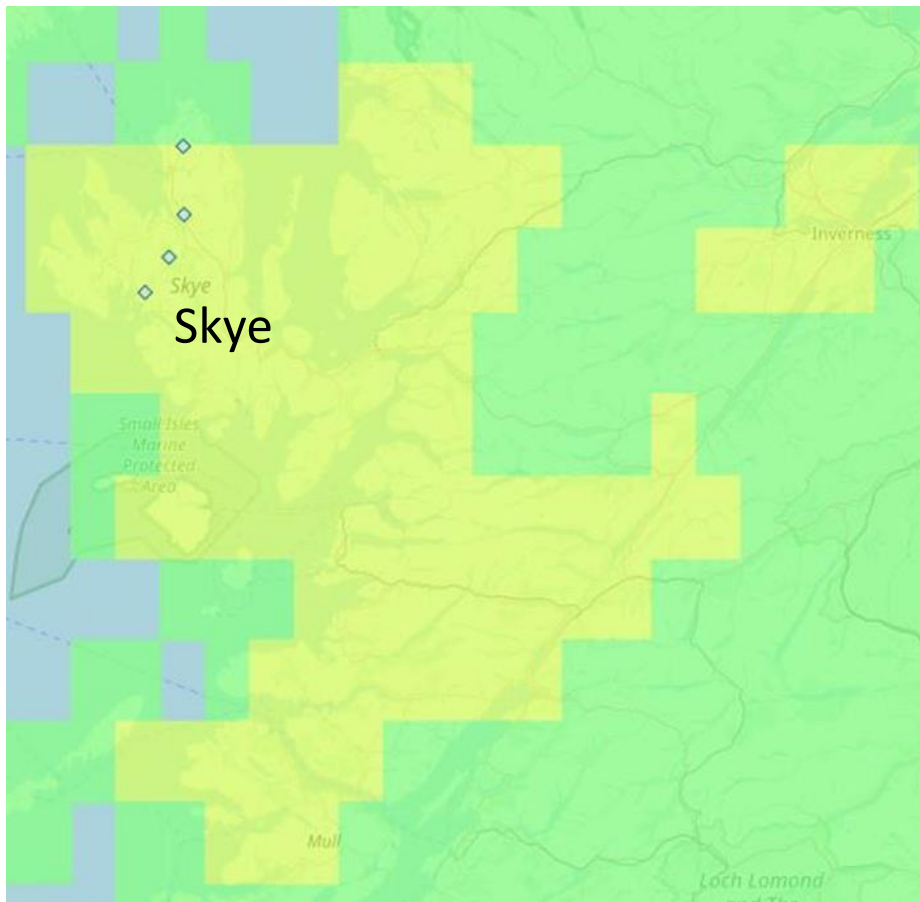
Eire / Northern Ireland



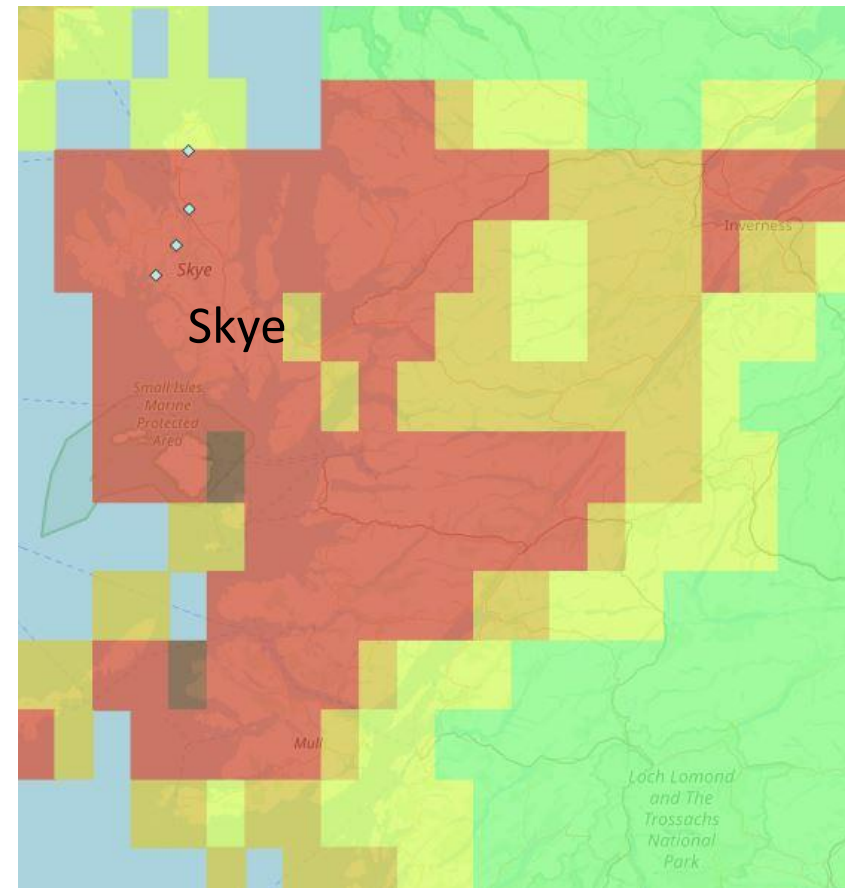
Spate of wildfires Skye 1st – 3rd March 2018

“Beast from the East” (Snow & gales) 1/3/18Wildfires in the West

Fine Fuel Moisture Code (FFMC)



Initial Spread Index (ISI)



Technology transfer, research, validation & adaptation

- Understand the strengths & weaknesses Canadian FWI system - fully.
- Understand UK fuels and their relationship with seasons & weather
- Fuel type analysis, fuel moisture, fire tests, and case studies of well documented prescribed burns and wildfires
- Compare fire records and statistics with index values
- Calibrate FDRS & develop appropriate fire danger classes & descriptors
- Establish collaborative support mechanisms/feedback with wildfire / prescribed burning communities/fire researchers
- Develop communication systems to reach target audiences

FDRS in Scotland – the future

- Short term - continue to improve communication of wildfire danger assessments and messages to target audiences
- Medium term - Scottish Government wildfire research project 2019 – 2021
- Aim: To calibrate a Scottish Fire Danger Rating system:
- Consortium
 - James Hutton Institute (Aberdeen)
 - Fire Engineering Dept Edinburgh University
 - Ohio University (Dr Matt Davies)
 - Firebreak Services Ltd
- Collaborate with FDRS progress in Northern Ireland, Wales and England