bushfire CRC

ADVANCING WILDFIRE RISK MANAGEMENT PRACTICES FOR THE HIGH COUNTRY

HighFire Risk

Rick McRae
ACT Emergency Services Agency
Jason Sharples
University of New South Wales at the Australian Defence Force Academy
Rod Weber
University of New South Wales at the Australian Defence Force Academy

HighFire Risk Project

KEY ISSUES

bushfire CRC

7) A solid understanding of the risks from wildfire in and around the high country must take into account the factors recognised by our studies.

HighFire Risk Project

KEY ISSUES

bushfire CRC

8) During wildfires, it is important that observers are able to correctly identify the features of these phenomena, to allow rapid and appropriate responses.


HighFire Risk Project
KEY ISSUES
bushfire CRC
9) Better decision-support tools can be developed to support bushfire operations.

Earliest instance of officer happy to measure weather (1992) [Photo: McRae]

2 burns, 2 winds [Photo: McRae]

HighFire Risk Project

bushfire CRC

- *If things are "mild"* handle weather as usual, *otherwise* get smart. Look for discrete events that can cause rapid changes. Observers, and the staff they report to, must know what to look for and how to react.

HighFire Risk Project

Memory Jogger

bushfire CRC

- Weather: stay informed
- Actions: must be based on fire behaviour
- Try out: escape routes
- Communications: maintained
- Hazards: heavy fine fuels and steep slopes
- Observe changes: in weather
- Understand: your instructions
- Think clearly, be alert

Specific Watchouts (ACT)

3. The wind changes speed or direction
4. The weather gets hotter or drier
8. Unfamiliar with weather and local fire behaviour
9. Frequent spot fires occur over your control line
17. The potential of the fire has not been assessed

Channelling event, 26 Jan 2003 [Image: Customs]

HighFire Risk Project

bushfire CRC

1 Highly significant observation, requiring immediate reporting

2 Significant observation, requiring immediate reporting

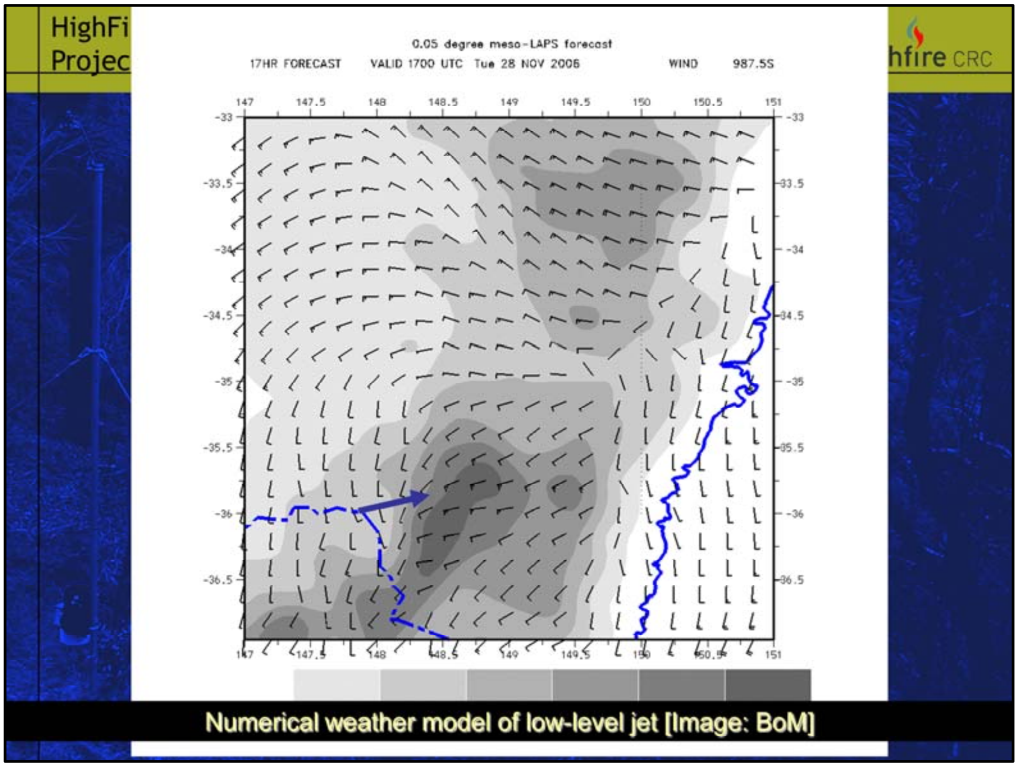
3 Significant observation, requiring immediate verification and reporting

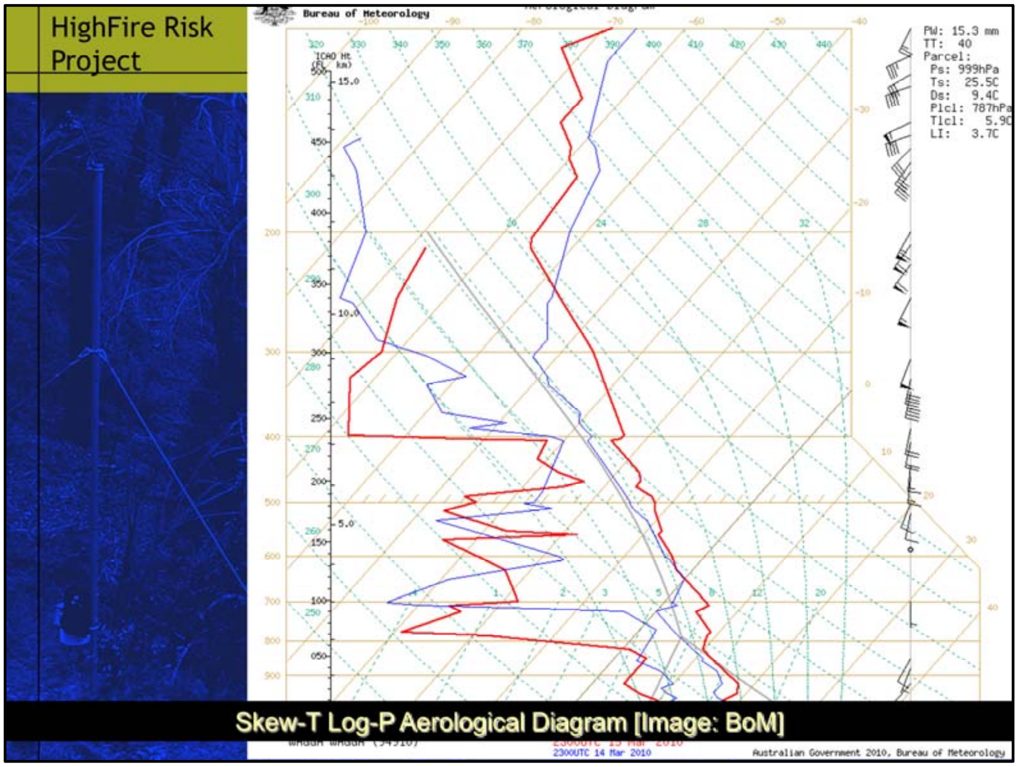
? Observation requiring verification

bushfire CRC

- Dynamic channelling
- Deep flaming zone
- Violent pyro-convection
- Mountain wind waves
- Foehn winds
- Low-level jet
- Wind change at fire
- Nocturnal dew point depression event
- Abrupt surface drying
- Eruptive fire growth
- Thermal belt
- Convergence zone

- Plume-driven fire
- Conditions conducive to plume-driven fire
- Passage of dry slot over fire
- Thunderstorm
- Wind change
- Channelling event
- Dew point depression event
- Foehn wind
- Unusual combustion
- Intense spotting


HighFi
Projec
hfire CRC
0.05 degree meso-LAPS forecast
17HR FORECAST VALID 1700 UTC Tue 28 NOV 2006 WIND 987.5S
Numerical weather model of low-level jet [Image: BoM]


HighFire Risk Project
Bureau of Meteorology
PW: 15.3 mm
TT: 40
Parcel:
Ps: 999hPa
Ts: 25.5C
Ds: 9.4C
Plcl: 787hPa
Tlcl: 5.9C
LI: 3.7C
2300UTC 14 Mar 2010
Australian Government 2010, Bureau of Meteorology
Skew-T Log-P Aerological Diagram [Image: BoM]

Project

bushfire CRC

HighFire Risk Project

AERODOLOGICAL DIAGRAM ANALYSIS

Version 1.1 - January 2010. For operational use with care.
This Web Page contains JavaScript. There may be unforeseen errors on some browsers
Note that it is pre-loaded with sample data to prevent errors if the "CALCULATE" button is pressed.
Always enter current data. When you have finished, print the browser page for a record.
Explanatory material on Aerological Diagrams is available.
Please make yourself familiar with this before using this page.

Locality:	Wagga	Download recent data from Wagga	
Date - Time:		*Check carefully that the Chart is still valid.*	
T500	-12	Lifted T@500	-7
T700	5		
T850	17	TD850 -5	Mixing Depth (km) 1.5
T Surface	31	TD Surface 15	Wind Speed Surface (km/hr) 12
[T=Temperature(°C)]		[TD=Dew Point Temperature (°C)]	Drought Factor (0 to 10) 10

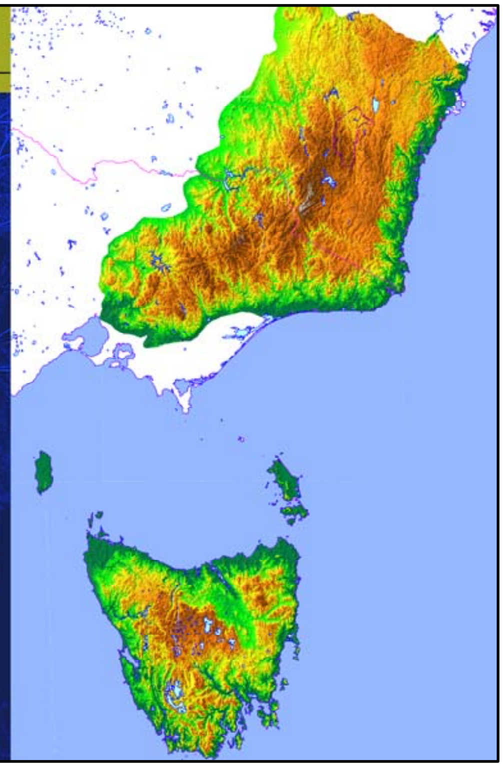
CALCULATE

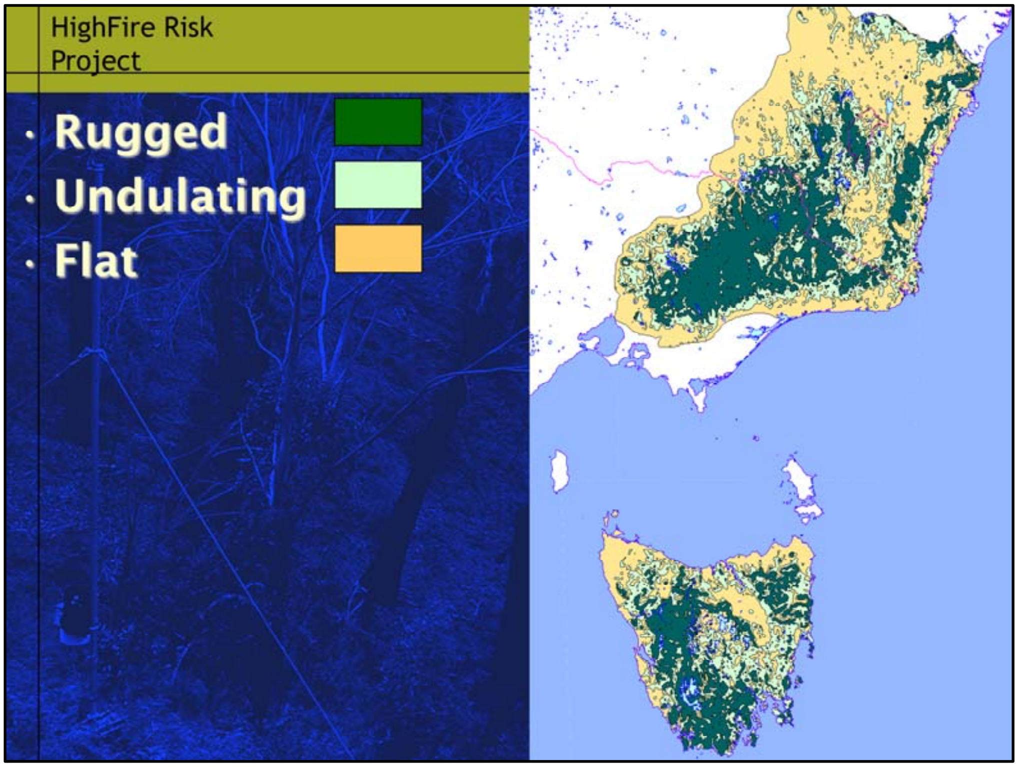
DERIVED OUTPUTS...

Ventilation Index...	5000 ... Fair to marginal
Lifted Index...	-5 ... Unstable, thunderstorms likely, some severe with lifting mechanism
Dry storm potential...	1 ... Dry storms likely
Mid-Level Haines Index...	6 [Tpart= 3] [DPpart= 3] ... High fire growth potential
Continuous Haines Index...	10.3 [Tpart= 4] [DPpart= 6.3]
Fuel Moisture Content...	6.5% ... Fuel Dry: HRBs difficult, wildfires can occur
Fire Danger Index...	13 ... High

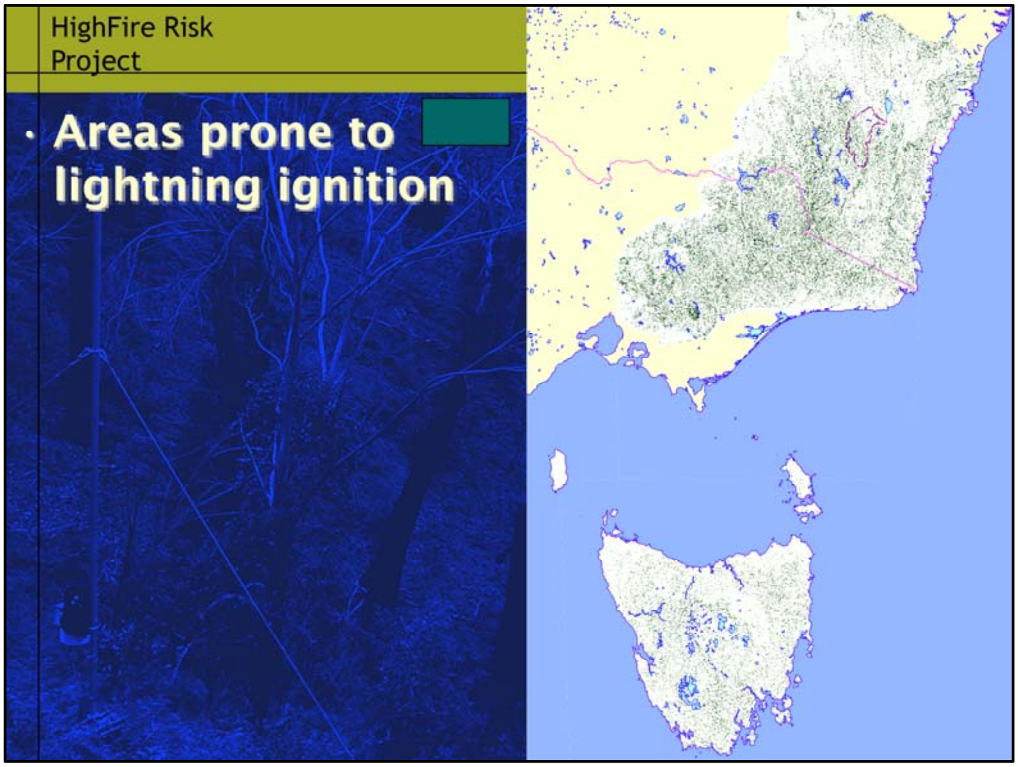
HighFire Risk
Project

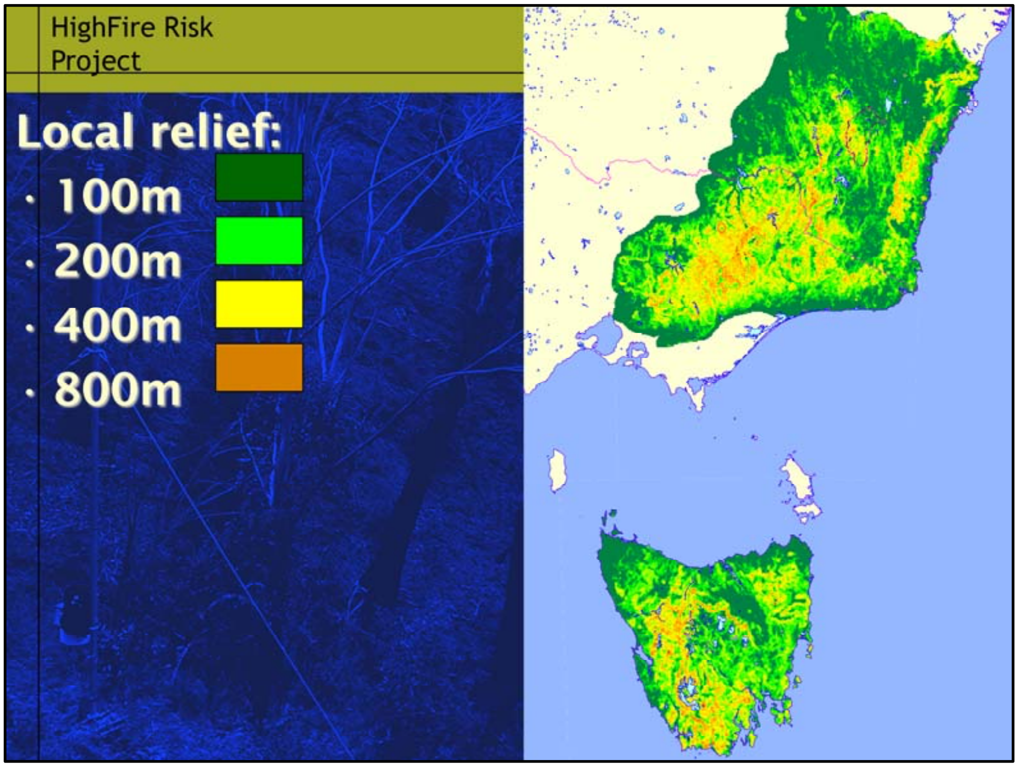
- **Elevation**





HighFire Risk Project
Rugged
Undulating
Flat


HighFire Risk
Project
· Areas prone to lightning ignition


HighFire Risk
Project
Local relief:
· 100m
· 200m
· 400m
· 800m

HighFire Risk Project

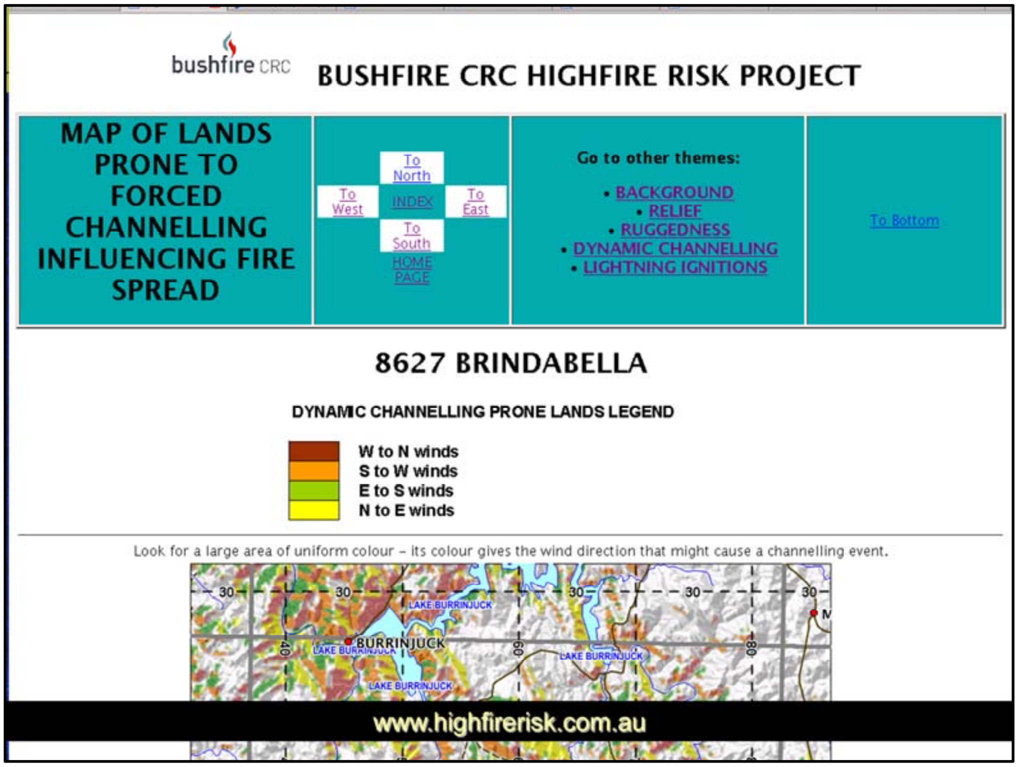
SCALE OF FIRE:

Small **Medium**	There is no real need for fire modelling. Ops will handle this based on the Fire Weather Forecast and the initial SitRep.	
Large **Very large**	This is where fire modelling is most important.	Refer to FlowChart B →
Plume-driven	Fire modelling is not of use here[1]. Take these steps *in lieu*:	1. Obtain an aerological diagram / met advice / field observations on the direction of the upper winds driving the plume. 2. Planning Officer must advise OpsO that this is a Red Flag condition and incident objectives are to be immediately re-evaluated. 3. Call in a technical expert to assist if required.

SPECIES OF FIRE:

Flat	Use at least one of: (a) Use a paper-based or spreadsheet model to predict a wind-driven, elliptical fire. Get ROS from suitable model[1]. Assess lateral spread from Pasquill's Index[2]. Predict forward spotting distance. (b) Use a computerised isochrone fire spread model to indicate where the fire might reach at future times[3]. (c) Use the fire vector model to indicate the pattern of fire spread from its origin[4].	
Undulating	Here the goal is to adequately assess: 1. the uphill runs, and the potential for advance spotting 2. downhill runs, and the potential for suppression[5]. 3. key wind / terrain interactions and the potential fior erratic fire behaviour[6]. 4. Prediction of likely arrival times at threatened assets.	Ensure at all times that weather observations have the fire within their radius of relevance. Assess potential for discontinuous fire behaviour[7]: 1. dew point depression events 2. forced channelling events 3. abrupt surface dryings 4. low-level jets 5. foehn winds 6. wind changes 7. thunderstorms
Rugged	As the fire has already escalated, it is likely to be difficult to predict or suppress.	Goals: 1. Model as per an undulating fire. 2. Outline extent of downwind rugged landscape and add 5 km on downwind edge. This is the threatened area. 3. Assess potential for plume-driven fire to occur based on strong convection, channelling or wind changes

What is the risk of ecological impact? [Photo: McRae]


bushfire CRC
BUSHFIRE CRC HIGHFIRE RISK PROJECT
MAP OF LANDS PRONE TO FORCED CHANNELLING INFLUENCING FIRE SPREAD
To North
To West
INDEX
To East
To South
HOME PAGE
Go to other themes:
• BACKGROUND
• RELIEF
• RUGGEDNESS
• DYNAMIC CHANNELLING
• LIGHTNING IGNITIONS
To Bottom
8627 BRINDABELLA
DYNAMIC CHANNELLING PRONE LANDS LEGEND
W to N winds
S to W winds
E to S winds
N to E winds
Look for a large area of uniform colour – its colour gives the wind direction that might cause a channelling event.
LAKE BURRINJUCK
BURRINJUCK
www.highfirerisk.com.au

Environmental Modelling & Software 24 (2009) 764–774

Contents lists available at ScienceDirect

Environmental Modelling & Software

journal homepage: www.elsevier.com/locate/envsoft

A simple index for assessing fire danger rating

J.J. Sharples [a,b,*], R.H.D. McRae [b,c], R.O. Weber [a,b], A.M. Gill [b,d]

[a] School of Physical, Environmental and Mathematical Sciences, University of New South Wales at the Australian Defence Force Academy, Canberra, ACT 2600, Australia
[b] Bushfire Cooperative Research Centre, Level 5, 340 Albert St. East Melbourne, VIC 3002, Australia
[c] ACT Emergency Services Agency, Curtin, ACT 2605, Australia
[d] Fenner School of Environment and Society, The Australian National University, Canberra, ACT 0200, Australia

ARTICLE INFO

Article history:
Received 4 June 2008
Received in revised form
10 November 2008
Accepted 16 November 2008
Available online 20 December 2008

Keywords:
Fire danger rating
Fire danger index
Bushfire weather
Bushfire management

ABSTRACT

Fire danger rating systems are used to assess the potential for bushfire occurrence, fire spread and difficulty of fire suppression. Typically, fire danger rating systems combine meteorological information with estimates of the moisture content of the fuel to produce a fire danger index. Fire danger indices are used to declare fire bans and to schedule prescribed burns, among other applications. In this paper a simple fire danger index *F* that is intuitive and easy to calculate is introduced and compared to a number of fire danger indices pertaining to different fuel types that are used in an operational setting in Australia and the United States. The comparisons suggest that *F* provides a plausible measure of fire danger rating and that it may be a useful pedagogical tool in the context of fire danger and fire weather.

A published paper

Fire danger is a broad concept that incorporates a multitude of … In particular, the potential for the occurrence and development fire knowledge NETWORK | bushfire CRC

PROGRAM B – Project B6.3

WIND-TERRAIN EFFECTS ON RUGGED LANDSCAPE FIRE PROPAGATION: LEE-SLOPE CHANNELLING

J.J Sharples, R.O Weber
School of Physical, Environmental and Mathematical Sciences, University of New South Wales at the Australian Defence Force Academy
R.H.D McRae
A.C.T Emergency Services Agency

Background

Analyses of line-scan data collected during the 2003 fires have shown that some interesting and unusual fire behaviour can occur along incised valleys and steep lee slopes that are aligned almost perpendicular to the wind. In particular, a number of significant events west of Canberra on the 18th of January have been noted. Typically, and with reference to Figure 1, these types of events are characterised by:

1. Rapid lateral propagation of the flank along the valley or slope
2. Downwind extension of the flaming zone of 3-5 km with uniform spectral signature in the imagery
3. The upwind edge of the flaming zone is constrained by a major break in topographic slope
4. One edge of the flaming zone is aligned with the main wind

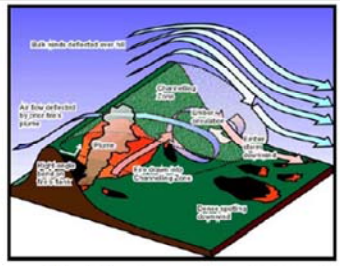
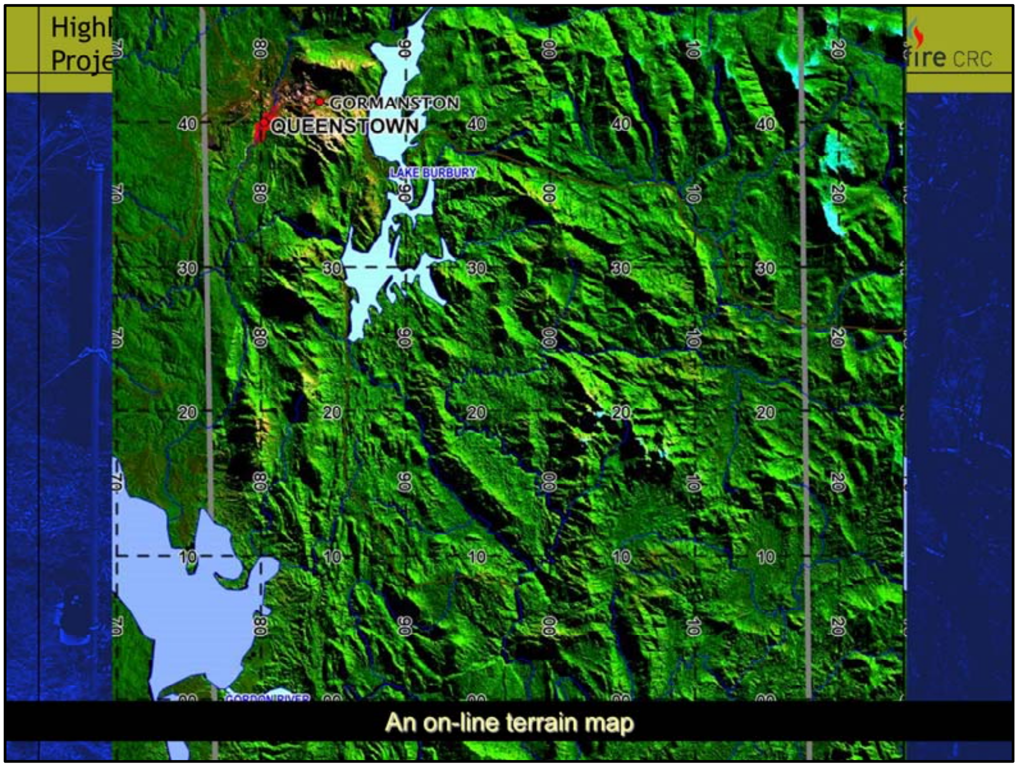
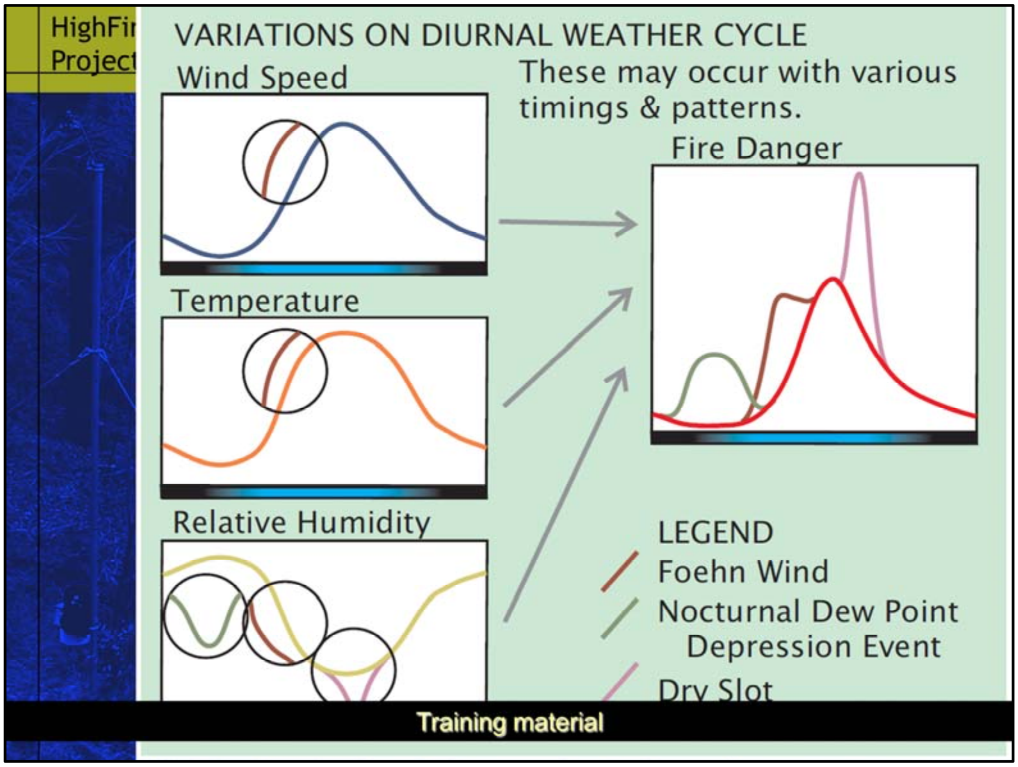


Figure 2. Illustration of a conceptual model for lee-slope channelling

Analysis of Field Data

A CRC Conference Poster


Highl
Proje
fire CRC
GORMANSTON
QUEENSTOWN
LAKE BURBURY
An on-line terrain map


HighFi
Project
VARIATIONS ON DIURNAL WEATHER CYCLE
Wind Speed
These may occur with various timings & patterns.
Fire Danger
Temperature
Relative Humidity
LEGEND
Foehn Wind
Nocturnal Dew Point Depression Event
Dry Slot
Training material

Event (2): Fire flank follows dog-leg around lee-slope

Air Observer

In this photo the wind is blowing strongly away from the camera. The Blue Range is in the middle ground, with Uriarra Pin
background. In the lee slope of the Blue Range a channelling event is driving the fire to the right. Note the intense convec
the more whispy smoke on the left-hand edge of the photo.

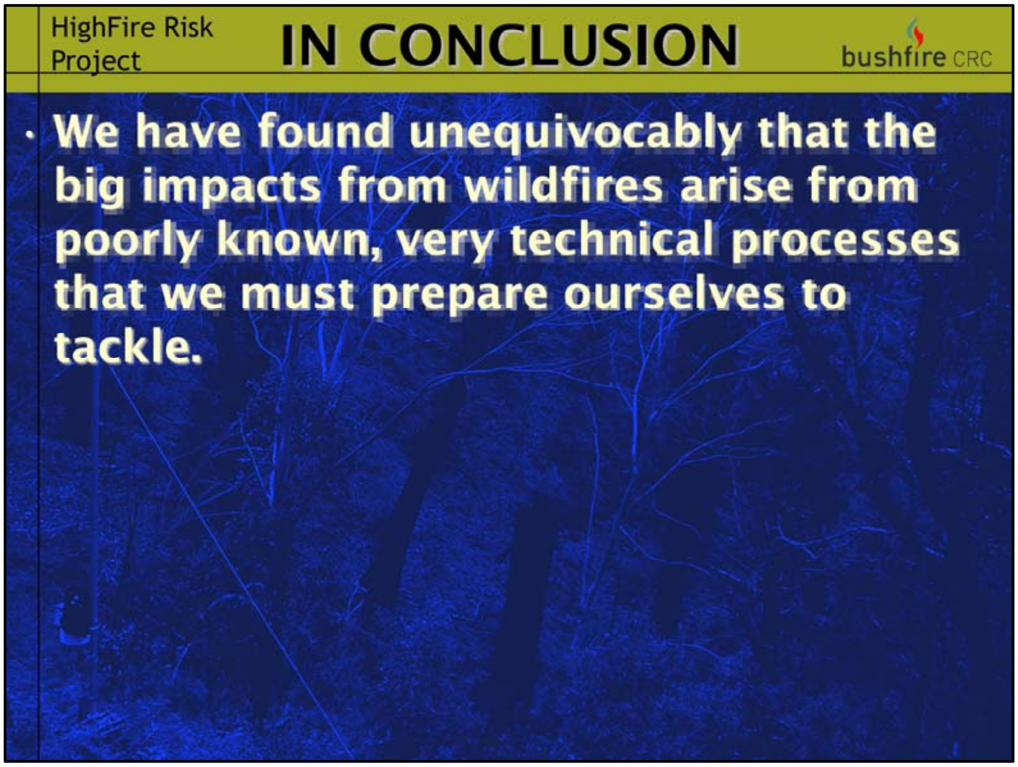
The fire edge moves away from the camera (in the lower-left corner), then makes a right-angle turn to move the the right
right-angle turn to move away from the camera again. This dog-leg configuration is diagnostic.

If observed again in, say, ten minutes, the edge moving away from the camera would have moved to the right, while the ec
still be anchored to the top of the slope.

Implications

Part of an operational guide for field observers

Dynamic channelling	3	6) Channelling event


HighFire Risk Project
IN CONCLUSION
bushfire CRC
We have found unequivocably that the big impacts from wildfires arise from poorly known, very technical processes that we must prepare ourselves to tackle.

HighFire Risk Project

bushfire CRC

- Collectively we must have a pool of specialists able to interpret the three-dimensional atmosphere and its interactions with the terrain and any real of hypothetical escalated fire burning on it.

HighFire Risk Project

ACKNOWLEDGEMENTS

Bushfire CRC

- Graham Mills, CAWCR
- Stephen Wilkes and Kelly Edwards for allowing use of their photographs
- AMOS2010 conference and session organisers
- Bushfire CRC
- HighFire Program
- Project collaborators
- HighFire Risk Steering Committee
- Bureau of Meteorology
- School of PEMS Mechanical and Electrical Workshops
- ACT Emergency Services Agency
- NSW National Parks and Wildlife Service
- ACT Territory and Municipal Services
- Tasmanian Fire Service
- Geoscience Australia
- Department of Sustainability and Environment, Victoria.
- Prof. John Dold, University of Manchester
- Prof. Domingos Viegas, University of Coimbra

HighFire Risk
Project

bushfire CRC

- **Questions?**

Remember to visit:

http://www.highfirerisk.com.au/