ADVANCING WILDFIRE RISK MANAGEMENT PRACTICES FOR THE HIGH COUNTRY

HighFire Risk

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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.
<table>
<thead>
<tr>
<th>Key Issues</th>
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<tbody>
<tr>
<td><strong>8)</strong> During wildfires, it is important that observers are able to correctly identify the features of these phenomena, to allow rapid and appropriate responses.</td>
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<tr>
<td>KEY ISSUES</td>
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<td><strong>9) Better decision-support tools can be developed to support bushfire operations.</strong></td>
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</table>
Earliest instance of officer happy to measure weather (1992) [Photo: McRae]
- *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.
<table>
<thead>
<tr>
<th>HighFire Risk Project</th>
<th>Memory Jogger</th>
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<tbody>
<tr>
<td><strong>Weather:</strong> stay informed</td>
<td></td>
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<tr>
<td><strong>Actions:</strong> must be based on fire behaviour</td>
<td></td>
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<tr>
<td><strong>Try out:</strong> escape routes</td>
<td></td>
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<td><strong>Communications:</strong> maintained</td>
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<tr>
<td><strong>Hazards:</strong> heavy fine fuels and steep slopes</td>
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<tr>
<td><strong>Observe changes:</strong> in weather</td>
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<tr>
<td><strong>Understand:</strong> your instructions</td>
<td></td>
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<tr>
<td><strong>Think clearly, be alert</strong></td>
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</tbody>
</table>
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
Would you know how to react to this?

Channelling event, 26 Jan 2003 [Image: Customs]
1 Highly significant observation, requiring immediate reporting
2 Significant observation, requiring immediate reporting
3 Significant observation, requiring immediate verification and reporting
? Observation requiring verification
- 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
Skew-T Log-P Aerological Diagram [Image: BoM]
**AEREOLOGICAL DIAGRAM ANALYSIS**


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.

<table>
<thead>
<tr>
<th>Locality:</th>
<th>Wagga Download recent data from Wagga</th>
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</thead>
<tbody>
<tr>
<td>Date - Time:</td>
<td>Check carefully that the Chart is still valid.</td>
</tr>
<tr>
<td>T500</td>
<td>Lifted T850</td>
</tr>
<tr>
<td>T700</td>
<td></td>
</tr>
<tr>
<td>T850</td>
<td>Mixing Depth (km)</td>
</tr>
<tr>
<td>I Surface</td>
<td>Wind Speed Surface (km/hr)</td>
</tr>
<tr>
<td>[T=Temperature(°C)]</td>
<td>Temperature (°C) Drought Factor (0 to 10)</td>
</tr>
</tbody>
</table>

### DERIVED OUTPUTS...

| Ventilation Index... | 0000 - Poor to marginal |
| Lifting Index...     | 0 - Unstable, thunderstorms likely, some severe with lifting mechanism |
| Dry storm potential... | 1 - Dry storms likely |
| Mid-Level Haines Index... | 6 [Tpaip=3] [Dpaip=3] - High fire growth potential |
| Continuous Haines Index... | 10.3 [Tpaip=4] [Dpaip=6.3] |
| Fuel Moisture Content... | 66% - Fuel Dry HR & BS difficult, wildfires can occur |
| Fire Danger Index...  | 13 - High |

[Calculating button]

[Image of a diagram with numerical data and calculations]

17
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<tr>
<td>• Rugged</td>
</tr>
<tr>
<td>• Undulating</td>
</tr>
<tr>
<td>• Flat</td>
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</table>
HighFire Risk Project

- Areas prone to lightning ignition
Local relief:
- 100m
- 200m
- 400m
- 800m
HighFire Risk Project

**SCALE OF FIRE**
- Small: There is no real need for fire modelling, Ops will handle this based on the Fire Weather Forecast and the initial SIRRep.
- Medium: Large: This is where fire modelling is most important.
- Plume-driven: Fire modelling is not of use here. 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 Ops/0 that this is a Red Flag condition and incident objectives are to be immediately reevaluated.
  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 RRO from suitable model(s).
  (b) Use a computerised plume-based fire model to indicate where the fire might reach at future times.
  (c) Use the tree vector model to indicate the pattern of fire spread from the origin.

- Undulating:
  Here the goal is to ensure that:
  1. The upwind run and the potential for advance spotting.
  2. Downwind run and the potential for suppression.
  3. Key wind / terrain interactions and the potential for vectors, fire behaviour.
  4. Prediction of likely affected areas, threatened assets.

- Rugged:
  As the fire has already escalated, it is likely to be difficult to predict or suppress.

**Goals**
- Model as per an undulating fire.
- Outline extent of downwind rugged landscape and add 5 km on downwind edge. This is the threatened area.
- 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]
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.
A simple index for assessing fire danger rating

J.J. Sharples\textsuperscript{a,b,c}, R.H.D. McRae\textsuperscript{b,c}, R.O. Weber\textsuperscript{a,b}, A.M. Gill\textsuperscript{b,d}

\textsuperscript{a}School of Physical, Environmental and Mathematical Sciences, University of New South Wales, Australia
\textsuperscript{b}Resilient Co-operative Research Centre, Melbourne, Australia
\textsuperscript{c}Defence Science and Technology Organisation, Melbourne, Australia
\textsuperscript{d}Victorian Department of Sustainability and Environment, Melbourne, Australia

\textbf{Abstract}

Fire danger rating systems are used to assess the potential for the occurrence, spread, and difficulty of fire suppression. Typically, fire danger rating systems combine meteorological information and estimates of the moisture content of the fuel to produce a fire danger index. Fire danger indices are used by emergency managers to plan and coordinate the response to fire threats, among other applications. In this paper, a simple fire danger index \( F \) 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 comparison suggests that \( F \) provides a plausible measure of fire danger and that it may be a useful pedagogical tool in the context of fire danger and fire weather.
WIND-TERRAIN EFFECTS ON RUGGED LANDSCAPE FIRE PROPAGATION: LEE-SLOPE CHANNELLING

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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 time-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 characterized by:

1. Rapid lateral propagation of the flame 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

Analysis of field data

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

A CRC Conference Poster
VARIATIONS ON DIURNAL WEATHER CYCLE
These may occur with various timings & patterns.

Wind Speed

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 Uralla River background. In the lee slope of the Blue Range a channelling event is driving the fire to the right. Note the intense convect the more wispy 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 e still be anchored to the top of the slope.

**Implications**

Part of an operational guide for field observers
• We have found unequivocally that the big impacts from wildfires arise from poorly known, very technical processes that we must prepare ourselves to tackle.
Collectively we must have a pool of specialists able to interpret the three-dimensional atmosphere and its interactions with the terrain and any real or hypothetical escalated fire burning on it.
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<tr>
<td><strong>• Graham Mills, CAWCR</strong></td>
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Questions?

Remember to visit: