THE BREATH OF THE DRAGON

- The January 2003 ACT Bushfires

ACKNOWLEDGEMENTS

- Linescans = NSW RFS
- Photographs:
  - NSW RFS
  - Public (off the web)
  - ESB staff
- Weather data from Bureau of Meteorology
- MODIS image from NASA

ENERGY BUDGET, pm 18/1/03

Area burnt in 12 hours	$9.0*10^4$	ha
Fuel loading	$3.0*10^4$	kg/ha
Energy content	$2.0*10^4$	kJ/kg
Fuel consumed	$2.7*10^9$	kg
Energy released	$5.4*10^{13}$	kJ
Blast energy TNT	$4.7*10^3$	kJ/kg
TNT equivalent	$3.5*10^5$	t
Time period	$4.3*10^4$	s
Power	$1.3*10^9$	W
Earthquake equivalent of fire	5.7	M(Richter)
Newcastle earthquake, 10:27, 28/12/1989	5.6	M(Richter)
Average tornado	4.5	M(Richter)
Domestic energy usage	$2.0*10^7$	kJ/person/annum
ACT usage	$6.0*10^{12}$	kJ/annum
ACT usage in 12 hr	$8.2*10^9$	kJ

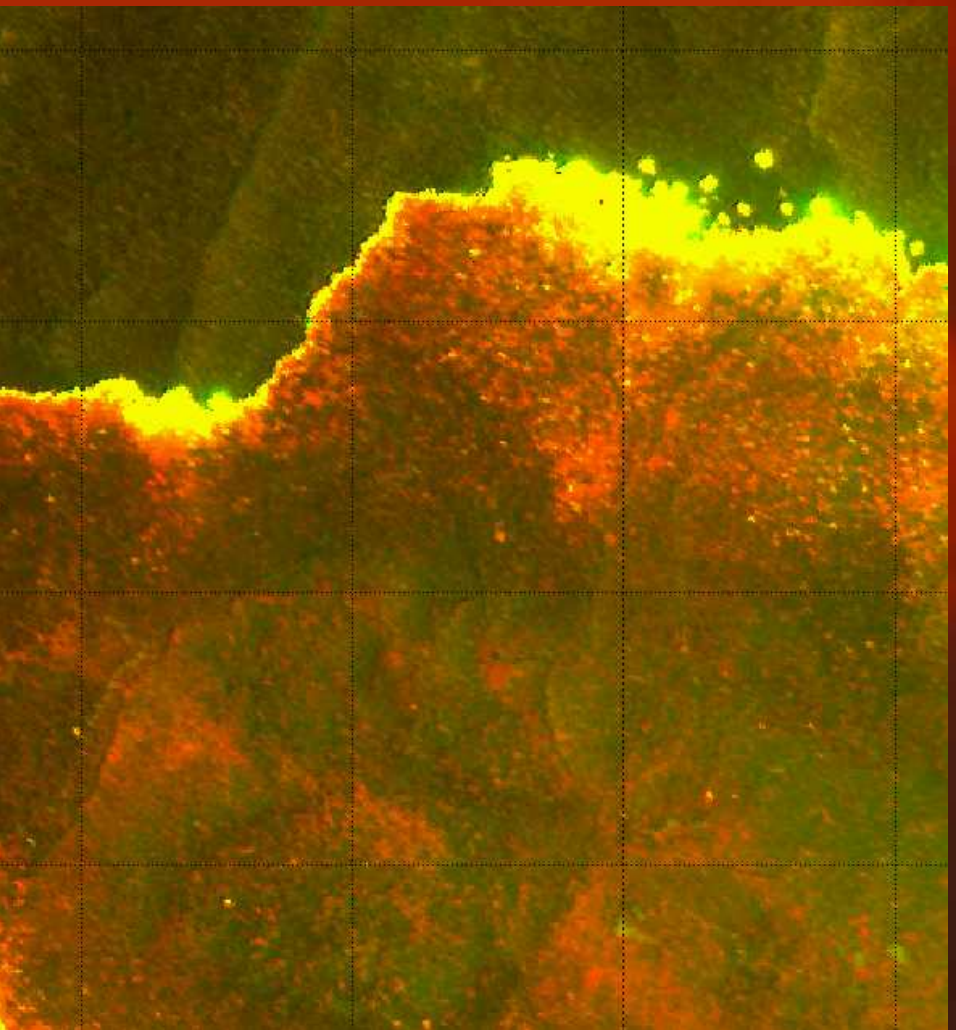
Ratio of fire to ACT domestic energy usage $6.6*10^3$

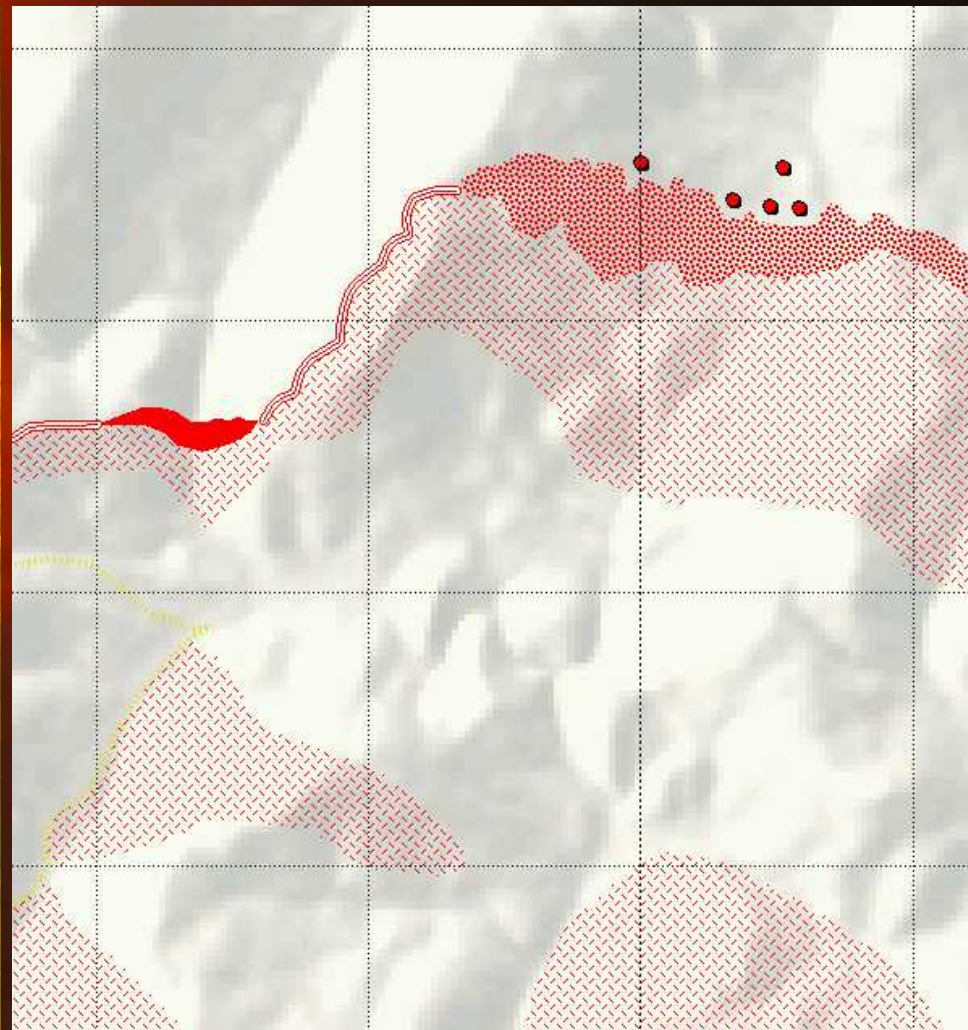
Based on WTNT = c * Wf * Hf / HTNT, where c=0.03

ASYMMETIC WIND/TERRAIN INTERACTION

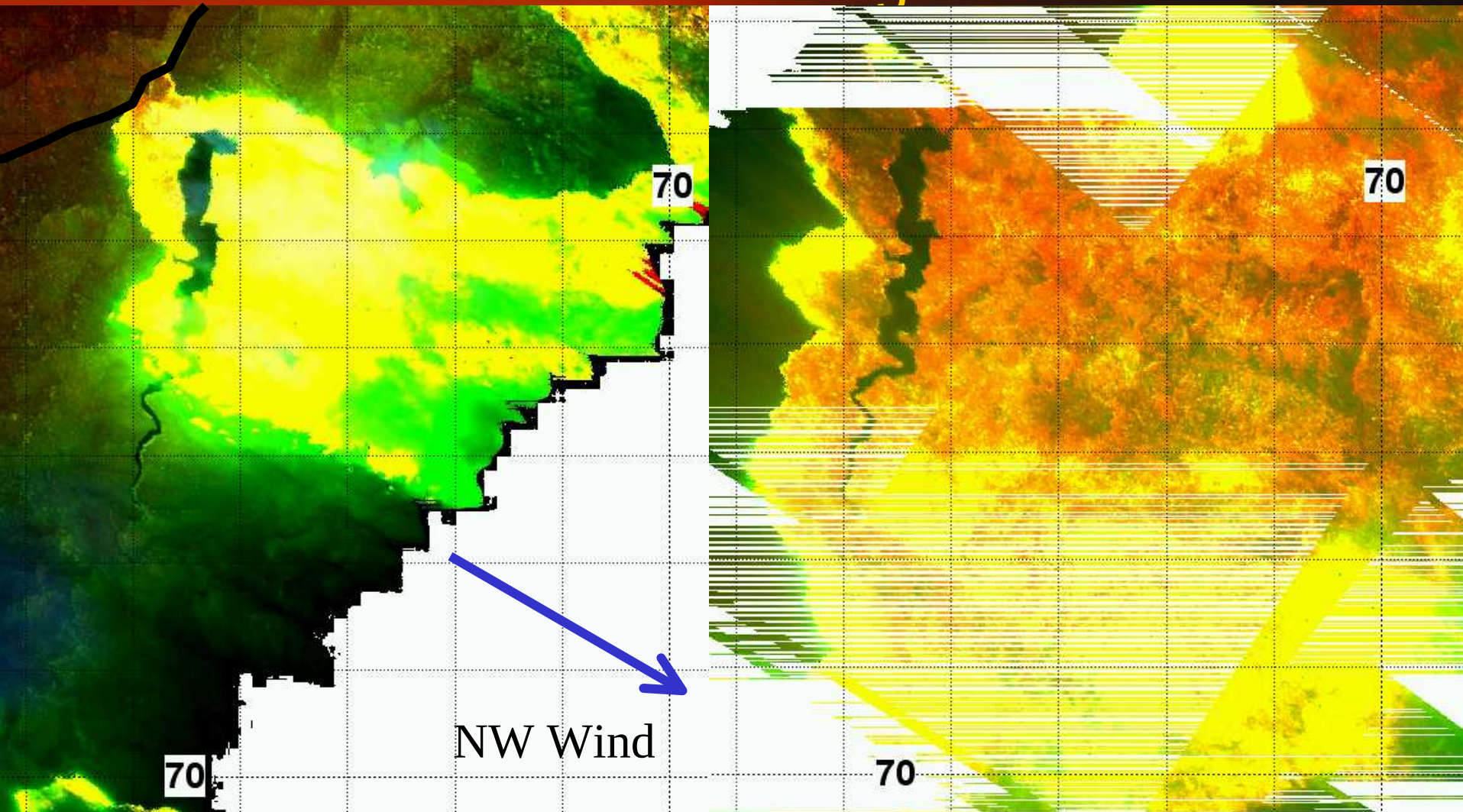
LEE SLOPE CHANNELLING

- Broken Cart Fire, 17/1/03





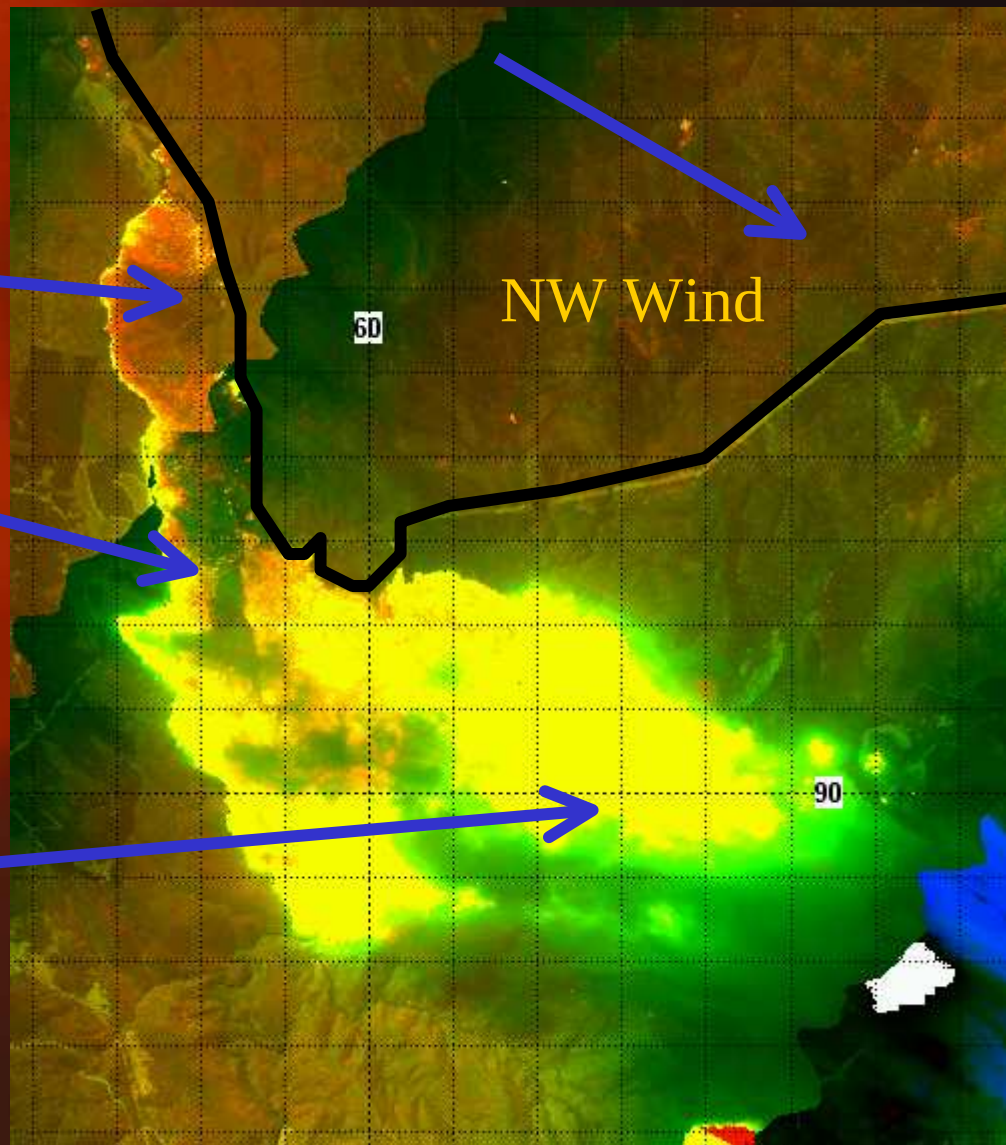
- Bendora Fire, 18/1/03.
- Left = 14:50 Right = 15:40



- Eddy winds of lee-slopes of hills produced lateral [right-angles to wind] push of embers.
- Resulted in lateral flank expansion up to 5 km/hr.
- Fire spills over landscape downwind across entire width.

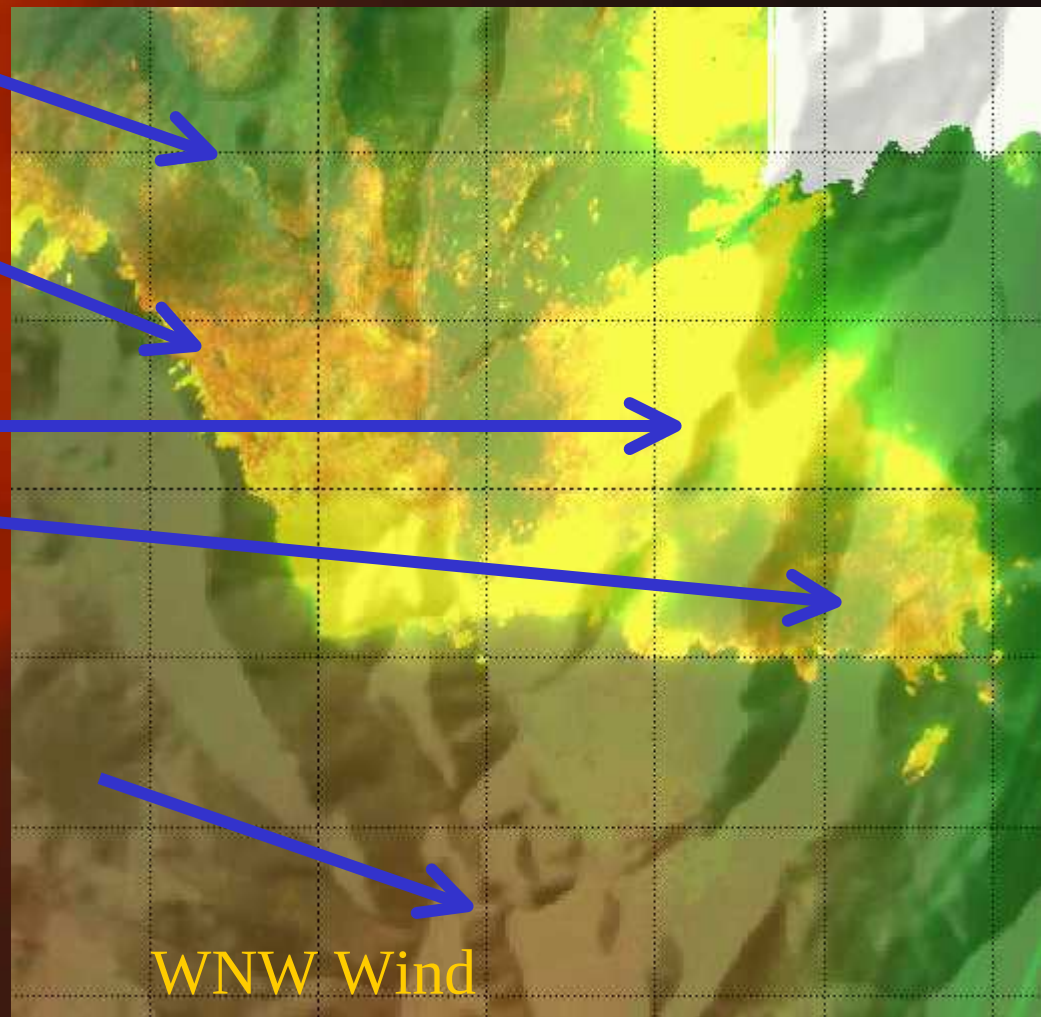
FORCED CHANNELLING [VALLEY BURN-OUTS]

- McIntyres Fire 18/1/03.
- Small initial fire breakout.
- Massive lateral expansion, contained to incised gorge.
- Spill-out over landscape

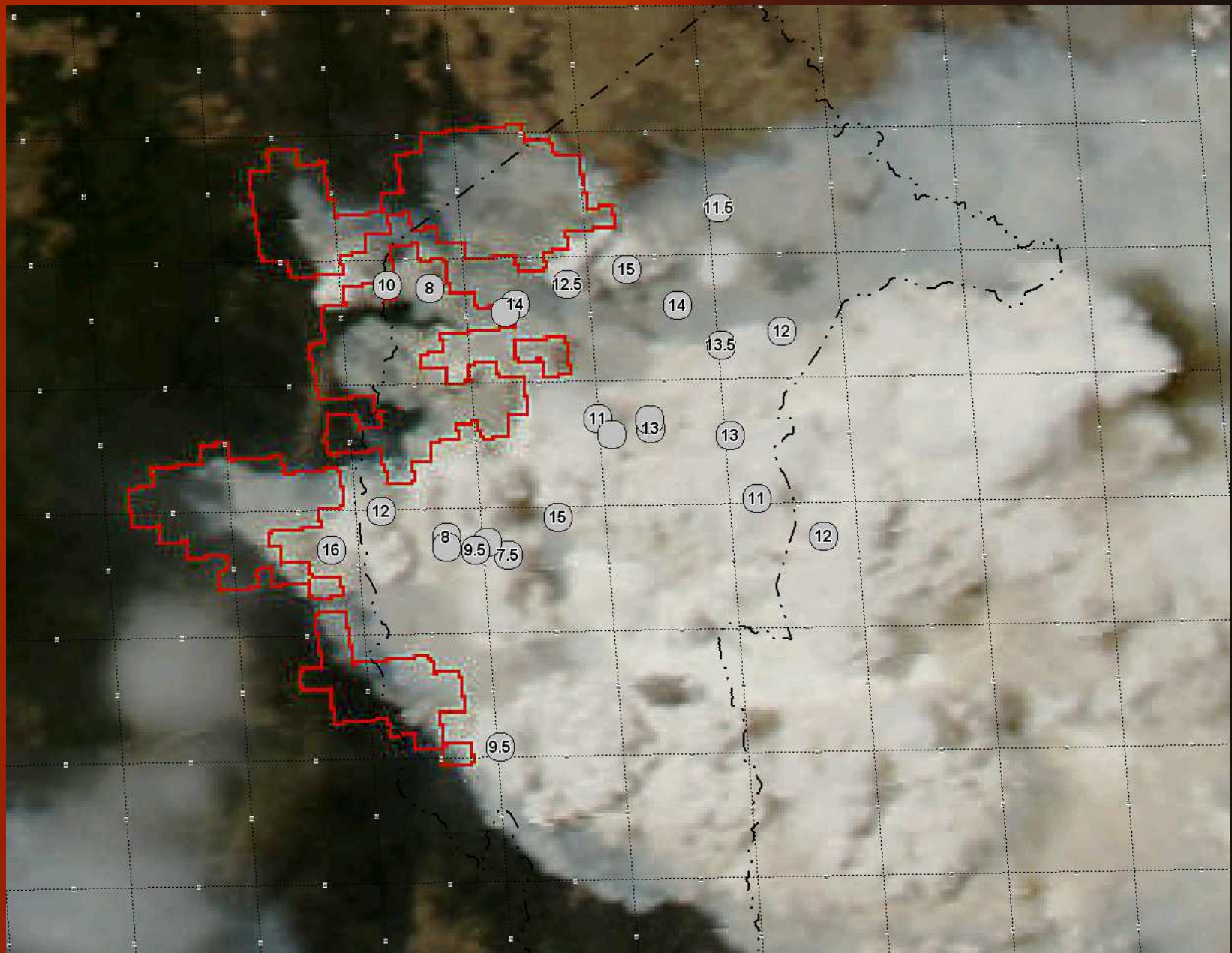


- **Bulk winds blowing over deep valleys are channelled into the valleys.**
- **May also be pressure-driven with opposite effect.**
- **Form a type of “archimedes scew” and push embers rapidly at right-angles to wind.**

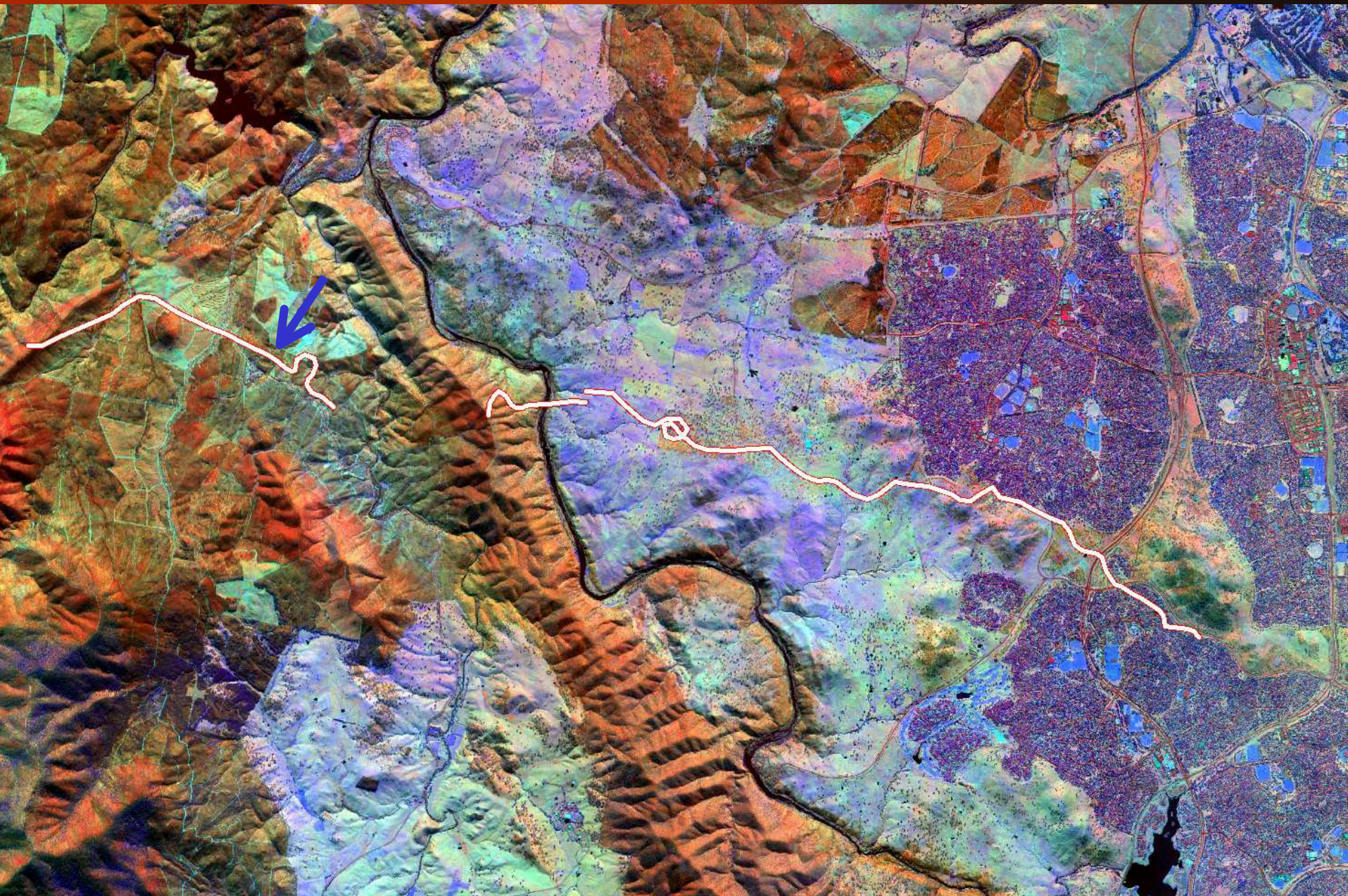
- Stockyard Spur Fire 18/1/03.
- Main run to ESE
- Lee slope channelling to SSE
- Major upslope runs
- Spotting ahead



MODIS IMAGE, 18/1/03 14:30

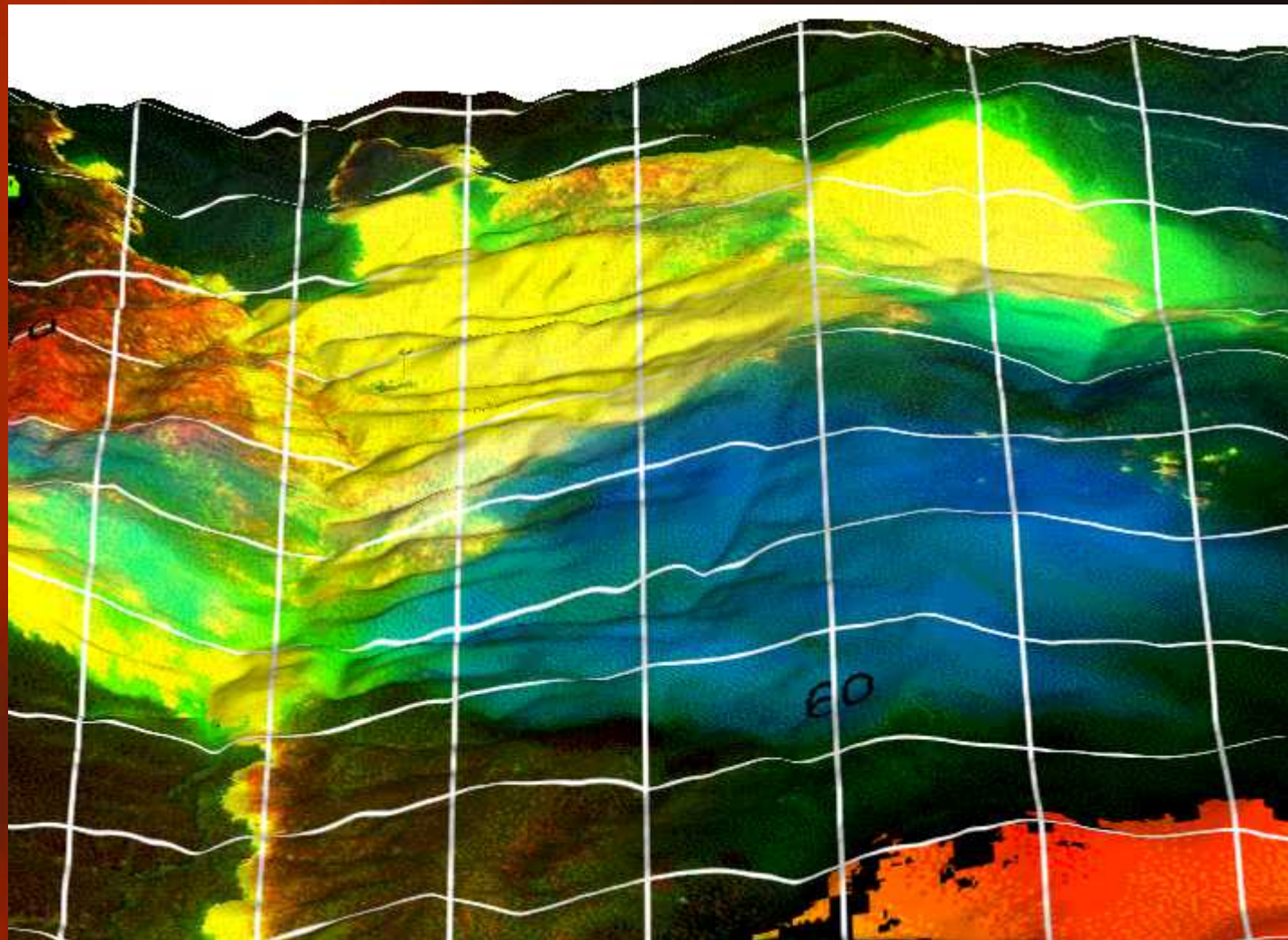


TORNADO PATH



THE VERTICAL KILOMETRE

- **Was the vertical kilometre from Goodradigbee River to Mt Ginini done in one lick?**




18/01/2003 - 1531 hrs


18/01/2003 - 1531 hrs

FUEL

LARGE FUEL

- Grasslands eaten out, carried fire.
- Short-range spots frequent.

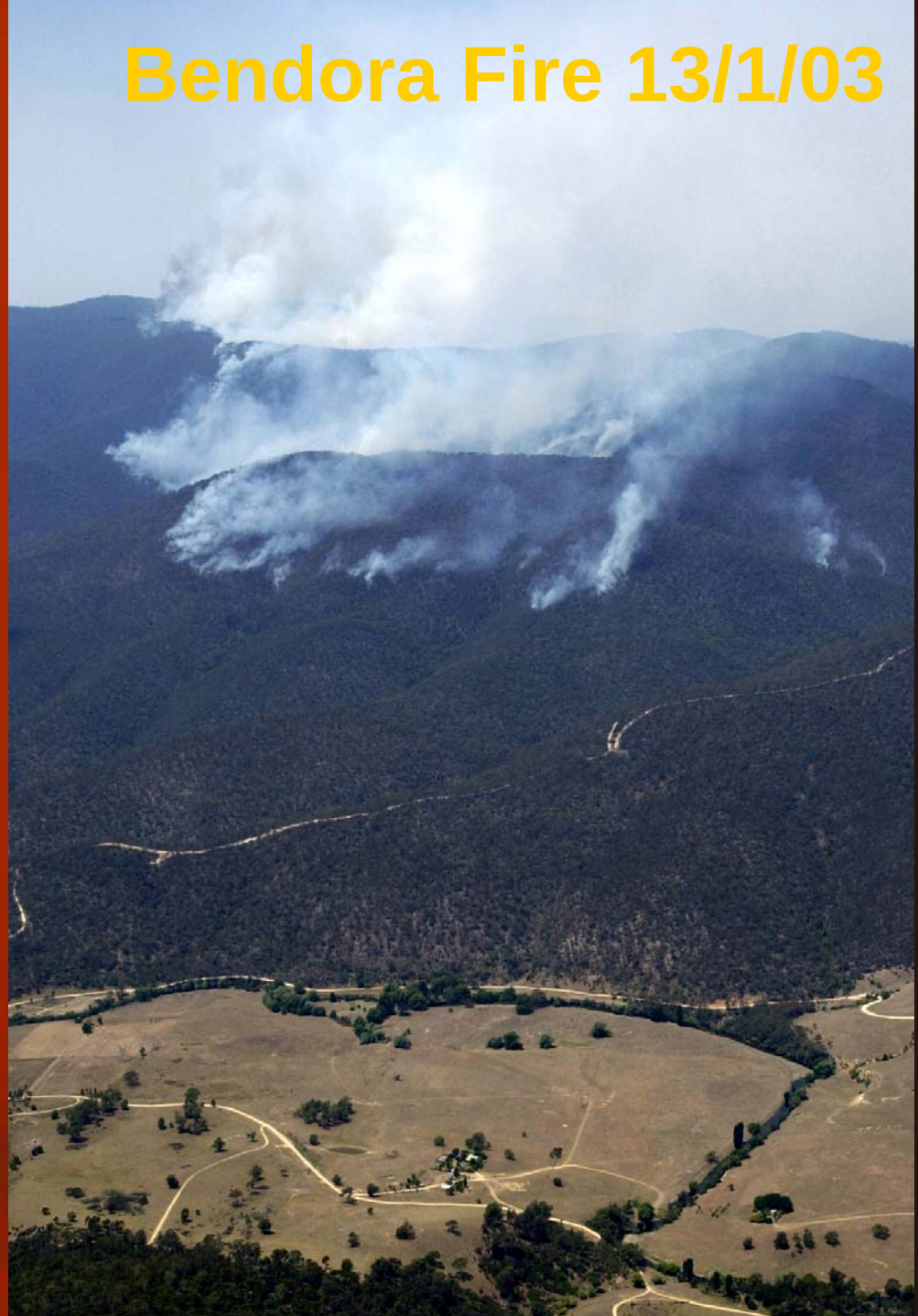
- **Short residence time [7 minutes later…]**
- **Note helicopter**


18/01/2003 - 1433 hrs


18/01/2003 - 1435 hrs

Bendora Fire 9/1/03

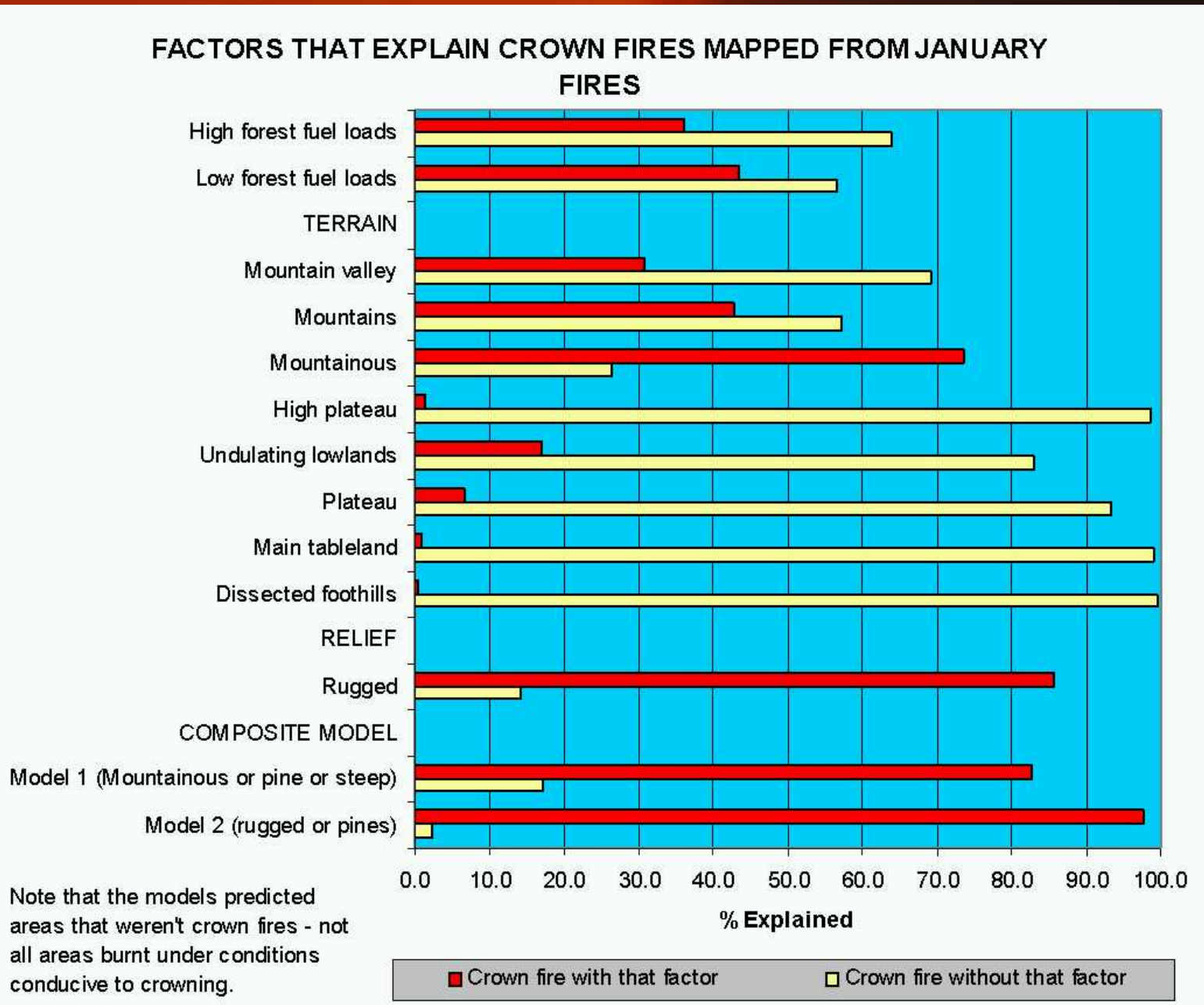
Bendora Fire 13/1/03



Bendora Fire - aftermath

PLUME FIRES

- Previous work – downbursts
- This event:
  - Cumulonimbus clouds to 16 km height
  - F2 tornadoes
  - Lightning
  - No wind-terrain interaction
  - Poorly correlated with fuel



Note that the models predicted areas that weren't crown fires - not all areas burnt under conditions conducive to crowning.

RESEARCH TOPICS

1. Effects of large fuels on fire suppression models and tactics
2. Implications for mountain meteorology on fire management in the vertical parts of Australia
3. Predictive models for development of plume-driven fires

1. LARGE FUELS

- The high level of drought made large downed fuels fully flammable. Reliance on fine-fuel based models caused significant operational difficulties. The switch to new models must proceed as rapidly as possible.

2. MOUNTAIN WEATHER

- Mountainous terrain interacted with wind to produce extraordinary fire behaviour due to two forms of channelling. Firefighting in mountainous areas must be supported by an understanding of these processes. Channelling appears to have aided the formation of plume fires.

3. PLUME FIRES

- Plume-driven fires developed locally in at least 7 instances. They also occurred in adjacent fires in NSW. We do not have the tools to forecast this, and desperately need those tools.