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RURAL FIRE RESEARCH UPDATE
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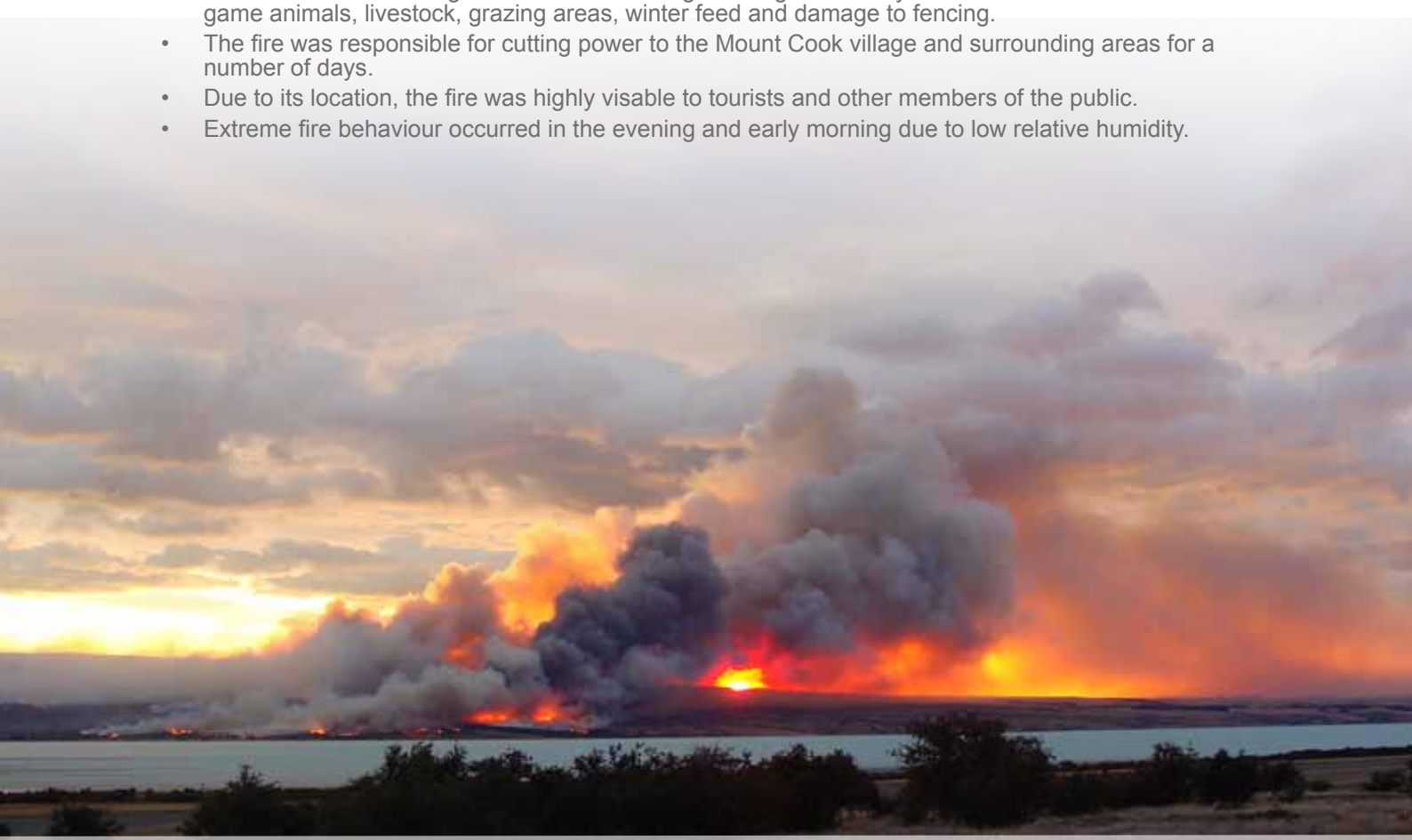
CASE STUDY: Mount Cook Station Fire

On the afternoon of Wednesday, 16 January 2008, a fire began on the eastern side of Lake Pukaki in the Mackenzie Basin, South Canterbury. This fire was started by a hot chainsaw coming into contact with cured grass and it spread upslope into heavily forested areas of wilding pine on rolling and steep terrain. The fire was fanned by strong northwest winds that hampered efforts to bring it under control. Extreme fire behaviour was witnessed during the first 24 hours. At its height, more than 60 personnel fought to contain the 750 ha fire area with a 14 km perimeter. Their efforts, combined with a change in weather, allowed the fire to be contained on 17 January 2008. A review of the fire by Scion revealed some valuable information on fuel hazard and fire behaviour in wilding pines.

Significance:

- This was the largest wildfire for the South Canterbury Rural Fire District in more than a decade.
- The fire burned in dense stands of wilding pines with high fuel loads, then into open grasslands.
- Aerial attack was the preferred option; at its height 11 helicopters fought the blaze.
- The fire was devastating to the owner and neighbouring farm. They suffered loss of numerous game animals, livestock, grazing areas, winter feed and damage to fencing.
- The fire was responsible for cutting power to the Mount Cook village and surrounding areas for a number of days.
- Due to its location, the fire was highly visable to tourists and other members of the public.
- Extreme fire behaviour occurred in the evening and early morning due to low relative humidity.



Photograph: R. McNamara, DOC.

Introduction

The main fire runs and extreme fire behaviour occurred within the first 24 hours. This fire burned mostly in open grasslands and mature wilding pines that had very high fuel loads, resulting in extreme fire behaviour that made suppression difficult and caused threats to life and property. This fire provided a significant learning opportunity, in that little is known about fuel loads and fire behaviour in wilding pines.

This fire was also costly for the South Canterbury rural fire district due to the involvement of a large number of aerial and ground resources. The fire was remote and the terrain was difficult, so aerial attack was the major resource used for suppression. This fire cost about $800,000 but could have easily cost more without the quick response of numerous aerial attacks. The fire threatened neighbouring properties, with an inital fear of it spreading potentially towards the Tekapo Township. Fortunately, no serious accidents or deaths occured in this fire.

Sequence of events

A single point ignition occurred on the eastern side of Lake Pukaki around 1820 hours on Wednesday 16 January 2008 (Map 1). The cause of the fire was heat transfer from a chainsaw coming into contact with 100% cured grass. The first run of the fire was upslope (about 20º) in grass fuels. It then travelled up and across slope with a northwest wind, burning in to dense wilding pines. The head of the fire was observed to have spread 1.6 km by 1940 hours, with intermittent crowning occurring in dense wildings. By 2200 hours, resources were stood down due to poor light.

The night crew observed the fire activity burning overnight and into the early hours of the morning. The fire continued to spread with the northwest winds, and the crew observed the fire 1.4 km from Landslip creek at 0315 hours on 17 January. The fire also back-burned into the wind overnight in the surface layer underneath the wilding pines away from the area of origin. The flank of the fire spread downslope towards the Braemar/Mount Cook roadside into grass and patches of matagouri.

At around 0630 hours, the fire jumped the natural barrier that was Landslip Creek. The fire spotted across the Braemar/Mount Cook Station road into another dense stand of wilding pines. The fire also ran down and up the Landslip Creek gully on the eastern side of the burn area into wilding trees. These two breakouts showed extreme fire behaviour and caused numerous spot fires ahead of the main fire between Landslip Creek and Pleasant Valley. By 0800 hours, resources were able to control the fire as it burned into a grazed paddock.

At its height, more than 60 personnel, 11 helicopters and 1 fixed wing aircraft fought to contain the blaze. Their efforts, combined with a change in weather and fuels, allowed the fire to be contained on the third day and resources to be scaled down. The fire area had encompassed 756 ha with a 14 km perimeter. Prolonged mop-up occurred over the following days and by the seventh day significant rain had fallen and extinguished any remaining hotspots. The fire was officially declared out 25 days after ignition on 9 February 2008.

Photographs: (left) R. Gardner, Mackenzie DC, (center & right) J. McCaughans, Aorangi Rural Fire Team.

Fire environment

Topography

The topography of the fire area was characterised by moderately steep terrain. The fire spread up and across rolling slopes and a series of terraces. These slopes were around 15 - 20 º. The steep terrain, in combination with the heavy fuels, made vehicle access difficult for ground crews.

There were few major barriers to fire spread, these being Lake Pukaki, the Braemar/Mt Cook Station Road, old earth breaks along fence lines within the fire area, and the streambed of Landslip Creek.

Fuels

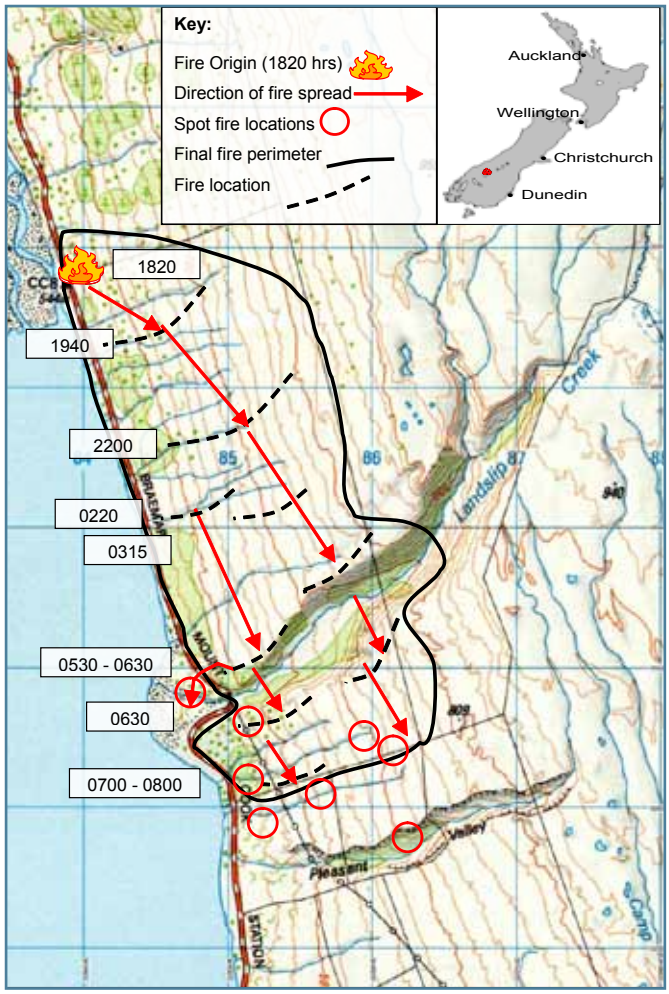
The major factors affecting fire behaviour were changes in fuel types, variability in fuel continuity and structure, and high levels of available fuels.

Fuels covering the fire area were predominately wilding pines of various ages and density and open grasslands. Other fuels involved in the fire were scattered patches of scrub (matagouri), tussock and bracken fern.

Weather

The Mt Cook Station fire originated within 20 km of three fire weather stations: Mount Cook, Tekapo and Pukaki RAWS. Several local rain gauges were located nearby, the closest at Braemar 9 km away.

The Tekapo RAWS was considered to best reflect the weather conditions during the fire, with rainfall readings from the Braemar rain gauge used to analyse the fire weather leading up to and during the fire.



Map1. Location of point of ignition, fire runs and final perimeter (Source: MapToaster Topo, NZMS 260 Sheet H37, scale 1:32,250 approx.).

Fire Weather

From November 2007 there were few significant rainfall events, so that fuels progressively dried out over the months leading up to the fire (Figure 1). The daily fire weather indices on the day were very high (FFMC 93, DMC 103, DC 432, ISI 11, BUI 129 & FWI 37).

The fire occured under strong northwest winds ahead of a cold front passage, with high temperatures and low relative humidity (Figures 2 & 3). Around the time of ignition (1830 hours), the hourly FWI readings were extreme (FFMC 94, ISI 63 and FWI 108) and remained so during the main fire runs (Figure 4). As a result, the fire exhibited high intensity runs in the wilding pines.

Fire behaviour

Observations

Observed rates of fire spread for the main fire runs were generally between 400 – 600 m/h over the first 24 hours. However, there were periods where rates of spread were higher, particularly when the fire breached Landslip Creek around 0630 hours on day two and a major run occured (800 – 1200 m/h).

Predictions

The Ungrazed Pasture model[1] was used to predict rate of spread in the grassland fuels. For the wilding pine fuels, the Mature (20 + yeares) and Immature (11-20 years) Pine Plantation models[1] were used (in the absence of any specific models for wilding pines).

All three models predicted significantly higher spread rates and intensities than those observed during the fire, especially when slope effects were also included.

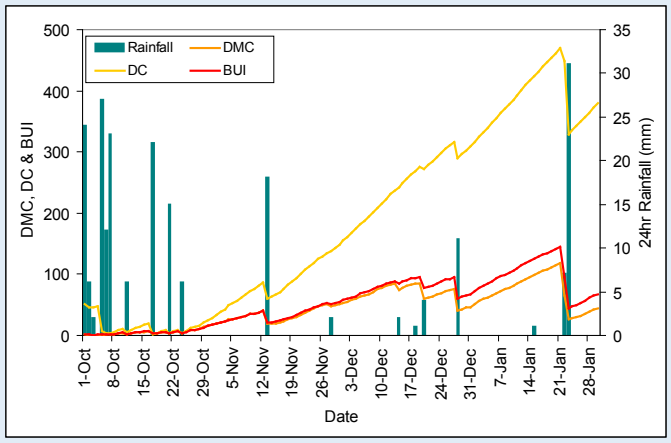


Figure 1. Daily rainfall, DMC, DC and BUI leading up to and during the fire (October 2007 to January 2008). Source: NRFA & NIWA.

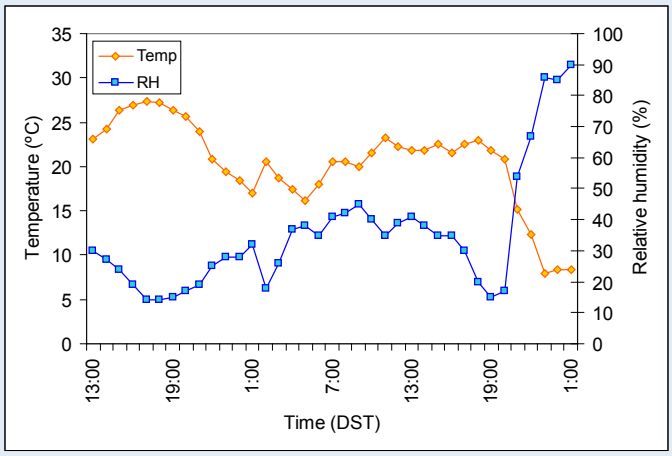


Figure 2. Hourly temperature and relative humidity on 16 & 17 January 2008. Souce: Tekapo RAWS (NRFA).

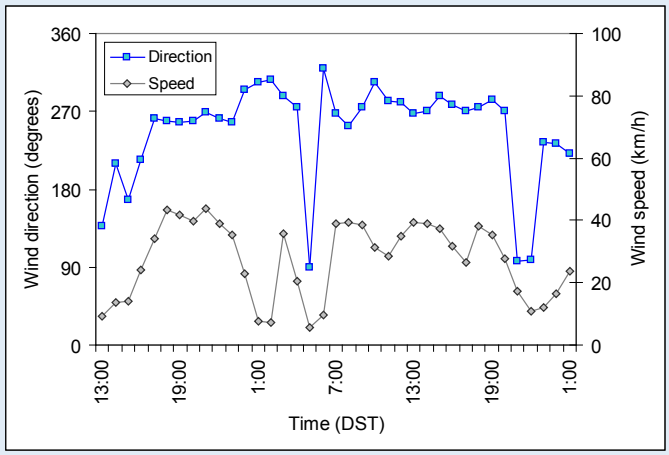


Figure 3. Hourly wind speed and direction on 16 & 17 January 2008. Souce: Tekapo RAWS and Braemar rainfall (NRFA & NIWA).

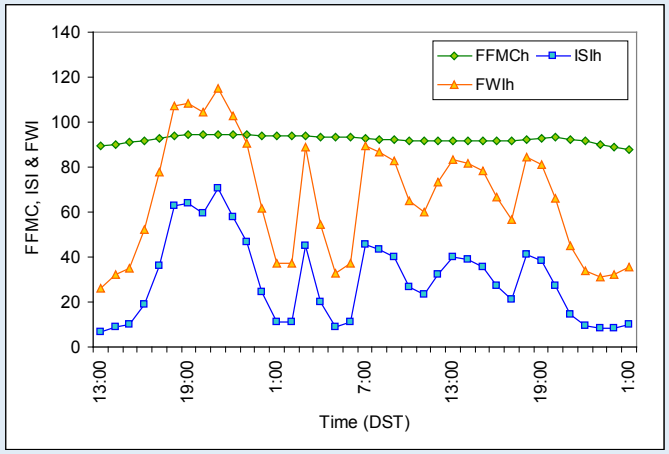


Figure 4. Hourly FFMC, ISI and FWI values on 16 & 17 January 2008. Souce: Tekapo RAWS and Braemar rainfall (NRFA & NIWA).

Discussion and conclusion

The most appropriate New Zealand models available against which to compare observed fire behaviour were those for Immature and Mature Pine Plantations and Ungrazed Pasture. However, none of these models performed particularly well, as they overestimated headfire spread and intensity. At times the predicted rates of spread based on the Fire weather conditions were ten times greater than those observed.

The differences between observed and predicted fire behaviour were probably due to variation in the local fire environment factors (fuels, weather and topography) that did not necessarily fit with the underlying assumptions of the selected models. For fire managers, it is therefore important to understand the assumptions and limitations of the fire behaviour models being used, and to modify them based on local knowledge of the fire environment.

It was difficult to compare observed and predicted headfire spread, with few observations made of time and location during the fire's main runs. Recording when the headfire reached major landmarks would have greatly assisted in predicting headfire rates of spread. Such observations can be captured in fire or communication logs, or using observation forms available in the NZ Fire Behaviour Field Manual[1] or on Scion's rural fire website.

Documentation of wildfires is invaluable for testing and validating existing fire behaviour models to support fire managment decision making. Regardless of the few fire behaviour observations collected at this incident, the Mount Cook Station fire provided valuable information on fuel hazard and fire behaviour in wilding pines. This study indicated a gap in our current knowledge in that the available models were not applicable to wilding fuels for fire behaviour predictions.

Acknowledgments

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Further information

The full report can be downloaded from the publications section of the Scion Rural Fire Research website: http://www.scionresearch.com/fire

Clifford, V.R & Pearce, H.G (2009) Case Study: Mount Cook Station Fire, 16 January 2008. Scion Report Number 17031. Scion, Christchurch.

1. Pearce, H.G.; Anderson, S.A.J. 2008. A Manual for Predicting Fire Behaviour in New Zealand Fuels. Scion , Rural Fire Research Group, Christchurch. June 2008

Photographs: R. McNamara, DOC & C. Miles, Tekapo Helicopters Ltd.

For more information, contact:
Rural Fire Research Group
Scion
PO Box 29237, Fendalton,
Christchurch 8540
Telephone: 03-364 2949
www.scionresearch.com/fire

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