Firefighters get more bushfire savvy

CSIRO

As bushfires again spark across the country following the hottest year on record for south-east Australia, advanced research has provided fire agencies and land managers with vital new methods of predicting bushfire behaviour in dry eucalypt forest and assessing forest fuel hazards. **Petronella Nicholson** reports.

Project Vesta has been Australia's most extensive research exercise into intense bushfires in dry eucalypt forests. The 10-year study found that our existing systems for anticipating fire behaviour could under-predict the spread of high-intensity summer fires by a factor of three or more, particularly in severe burning conditions such as those in the infamous 1983 Ash Wednesday fires. The implications of that are obvious.

The research has resulted in a new bushfire spread model for summer wildfires that underpins a national fire behaviour prediction system for dry eucalypt forests. It has also led to critical safety knowledge of the Dead Man Zone for firefighters internationally, and a quick reference field guide for national fire managers that relates fire spread to fuel structure and weather conditions across the entire country.

Mr Rick Sneeuwjagt, State Manager of Fire Management Services for the Western Australia Department of Environment and Conservation, the world's biggest fire jurisdiction, says Project Vesta has given agencies an updated understanding of fire behaviour. 'Knowledge of fire behaviour is totally critical for good fire management and fire suppression,' he says. 'We should now be able to predict better how a fire will behave and then, at the beginning of each day, we can organise our resources with much more confidence and accuracy.'

The project has also provided answers on the risks posed by fuel in forests, and the issue of prescribed burning, by analysing the relationship between fire behaviour and fuel age and structure. Mr Jim Gould, CSIRO Bushfire Research Leader, says, 'In the past we have always concentrated on the fuel load but this research has found that the structure and dynamics of fuel are also important to manage'.

The project has also provided answers on the risks posed by fuel in forests, and the issue of prescribed burning . . .

Previous fire behaviour guides have been specific to certain vegetation types

Research on spread speed and pattern during Project Vesta identified new ways to protect firefighters from the Dead Man Zone. CSIRO

but the new field guide developed from Project Vesta numerically characterises the different fuel layers in the dry eucalypt forest: surface leaves, twigs and bark; near-surface grasses, low shrubs and suspended dead fine matter; elevated fuel contributed by tall shrubs; and bark on the intermediate and overstorey trees.

'The field guide is a new way of looking at fuel, based on things you can see,' Mr Gould says. 'People can go through it and make quick assessments on fuel hazards without having to do measurements. It gives practitioners and the general public better guidelines on how to assess the fuel on their properties and mitigate their risks.'

Mr Sneeuwjagt highlighted that the guide is important in that fuel structure can be consistently described among fire managers.

Fire agencies around Australia received copies of the field guide in December 2007, and the Vesta researchers plan to undertake a national roadshow in 2008 to help implement the new assessment system.

The wider study found that prescribed burning will reduce the rate of spread, flame height and intensity of a fire. 'There has been criticism of burning off,' Mr Sneeuwjagt says, 'but now we can confirm its value in hard figures. It's a good tool backed with good science.'

Mr Gould says that while the relevant agencies must manage prescribed burning against other biodiversity issues, burning off has shown to be effective for up to 20 years on some types of fuel structure. 'It will also reduce bark fuel,' he says. 'Spotting and ember attack from bark is one of the major causes of loss of houses and property.'

Project Vesta was a major cooperative effort conducted by CSIRO Forest Biosciences and the WA Department of Environment and Conservation (DEC), with support given by a range of agencies including the Australasian Fire Authorities Council (AFAC), Hermon Slade Foundation, Forest and Wood Products Research and Development Corporation, Bushfire CRC, other research providers, local government and corporate sponsors (Isuzu Trucks and the Insurance Council of Australia). The research was led by CSIRO Honorary Fellow Mr Phil Cheney, Mr Gould and Dr Lachie McCaw from DEC.

Over the decade of research, experimental fires were conducted at two sites with different understorey fuels ranging from two to 22 years since fire in the south-western Australian eucalypt forests. During the summers of 1998, 1999 and 2001, 104 experimental fires were lit under dry summer conditions of moderate to high forest fire danger.

The existing fire prediction systems were based on low-intensity fires and were excellent for planning and predicting prescribed fires. But as soon as the experiments were underway, the researchers realised that they were inadequate for predicting the spread of high-intensity wildfires. 'We were lighting a 120-metre ignition line and we would have thought that the fire would take a few minutes to get to its full potential spread,' Mr Gould says. 'But instead it was at its full potential rate of spread immediately.'

This discovery about fire fronts more than 100 metres wide also provided new knowledge of the effect of wind changes – when a wind change turned a flank-fire into a head-fire, the fire would immediately spread at its full potential. From this came the concept of the Dead Man Zone, a breakthrough for firefighter safety around the world.

A training guide about the Dead Man Zone was released in 2001 and has already been put into practice by fire agencies.

CSIRO researchers meet to execute plans in response to a large bushfire. CSIRO

Experimentally lit fires take off in dry eucalypt forest. Greater understanding from bushfire research is helping to reduce the frequency of major fire events. CSIRO

Mr Sneeuwjagt says it is saving the lives of firefighters. 'This is a huge step in understanding fire behaviour,' he says. 'Firefighters need to be aware when they're working in that zone of what can happen if the wind changes direction.'

The new field guide and prediction models will be useful in assessing risk and predicting the rate and spread of summer bushfires in crucial sites, such as our water catchment areas. Most of Australia's urban water supplies come from high-rainfall forested catchments on which bushfire can have a significant effect.

Another study, recently released by CSIRO, used Landsat satellite images of the Alpine Catchment Management Unit in north-east Victoria from before and after the 2002–03 fires to map changes in the forest cover. From the analysis, researchers could predict how the forest would regenerate, and the short-term and long-term impacts on water use and stream flow.

Principal research scientist Dr Richard Benyon said that understanding the long-term impact of fires on water yield from major catchments is critical to understanding the long-term security of water supplies to cities, farms and the environment.

Initially the burnt areas used less water and so more runoff entered streams. However, as the forest grew back, the young trees consumed more water, and therefore substantial reductions in water yield from the catchment could be expected over the coming decades.

The study, which was supported by the Victorian Government through the North East Catchment Management Authority, demonstrated a promising technique for catchment managers to more accurately predict changes in stream flow following wildfire.

Forest fires have many consequences, not just in relation to water use. CSIRO scientist Dr Phil Polglase is assessing threats to forests which will affect their dominant role in controlling water and carbon balances, and the provision of biodiversity. It is estimated that the 2006–07 fires in Australia released an amount of carbon dioxide equivalent to that sequestered by 6 million hectares of plantation – about three times the current plantation area in Australia.

'The future climate will be unprecedented,' Dr Polglase says. 'The question is, will climate change lead to an increase in the frequency and severity of bushfires? Forest fires lead to increased emissions of carbon dioxide, less runoff when forests regenerate and less biodiversity. We can't say yet that the 2002–03 and 2006–07 fires are due to climate change, but it may be a sign of things to come.'

More information:
Project Vesta, www.csiro.au/science/vesta

For copies of the report or field guide, please contact Mr Jim Gould, jim.gould@csiro.au