Forest Health News

SCION
FORESTS ▪ PRODUCTS ▪ INNOVATION

No. 280, March 2018 ISSN 1175-9755

FIRE RESEARCH BURN EXPERIMENTS TEST NEW THEORY ON FIRE SPREAD

It's a hot, windy February day - perfect conditions for fire. Twenty-seven scientists and several million dollars of specialised equipment are gathered in a paddock of harvested wheat stubble near Darfield.

As Jason Forthofer from the US Forest Service's Missoula Fire Sciences Lab counts down to ignition, the researchers are all hoping the burn will bring the same thing: data. They will use this data to help unlock the mysteries of fire behaviour and produce better models for fighting wildfires.

This is the first phase of a four-year burning programme that will test a new theory on fire spread. It's a collaboration between Scion's Rural Fire Research Team, the University of Canterbury, Missoula Fire Sciences Lab and San Jose State University's Fire Weather Research Laboratory.

The new theory was developed in the US Forest Service lab in Missoula, Montana, but this is the first time it's been tested in the field.

Figure 1. A member of the Scion fire research team observes fire spread during one of the stubble experimental fires.

Researcher Mark Finney from Missoula explains, "For decades, the conventional wisdom was that fire spread by radiated heat. We've done some tests that show fire spreads by convection - hot gas and flame that moves through the wind. We're trying to understand how that works and it's a challenging problem that involves not only heat transfer but also fluid mechanics and weather - we're trying to understand how all of these factors combine to allow a fire to spread."

"This science just wouldn't be possible without this collaboration," says Scion senior fire scientist Grant Pearce. "The University of Canterbury brings meteorological expertise and drone capabilities, and the Americans bring expertise and unique instrumentation that we don't have here."

As the stubble fire is ignited and sweeps across the paddock, the researchers are pleased to see the flames move past their sensors as planned. Most of the equipment has been designed and built by the people looking on.

Figure 2. A stubble experimental fire moves past a set of "in-fire" video cameras being used to monitor flame front dynamics and fire spread rate.

The Scion team has organised the field research and has their own sensors laid out in the paddock and weather towers reaching up to record atmospheric details.

From a cherry picker just north of the paddock, University of Canterbury Geography researcher Marwan Katurji is looking after three infrared cameras, which are measuring the surface temperatures before, during and after the burn. A fixed-wing and quadcopter drones capture images that measure how fast the fire is moving.

A couple of hundred meters away, researchers from San Jose State University are sitting in the shade of a van, monitoring the Doppler LIDAR machine they have brought all the way from California. LIDAR stands for Light Detection and Ranging. It's like a radar that uses reflected light instead of sound waves. The LIDAR data will show the air movement above and around the fire.

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It's been a long hot day, but as the researchers pack their equipment away, they are pleased.

Figure 3. A post-burn view of one of Scion's 10m towers equipped with sonic anemometers to measure three-dimensional air movements, and thermocouples to record vertical flame and air temperatures, as the experimental fire moves by. A range of the US Forest Service team's equipment, including a flame height reference pole, in-fire cameras, heat flux and pressure sensors, and horizontal thermocouple arrays, can also be seen.

"Everything's gone really well," says Jason. "At least half the burns were almost perfect. We're getting great data."

Rural fires cost New Zealand around $100 million per year and, more importantly, they affect people's lives. Scion Rural Fire Research team leader Tara Strand explains why this research is important to New Zealand. "Extreme fires are becoming more common in New Zealand, so we need to be prepared. The better we understand fire spread, the better we will be at preventing the leap to extreme fire behaviour."

Kris Herbert (CreativeAgent)

HUNT FOR THE WILDERBEETLES

Scion entomologists and ecologists spent three weeks in Kahurangi National Park this last summer with a DOC permit to search for a group of native beetles that very little is known about. The search was part of efforts to complete host testing of the parasitoid *Eadya daenerys*, the proposed new biological control agent for eucalyptus tortoise beetle that targets the larval life stage. To date the only effective agents established in New Zealand are egg parasitoids.

We hoped to collect native larvae from the leaf beetle subfamily (Chrysomelinae) to test whether the parasitoid would try to sting the natives. Armed with only a few vague notes from decades old collections, the first search, starting in November, unfortunately turned up nothing. We were particularly hoping we would find the largest species called *Chalcolampra speculifera*, last reported in the 1970s as burrowing into stem swellings on leatherwood (*Olearia lacunosa*). There were also reports of beetles beaten off *Hebe* and alpine *Celmisia*. So all these plants were systematically visually inspected.

The second search, in mid-December, began with low expectations, but was a stunning success! During the second search, Matt Scott and Andrew Pugh visited a number of different sites around the Mt Arthur area, including a large site just behind the hut we stayed in. Over 120 larvae of a single (probably new to science) species were located scouring the surface of *Veronica* (*Hebe*), and successfully brought back to Rotorua for host testing in our Containment lab.

Figure 4. A field collected larvae (top left) and a lab reared adult of the veronica leaf beetle (top right) from Kahurangi National Park.

Day and night searches allowed the crew to make useful notes on the biology and host plant range to increase our overall understanding of this little studied group.

A further search in early January turned up a handful of larvae in the Cobb Valley area, but persistent heavy rain impacted the search. A publication is being prepared that will introduce this new species to the world and propose a scientific name for it.

Andrew Pugh & Toni Withers (Scion)

Printed by Scion Digital Print Centre, Rotorua (07 343 5711)