New Zealand's Rural Fire Research Group

Science and technology to protect life and property and manage fire in the landscape

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FOREST GROWERS RESEARCH

Preparing New Zealand for Extreme Fire

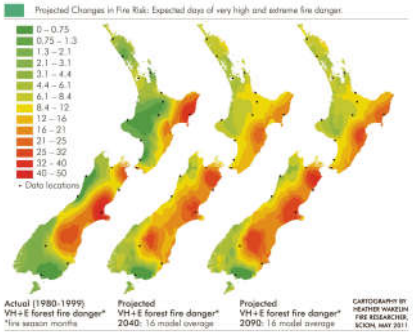
Five-year programme (1 Oct 2016 to 30 Sept 2021) with five research themes:

- 1. Extreme fire behaviour
- 2. Real-time fire monitoring tools
- 3. Extreme fire prevention technology
- 4. Targeted protection of important sites and endemic species
- 5. Fire as a land management tool

Global trends

- Changing climate, changing fire landscape
- More fires
- As climate conditions become hotter, drier and windier, the risk of fire, and unpredictable fires increases.

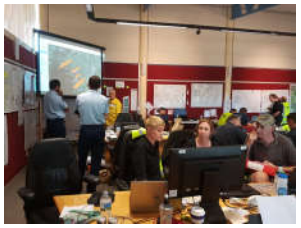
Local trends



- A warming climate will make wildfires more common and increases the risk of large fires for New Zealand.
- more severe fire weather days are expected for many parts of the country within 20 years.
- this means more hot, dry, windy days, particularly in the eastern areas of the country, but also in those lesser fire prone areas
- Scion Research indicates that areas that would not currently be perceived as having high fire risk may see quite dramatic increases in the future including, such as coastal Otago, Manawatu, and around Wellington and Whanganui.
- Areas that already have severe fire risk – Marlborough, Canterbury and the North Island's East Coast – are expected to see slight increases over current levels.
- In addition, fire seasons are also expected to get longer, starting earlier and extending later in many areas.
- We are noticing that fire seasons are shifting in New Zealand. A few decades ago, the greatest fire risk was around Christmas and New Years. Now we are seeing our fire seasons starting later and running longer. We are seeing hot dry conditions during February and March.

Nelson fire response

- Scion's fire scientists regularly join incident management teams for serious rural fires
- During the Pigeon Valley fire, a fire scientist two weeks using methods developed by Scion to support fire operations.
  - fire growth prediction model Prometheus
  - smoke modelling - BlueSky framework
- Used Prometheus model with data obtained from drones on infra-red hotspot
- Ran BlueSky model to produce smoke predictions
- Tested models under real conditions
- Will prepare a summary of factors and fire spread for the Pigeon Valley fire



Real time tools

- Linking fire detection, fire growth prediction and smoke methods with high-resolution weather forecast data for near real-time prediction of fire spread and effects
- Aim is to develop methods used by emergency services
- By 2020, hope to have a prototype ready to trial
- Aim to run the models as part of their day-to-day operations, giving better, faster, information on fire occurrence, spread and potential effects
- When a new fire starts anywhere it will be automatically detected using thermal infrared satellites
- Will link into weather data and feed into the fire behaviour prediction model
- It will provide early warning of any potential hazardous situations

Theme 2: Real-time fire & smoke monitoring tools

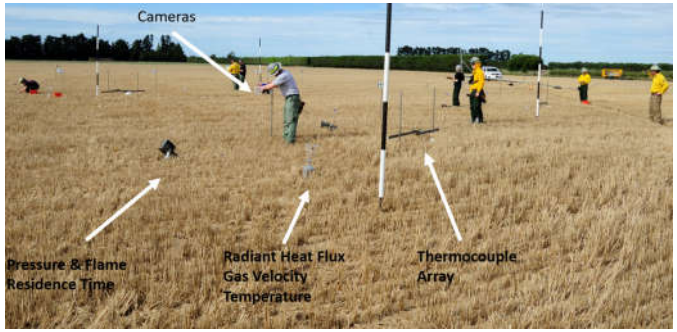
Developing new innovative decision support tools

- To improve our current and future fire response capabilities
- Useful for timely decisions around:
  - Resource deployment and evacuation decisions (by Incident command) or
  - Informing best days to conduct burn offs to avoid smoke nuisance
- Extensive scientific collaboration:
  - US Forest Service Pacific Northwest Research Station
  - Alberta Agriculture and Forestry
  - Heartland Software Solutions
  - CSIRO

Theme 2: Real-time fire & smoke monitoring tools

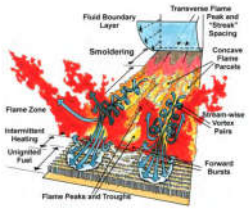
Developing new innovative decision support tools

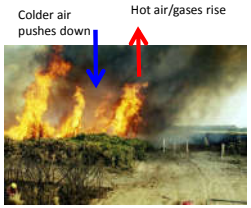
- Need tools to collect data
- Unique instrumentation designed just for this research



New fire spread theory

- We are testing a new theory that heat at the fire front is transferred by turbulent convection (hot material moving violently upwards) rather than radiation.
- Lab experiments show important role of convective heat transfer in wildfire spread. This has not been proven in the field.
- New Zealand field-scale fire experiments to test convective heat transfer in wildland fires
- We are studying this using in-fire sensors in experimental burns in a range of vegetation fuel types.
- The new fire spread model will help us understand and predict extreme fire behaviour so New Zealand and its people can adapt and respond to the threat of extreme fires.





New fire spread theory

- Crop stubble burns were done in March to refine fire measurement methods
- Data continue to support f the new fire spread theory
- Also contributed to ground-breaking new image velocimetry techniques

Aerial imagery captured by drone from additional crop stubble burn experiments involving simultaneously ignited point and line fires, being used to improve understanding of fire spre acceleration processes

Burn Plots

- 2018: Burn Plot sizes ranging from 1.5 to 2 ha
- 2019: Burn Plot sizes ranging from 3 to 5 ha

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