

Scion Rural Fire Research Programme

Annual Summary of Activities 2009/10

Research Programme Background

Every year, significant areas of New Zealand either experience or are threatened by wildfire, and the reality is that the risks from rural fire are growing. This programme aims to protect life property, and economic and conservation resources from wildfire in New Zealand's rural environments. This goal will be achieved through providing land managers, Rural Fire Authorities and policy makers with information and tools that will help reduce the number and consequences of wildfires.

The research programme aims to improve understanding of fire behaviour in the New Zealand fire environment by developing a New Zealand Fire Danger Rating System (NZFDRS) to support fire management decision making. Key components of the NZFDRS include a New Zealand Fire Behaviour Prediction (FBP) System comprising models that predict fire behaviour in different vegetation types, and models describing the effectiveness of various firefighting resources in relation to fire behaviour and other fire environment factors (e.g., vegetation, terrain). Increasing our knowledge of the role of fire in the sustainable management of New Zealand ecosystems is also a high priority and the second major objective, research to quantify the effects of fire on tussock grasslands, provides a case study on the role of fire in ecosystem management so that appropriate management can be developed.

2009/10 Research

Improvements to **fire behaviour prediction models** for NZ fuel types have been made following analyses of experimental data collected in recent years. Operational and research models were developed to provide better predictions of fuel loads for a range of grass and scrubland vegetation types by including fuel treatments such as grazing and baling. Improved fire rate of spread prediction models have also been produced for tussock, stubble and scrub fuel types. The new models are being peer-reviewed through publication in international journals, and updates to fire behaviour prediction tools, including the Field Manual and Toolkit calculator software, are planned over the next few months. A photographic guide for aiding selection of the appropriate fuel load and rate of spread models for predicting fire behaviour in NZ vegetation types has also been developed and, following operational trialling, will be published and disseminated more widely. Fire managers are being notified of these changes to the existing models and tools through newsletters, conference presentations and training courses.

A further tool, a **NZ fire growth simulation model** has been developed for predicting the spread of fires across the landscape. This work was funded by the Department of Conservation, and supported by Canterbury Conservancy GIS. The NZ fire growth simulation model was based on modification of the Canadian wildland fire growth model, *Prometheus*, because it utilises the same fire danger rating and fire behaviour modelling systems used here in NZ. The *Prometheus* software has been customised for use in NZ by incorporating NZ fire behaviour models and Southern hemisphere fire danger calculations, and the revised version successfully validated against a number of historic NZ wildfires. A DOC-led training course run was run for NZ fire managers and GIS technical staff on the use of the *Prometheus* modelling software and its limitations and assumptions. Work is now underway to apply the fire simulation model to a range of fire management applications, including operational prediction of fire growth during wildfires events, strategic risk assessments and planning, and reporting on fire suppression effectiveness and values saved. This fire growth model adds a further tool in the suite of fire behaviour prediction tools available to fire managers that will become a key fire management decision-support aid in future.

Research to develop a method for **assessing and predicting the seasonal die-off of grasslands**, which has been conducted in conjunction with the Bushfire Cooperative Research Centre (CRC), is nearing completion. A NZ pilot trial was conducted to assess the relative accuracy of regional curing estimates provided by four satellite assessment products. Due to the timing (late summer/autumn) and limited period of trialling, it has been recommended that a further full season of testing be conducted during 2010/11 using the best of satellite products before deciding on the best product and method for implementation. As part of the broader Bushfire CRC project, investigation is also continuing of other alternative grass curing assessment and forecasting methods, including pasture productivity models.

An improved understanding of relationships between **fuel moisture and fire ignition and spread in gorse scrub and grass fuels** has been gained through completion of two separate Masters studies. Stuart Anderson's study determined the threshold conditions for ignition and spread in gorse vegetation, and produced a model for predicting the moisture content of elevated dead gorse. Heather Wakelin's project, which was funded by DOC's Canterbury Conservancy, included laboratory and field experiments to determine the fuel moisture thresholds for ignition of grass fuels from a range of ignition sources, including hot metal contact (vehicle exhausts), carbon emissions from exhausts (e.g. 4WDs, trains), hot metal sparks from machinery (e.g. grinding operations) and open flame. These studies have resulted in significantly improved understanding of the conditions in which fires will ignite and spread in these vegetation types, and production of guidelines based on fire weather conditions for use in supporting fire management decision-making, such as fire permit issue, vehicle access restrictions and education of farmers and recreational users.

Collection of data on **firefighter productivity** during wildfire suppression activities continued over the 2009/10 fire season. Firefighter instrumentation kits were located with fire crews across the country, and in some cases were relocated (e.g. to Northland) to maximise opportunities for data collection. Further data collection is planned during 2010/11, prior to compiling results into guidelines on workload and productivity of firefighters undertaking a range of suppression tasks. Lead scientist, Richard Parker also submitted his PhD thesis on "Measuring Dangerous Work - tree felling and rural fire fighting". The thesis contained two fire-related chapters based around the data on fire suppression resource productivity and effectiveness collected using the firefighter instrumentation kits.

Research to identify **mitigation options for human-caused fires** was progressed through investigation of means of reducing deliberately lit fires. This included arson and maliciously lit fires, accidental fires lit for recreation (including visitors and tourists), and fires resulting from carelessness (by lifestyleers and farmers). Information on contributing factors and possible mitigation options was collected from literature and through interviews and separate focus groups with fire managers and farmers. Findings are currently being analysed and written up, with a report and Fire Technology Transfer Note to be completed in the next few months.

Ground-breaking research on the **effectiveness of fire danger warnings** has resulted in identification of a number of issues relating to communication of fire danger and fire prevention messages. The pilot study of fire managers' expectations of fire danger communication conducted in Canterbury during 2008/09 was extended to Northland, and confirmed that there is confusion in the behavioural changes fire managers expect of the public through communication of fire danger warnings. Over 100 members of the public were also interviewed in Canterbury and Northland during December and January to determine their understanding and appreciation of fire danger warnings and other fire prevention communications. While the report on findings is still being finalised, the research highlights that the fire danger ratings are not clearly understood and the community lacks an understanding of necessary behaviour change associated with increasing fire risk. These results are highly significant to the ongoing use of fire danger signs and other fire prevention messages, and will be used as the basis for recommending potential solutions as well as further research needs in this area.

Understanding of factors affecting **community resilience and recovery following wildfire events** continues to grow as a result of documentation of lessons learned from NZ wildfires. Findings from the interviews conducted with affected residents and fire and emergency workers following the 2003

Mt Somers (mid Canterbury) wildfire have been documented as part of the detailed community recovery case study on the fire, and results from this and other NZ case studies presented to a range of audiences (rural fire, Civil Defence, social scientists) via national and international conferences and in several papers be prepared for international journals. Linkages have also been established with natural hazards researchers investigating community resilience and recovery which will be extended in coming months.

Researchers also contributed to the development and presentation of an upgraded national **Intermediate Fire Behaviour training course**, which included recent research findings as well as new practical assessments. The latter was introduced to remove the requirement to complete a fire behaviour case study to achieve the NZQA Unit Standard for the course, and resulted in 15 of the 21 gaining this qualification during 2009/10. This is a significant advance over previous years, where the old course assessment was a major stumbling block to participants proceeding on to higher fire qualifications.

Fire research staff also presented at the national Principal Rural Fire Officer (PRFO) training course, and also ran several training sessions on the new fire behaviour prediction tools and other research activities to fire managers, including the annual DOC Fire Management Workshop, National Incident Management Team workshop and Regional Rural Fire Committee Chairpersons Conference. Results from the research were also disseminated via technical reports, newsletters and research updates. Meetings of the Rural Fire Research Advisory Committee, which has a governance role to the research programme, were also held at which updates were provided on research projects and activities.

Conclusions

Very good progress was made during 2009/10 across all areas of the research programme. Highlights include additions and improvements to the suite of fire behaviour tools available to fire managers (particularly the introduction of a NZ fire growth simulation model), and the increased knowledge gained on fire ignition and spread thresholds in scrub and grass fuels, as well as regarding fire danger communications. Considerable effort also went into transferring the results from the research to end-users, through training courses, newsletters and reports, workshops and conference presentations. Focus was also placed on peer review of research findings, through presenting to international conferences and publishing in scientific journals.

The quality and value of the research being undertaken was highlighted in the external review of the programme undertaken in mid-2009 by the Foundation for Research, Science & Technology (FRST). The Rural Fire programme obtained an overall "Excellent" rating, with the review panel finding that the quality and productivity of programme outputs and progress against contracted milestones "exceed expected performance". They also emphasised the group's strong end-user linkages and benefits of collaboration with the Bushfire CRC. The Minister of Internal Affairs (Hon Nathan Guy) also acknowledged this result in his opening speech to the annual FRFANZ Conference in Timaru in August. This result was a very good outcome which puts the programme in a strong position for re-bidding for FRST funding from 2011 onwards.

In this regard, a research strategic planning workshop was held with rural fire sector stakeholders in Wellington in November. The workshop sought to identify the key research needs and drivers for the rural fire sector in NZ, and five key research themes were identified at the workshop and subsequently communicated to FRST as the basis for a new fire research programme. These included increased focus on firefighter safety and community resilience, as well as the development of knowledge and tools to support the safe and effective use of fire as a management tool (particularly in tussock grasslands). While re-bidding has been postponed for 12 months (and the current contract extended), signals around increased FRST funding and opportunities for expansion of the scope of the programme bode well for the research programme, and for the continued production of beneficial fire research outcomes for NZ fire and land managers.

Other Highlights

- Dr Francisco Moreira, from Instituto Superior de Agronomia in Lisbon, Portugal, visited the fire team during November as part of an EU-funded COST exchange. He worked with the Fire Project on COST initiatives around post-fire management, landscape-scale fire management planning, as well as general discussions to explore further opportunities for collaboration under the TRANZFOR scheme.
- Dr Filipe Catry, also from the Instituto Superior de Agronomia in Lisbon, visited with the fire team in April as part of the TRANZFOR scheme to discuss post-fire response of forests and other vegetation. Filipe also discussed some of his other areas of research, including modelling the occurrence of wildfires in Portugal.
- Fire project staff met with Dr Tom Wilson and Prof. Jim Cole, Natural Hazards Research Centre, Geological Sciences, University of Canterbury in December to discuss possible research collaboration. Tom Wilson is particularly interested in collaborating in social research, and Lisa Langer subsequently presented a guest lecture on the community recovery research to 4th year Natural Hazards students.
- Fire team members contributed to a new Fire theme covering both urban and rural fires within the NZ Science Learning Hub ([http://www.sciencelearn.org.nz/contexts/ fire](http://www.sciencelearn.org.nz/contexts/fire)). This is a web-based learning centre managed by the University of Waikato and funded by MRST. It contains extensive resources covering top-class science under a range of topics, aimed at high school science teachers and students. The Scion Rural Fire Research Group is highlighted throughout this theme, and the content includes video clips of project staff being interviewed on fire topics and other information related to Scion's fire research.
- Lisa Langer received funding support from the USDA Forest Service as well as the Bushfire CRC to enable her to travel to the US to present a paper at the Human Dimensions of Wildland Fires Conference in San Antonio, Texas, and to spend time working with Dr Pam Jakes (senior social scientist) on completing the case study work undertaken in New Zealand in 2008 when Pam visited here on sabbatical. Further collaboration opportunities in the social fire science area were also explored with US, Canadian and Australian researchers, as well as new opportunities with several European research groups.
- Grant Pearce and Lisa Langer also participated in a joint US/Australian symposium on rural/urban interface fire issues in Melbourne and Canberra in June. Coordinated by the Bushfire CRC and US Dept. of Homeland Security, the symposium discussed collaborative research opportunities and funding in fire behaviour, building design and risk planning, and community safety.
- Fire group leader Stuart Anderson left Scion in May to take up a position with the Ministry of Agriculture and Forestry in Rotorua. We thank Stuart for his contribution to rural fire over the past 9 years. Human factors researcher Richard Parker has been appointed to take over the fire group management role, with support from Grant Pearce as the science leader.

Outputs

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