

The RxCADRE study: a new approach to interdisciplinary fire research

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Much like other scientific endeavours, most fire research is conducted either within individual disciplines – fuels, physics, chemistry, ecology, modelling, and so forth – or, at best, across only two or three disciplines. This is primarily because fire scientists have particular areas of expertise and most collaborations are between scientists within that expertise. Although this approach often leads to significant discoveries, the lack of co-located, multi-scale measurements of pre-fire fuels, active fire processes and post-fire effects hinders our ability to tackle fundamental questions in fire science.

Although large-scale, interdisciplinary field experiments have been rare, notable exceptions exist. For example, the International Crown Fire Modelling Experiment (1997, Northwest Territories, Canada) included scientists from Canada, Russia and the United States, and focussed mostly on fire behaviour and other physical measurements. The FROSTFIRE Boreal Fire Experiment (1999, Alaska, USA) added to our knowledge of crown fire in boreal forests and included a broad range of studies in physics, chemistry and biology. These types of field experiments have been rare because of the logistical challenges they involve, including: (1) generating funding for a large-scale project, (2) organising a large number of researchers, (3) implementing timely and effective experimental fires, (4) deploying equipment and sensors, (5) ensuring data quality for a large number of measurements, (6) conducting timely data analysis and publication of results, and (7) integrating results to derive inferences that are truly interdisciplinary in nature. Further, it is no small challenge to reach agreement over shared research questions and objectives towards which to direct multiple disciplines. Perhaps it is not surprising that few of these types of studies have been carried out.

This special issue of the *International Journal of Wildland Fire* documents a recent landmark study called the Prescribed Fire Combustion and Atmospheric Dynamics Research Experiment (RxCADRE) (2008–2012, Florida, USA). Building on concepts from early grassfire experiments (1986, Northern Territory, Australia) that helped quantify fuel–fire–atmosphere interactions, RxCADRE was designed to collect complementary data across multiple disciplines before, during

and after the active burning periods of prescribed fires in grass-dominated fuels. Unprecedented in scope, the project encompassed measurements of fuels, fuel consumption, fire behaviour, smoke and fire effects. High-resolution fire progression and heat release data are critical for understanding fine-scale fire behaviour and fire effects, which in turn are needed to improve computational fluid dynamics-based fire behaviour simulators.

The papers that follow cover every aspect of the RxCADRE project, from fine-scale fuel measurements to remotely sensed data. The studies involve not only rigorous science but also a high level of coordination and cross-referencing between papers, representing the implicit collaboration throughout the project – no small task when 90 scientists from a broad range of disciplines and organisations are involved. As guest editors for this special issue, we appreciated the efforts of all authors to provide timely, well written manuscripts, supplemented by the best peer-review feedback that we have ever seen.

Despite the success of RxCADRE, it was quickly recognised that data are needed from more complex burning conditions that represent the majority of natural fuels and fires in North America and beyond. To that end, a new project, the Fire and Smoke Model Evaluation Experiment (FASMEE) is being supported by the US Joint Fire Science Program. Scheduled for implementation over the next 5 years, FASMEE will augment RxCADRE by focusing on fuel and consumption, fire behaviour and energy, plume development and meteorology, smoke and chemistry, and applications in model simulation. By conducting experimental burns (>200 ha) in diverse fuelbed types, FASMEE will capture fire phenomena and variability at larger spatial and temporal scales.

The true test of RxCADRE and its successor, FASMEE, will be their influence on the future of fire science and next-generation, process-based fire modelling. Scientists involved with these projects will need to work directly with modellers to ensure that large databases are interpreted and applied effectively. We look forward to learning about their progress in the years ahead, and perhaps another special issue of the *International Journal of Wildland Fire*.