Simulation Used to Generate Alerts within a Wildfire Early Warning System.

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Extended Abstract.

Following the February 2009 bushfires in Victoria, Australia a nation-wide alert system has been established, using alerts issued via mobile and landline phones and the internet. As an outcome of this devastating wildfire, in which many lives were lost, a focus has emerged in Australia in terms of improving communication to the public of both current and predicted fire-front locations. Improved communication will contribute to bridging the "information gap", giving the population in rural communities and in the urban/rural interface ready access to up-to-date information on the location of current wildfires together with predictions of where they may be located in the future. Predicted fire location information should be communicated in such a way as to facilitate timely and safe evacuation to secure locations. Current research at the University of Western Australia (UWA) is examining the role of a high performance fire prediction simulator as a core component of a future wildfire early warning system.

The aim of this research is to determine the best methods of providing early warning as to the possible arrival of a wildfire front and to provide accurate, detailed, map-based information to permit early evacuation via safe routes to safe areas. We are investigating the central role which high-performance simulation has to play in such an early warning alert system. Specifically we aim to test the performance of the UWA simulation technology to rapidly generate the future location of fire-fronts for both large wildfires and for multiple active wildfires.

Running within a Geographical Information System (GIS) the UWA Wildfire Simulator is configured to automatically access appropriate topographical and fuel age maps, to take current and forecast fire-ground weather as a live feed and to accept current fire location data. From this it generates *predictions* for the future position and time-of-arrival of the fire front. These predictions will be available for communication to the public both as text messages and as maps sent over the internet and via web-enabled mobile devices.

The UWA Wildfire Simulator incorporates fire behaviour rate-of-spread models which have been developed for a range of Australian fuel types and climatic conditions, ranging from tropical savannah grasslands to temperate rainforests. The new prediction/alert system is designed to permit any location in Australia to be selected in the GIS system.

The appropriate fire behaviour model for the fuel type found at that location will be automatically accessed together with fuel load data and the forecast weather which is required to predict the fire rate of spread.
Challenges arise with such an automated system and these include the following:

- Poor data: How accurate is the fuel type and fuel load data for the region in which wildfire simulation is required? Accurate data requires significant effort both in the field and in maintaining the fuel layers within the GIS system to reflect previous burning history and fuel accumulation rates which are dependent on rainfall patterns, soil types and other factors.

- Quality of rate-of-spread models:
  These models have been derived from field experiments which have been conducted in moderate weather conditions, by necessity. The models used in Australia are generally accepted to underrepresent the correct rate-of-spread during extreme weather conditions. We are conducting research aimed an *deriving* accurate rates-of-spread under extreme weather using data obtained from known extreme wildfires sampled remotely from satellite images or from overflying aircraft. This research component is funded by the Australia Research Council.

- Accurate real-time fire mapping:
  Prediction of the future location of a wildfire by use of a high-performance simulator requires that the *current* location of the fire-front is known. If this cannot be obtained, all *predicted* future locations will be inaccurate. Actual fire-ground weather data and high-quality forecasts of wind speed, direction and changes in wind direction at the fire-ground are also required. To achieve this, the system will interface with a real-time feed of current and forecast weather from the Australian Bureau of Meteorology. The developed system will also include fire-fighting decision-support features such as the simulation of intervention measures such as fire break creation and direct attack. To allow fire controllers to better understand future “worst case” scenarios the system will permit quick specification and simulation of alternative future weather scenarios, such as changes to wind speed or the timing of changes in direction.

- Difficulty in validating simulation technology:
  High-quality data from historical fires, which capture the actual location of the fire-front at regular periods of time, is hard to obtain as the main concern of fire agencies is in managing a wildfire and mitigating its impact, and not in collecting real-time data. As well asc fire-location data any validation exercise using historical fires requires: collection of accurate fire-ground weather; accurate pre-fire mapping of fuel types and load; and accurate rate-of spread meters.

The *design* of this Wildfire Early Warning System will be discussed together with an update of the status of its development.

This project is a co-operation of the Fire and Emergency Services Authority of Western Australia, Landgate WA, and the University of Western Australia. The UWA Wildfire Simulator was developed as an Australian Bushfire Cooperative Research Centre project.