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Remote sensing and spatial analysis for fire management

BCS Remote Sensing and Spatial Analysis

Project Core Team

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Context

The department's fire management, monitoring and reporting functions require knowledge of fire events that are effectively derived through fire scar mapping. The imagery used for this analysis is predominantly satellite imagery and includes optical and thermal imagery from airborne platforms. Research areas include historical mapping that utilises the extensive archive record of satellite imagery and occasionally aerial imagery to build a fire history (or fuel age) for a location or to reconstruct the spread of major bushfires. These activities also include monthly mapping during the prescribed burn season. The project also plays a key role in fire research and development, through research into fuel growth, fire spread, fire risk and fire severity models. Internal and collaborative activities are carried out to further streamline and automate mapping techniques. General imagery support is also provided to Fire Management Services Branch and regional staff, including incident mapping and prediction and advice about imagery and systems development.

Aims

- Improve processes of fire scar identification to enable historical fire regimes to be understood for safety and ecological applications.
- Improve burn security through the development of methodology to detect and communicate hotspot locations.
- Develop techniques to provide inputs for fire behaviour models to enable desktop assessments.
- Progress prescribed burn reporting with fire severity model development.
- Provide remotely sensed spatial and temporal data streams to assist with bushfire investigations and reporting.

Progress

- Developed information on fire size in relation to the time of year burnt in the Western Desert, in collaboration with the 10 Deserts Project (a part of the Indigenous Desert Alliance).
- Fire scar information for the Pilbara and Goldfields regions, Kanyirninpa Jukurrpa and Desert Support Services was supplied monthly and annually to inform and report on prescribed burning activities in the Western Desert and Pilbara regions.
- Supported the operational use of airborne thermal cameras to detect hotspots for burn security.
- Initialised investigation into remote piloted aircraft (RPA) based LiDAR for fuel accumulation modelling and fire behaviour response.
- Supported regional and district fire managers in interpreting satellite derived burn severity products.
- Model development linking field measures of fire severity to satellite imagery was progressed.
- Development of processing scripts in R to effectively derive fire history based statistics.
- Provided data to Fire Management Services Branch to inform fire recovery, fire chronology and the new satellite technology/availability.
- Spinifex satellite fuel cover model updated with new Pilbara field data and delivered to the Pilbara region.
- Options for monitoring vegetation change in landscapes of the Great Victoria Desert were developed.
- A comprehensive update of the fire history information across the entirety of the Great Western Woodlands for the period of 2010 to 2020 was undertaken by Landsat image analysis.

Management implications

- The information provided for fire management is designed to significantly increase the accuracy of reporting and decrease the risks of fire management activities. Delivering fire scar mapping and information allows practitioners to make informed decisions that lead to more efficient fuel reduction activities and successful completion of burn prescriptions.

- Effectively processing the DBCA fire history data provides quantitative and current statistics on fire frequency, number of repeat fires and fire interval.
- Consistent production and attribution of monthly fire scar mapping have resulted in the compilation of an annual fire scar mapping product with improved date, area and cause attribution. This product is suitable to analyse and provide spatial metrics that will aid in assessing the effectiveness of the fire management program over Millstream Chichester and Karijini National Parks.
- Delivery of aircraft-based thermal imagery hotspots to on-ground staff improves the security of burns.
- Development of a new cost-effective method for ground staff to assess burn security by detecting boundary hotspots from a RPA can be more efficient in more remote areas or when visibility is limited from an aircraft.
- Using RPA-based LiDAR for fuel height and density measurement will lead to a more accurate model of fuel accumulation for better management of fuel levels in the forest and safer bushfire management.
- Satellite derived spinifex fuel cover maps enable regional fire activities to be more targeted, efficient and safe in their fuel reduction activities.
- Identifying differences in the size of fire in desert landscapes informs fire managers about reducing the impact of large fires in the hot season by burning during the cool season.
- Fire history information in the Great Western Woodlands will be used to identify locations vulnerable to fire regime change and guide burn planning to protect these vegetation communities.

Future directions

- Continued development and automation of fire scar detection methodology.
- Investigation and development of new data sources including new satellite data and aerial capture.
- Continue testing and finalise fire severity model in south west forests.
- Implementation and development of spatial analysis of fire patterns and fuel loads.
- Investigate the viability of utilising remote piloted aircraft based thermal imaging for operational use by detecting near boundary hot-spots after prescribed burns.