Planned Burn Mapping in Victoria using Remote Sensing

Research Fact Sheet

Forests, Fire and Regions Group invests in a *Bushfire Risk Management Research* agreement with the Bushfire and Natural Hazards CRC to deliver critical scienctific research projects to support policy and operational practices. '*Planned Burn Mapping in Victoria using Remote Sensing'* is one of these projects andcommenced in July 2015. It is due to be completed by June 2019.

The Project

The Department of Environment, Land, Water and Planning (DELWP), under the *Code of Practice for Bushfire Management on Public Land (2012)* uses a risk-based approach to bushfire management on public land and is requiredto report annually on bushfire management activities. Additionally, theVictorian Bushfires Royal Commission (2009) (the VBRC), reccomendations committed to expanding its fuel management program and report on its planned burning in a manner that meets "public accountability objectives." The data that underpins this reporting is also required to provide feedback to staff who manage planned burning and to support risk modelling as part of FEMD's strategic bushfire management planning approach.

Resource requirements for burn mapping are currently high and the accuracy of burn maps is not always consistent across the state.

The objective of this project is to develop mapping software tools and user guides that can help to improve the efficiency and consistency of planned burn mapping across the state.

This includes reducing the resource requirements for burn mapping and to develop methods that can be used to quantify the accuracy of resulting maps.

Tradtiionally, the manual delineation of polygons (regions of similar burn severity) requires significant knowledge and expertise in image interpretation (**Figure 1**), and depending on the complexity of the burn, this can be incredibly time consuming.

In order to improve this DELWP has already developed significant background research and skills to deliver burn mapping. This project team has taken on the challenge of providing tools to help improve the efficiency of the current work flow. The first step in this incremental process was to implement an automated aerial image segmentation procedure. This subdivides the image into approximate homogeneous regions that can be later labelled with an appropriate severity class. Software that allows staff to run image segmentation on their own imagery has been tested at DELWP in limited trials, with feedback suggesting significant efficiencies can be achieved.

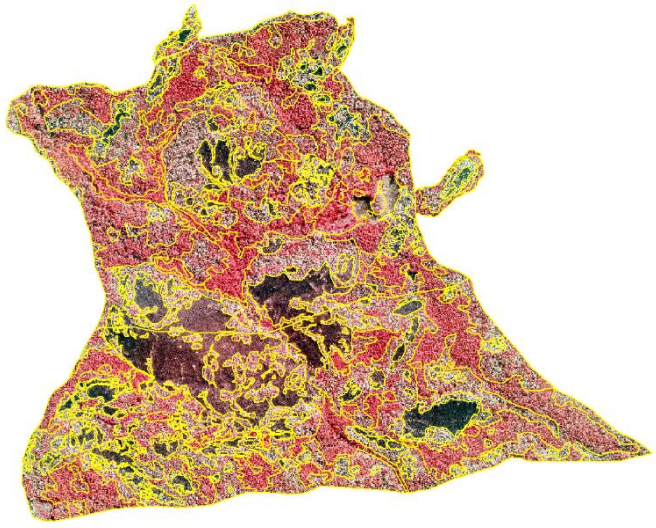

Figure 1: Manually defined burn severity polygons overlayed on false colour (near-infrared, red, green) aerial imagery.

While stand-alone segmentation software was tested, tools that are integrated with the existing Geographic Informaiton System (GIS) workflow were found to be more flexible and easily integrated.

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For this reason, both the integrated approach and the development of other tools to support the current workflow, were implemented (**Figure 2**).

The new GIS toolbox structure has enabled "best estimate" burn severity classes into the semi-automated workflow. Currently, this is based on simple Gaussian classification approaches. However, the ability to incorporate other more sophisticated machine learning is also being explored.

Project Outputs

The research team initially worked with DELWP staff to understand the operational burn mapping work flow. This involved:

1. An overlay of the burn plan on high resolution aerial imagery, acquired soon after the burn is complete
2. Careful interrogation of the imagery to delineate the boundary between burn severity classes
3. Attribution of polygons with appropriate burn severity classes, and
4. Submission of the burn severity map to the DELWP fire history database.

Policy and Operational Implications

Information derived from burn mapping helps to improve the accuracy of bushfire risk modelling, based on estimation of residual fuels post-burn and fuel re-accumulation rates. These can be used to determine if risk reduction targets have been achieved and to justify and prioritise future fuel management.

A clear understanding of the accuracy of burn maps is critical in achieving public confidence in fuel management and for understanding the limitations of risk modelling outputs.

The Research Team

The project is being managed by the Bushfire and Natural Hazards CRC, with the research being conducted by the CSIRO; including Dr Glenn Newnham, Dr Miguel Gomes Da Cruz, Mr Ben Leighton, Mr Alessio Arena and Dr Christopher Watkins, in close collaboration with DELWP policy and operational staff.

Project Status

The project team is currently extending the group of initial users who are testing and providing feedback on the toolbox. The software development path for this final year of the project includes a number of activities such as:

- Integration of field data to provide automated accuracy assessment of burn severity maps.
- Extension of severity classification options, including (Google TensorFlow) machine learning.
- Severity map quality assurance tools to assist in ensuring topological integrity and attribute consistence.

While the final GIS toolbox and associated user guides will help in achieving increased consistency and efficiency in burn severity mapping, the current workflow structure of the tools will also provide a basis for incorporating new data and methods as they become relevant and available.

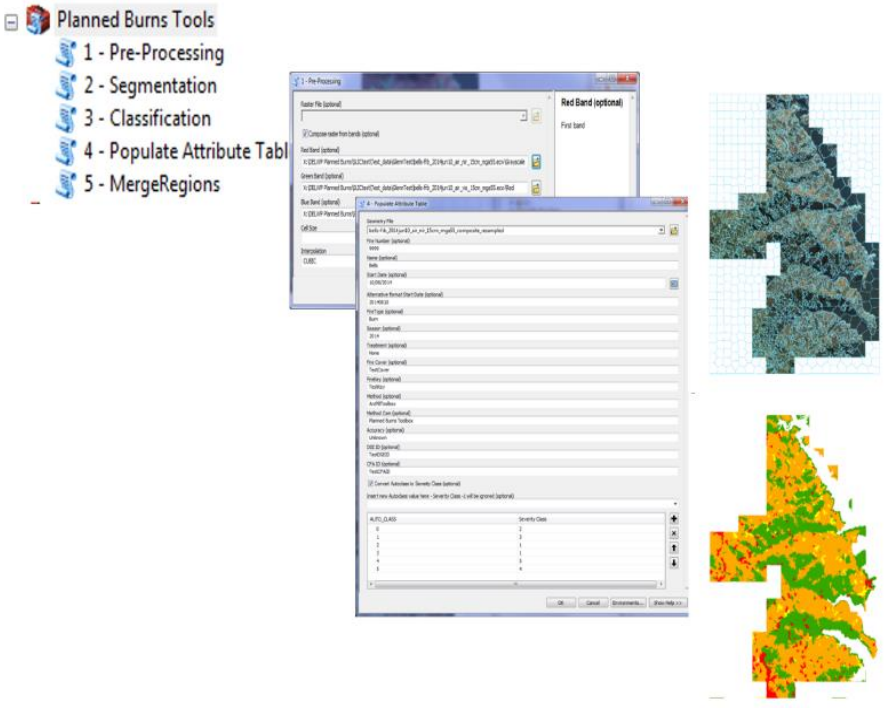

Figure 2: ArcMap Toolbox developed to assist in increasing the efficiency and consistency of burn severity maps.