MAPPING FIRE AFFECTED AREAS IN NORTHERN WESTERN AUSTRALIA – TOWARDS AN AUTOMATIC APPROACH

This thesis is presented for the degree of

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Submitted by

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

....................................

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Wildfires across northern Australia are a growing problem with more than 2.5 million hectares being burnt each year. Accordingly, remote sensing has been used as a tool to routinely monitor and map fire histories. In northern Western Australia, the Department of Land Information Satellite Remote Sensing Services (DLI SRSS) has been responsible for providing and interpreting NOAA-AVHRR (National Oceanic and Atmospheric Administration-Advanced Very High Resolution Radiometer) data. SRSS staff utilise this data to automatically map hotspots on a daily basis, and manually map fire affected areas (FAA) every nine days. This information is then passed on to land managers to enhance their ability to manage the effects of fire and assess its impact over time.

The aim of this study was to develop an algorithm for the near real-time automatic mapping of FAA in the Kimberley and Pilbara as an alternative to the currently used semi-manual approach. Daily measures of temperature, surface reflectance and vegetation indices from twenty nine NOAA-16 (2001) passes were investigated. It was firstly necessary to apply atmospheric and BRDF corrections to the raw reflectance data to account for the variation caused by changing viewing and illumination geometry over a cycle.

Findings from the four case studies indicate that case studies 1 and 2 exhibited a typical fire response (visible and near-infrared channels and vegetation indices decreased), whereas 3 and 4 displayed an atypical response (visible channel increased while the near-infrared channel and vegetation indices decreased). Alternative vegetation indices such as GEMI,
GEMI3 and VI3 outperformed NDVI in some cases. Likewise atmospheric and BRDF corrected NDVI provided better performance in separating burnt and unburnt classes.

The difficulties in quantifying FAA due to temporal and spatial variation result from numerous factors including vegetation type, fire intensity, rate of ash and charcoal dispersal due to wind and rain, background soil influence and rate of revegetation. In this study two different spectral responses were recorded, indicating the need to set at least two sets of thresholds in an automated or semi-automated classification algorithm. It also highlighted the necessity of atmospheric and BRDF corrections.

It is therefore recommended that future research apply atmospheric and BRDF corrections at the pre-processing stage prior to analysis when utilising a temporal series of NOAA-AVHRR data. Secondly, it is necessary to investigate additional FAA within the four biogeographic regions to enable thresholds to be set in order to develop an algorithm. This algorithm must take into account the variation in a fire’s spectral response which may result from fire intensity, vegetation type, background soil influence or climatic factors.
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