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Stacks of fire – proving the theory

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Abstract

The 66,640km^2 Mount Isa Inlier/Northwest highlands bioregion in north western Queensland is typified by rugged red rocky hills, low open woodland of spinifex and snappy gum and is the location of the Mount Isa Mines copper, lead and zinc open cut, underground mining, processing and smelting operations, ancillary utilities and large pastoral holdings. A biodiversity assessment conducted on the Mount Isa Mines 35,000ha Mining Lease in 2009 identified large scale, intense wildfires to be a key threat to biodiversity. Research including habitat and distribution surveys of the fire sensitive Carpentarian and Kalkadoon grasswrens found that wildfires were extensive across the bioregion and threatening these species. An on-ground implementation fire management program commenced in 2011, continues into its fourth season with full support of mining operations and four neighbouring pastoral holdings. The fire management program is encompassing both asset (mining infrastructure, local airport and high-voltage powerlines network) protection and biodiversity outcomes. The two key principles applied for the successful delivery of the project are; extensive engagement of stakeholders, considered of particular importance due to the heightened awareness of the detrimental impacts of fire in the area and the burning implementation techniques applied. The success of engagement has been demonstrated by the ease at which the burning implementation can be carried out in close proximity to mining infrastructure and with neighbouring property holders. The parameters which attribute to the high rate of success with this program included no mine shut downs or production interference during the burns. The burning method hypothesis utilised has been tested with a series of 'experimental method' burns in 2014 to enhance fire behaviour understanding. The experiment tested the wet season against the wind, patchy ignition method verses the dryer season, single line with the wind method to ascertain impact on vegetation damage, germination and soil health.

Introduction

The Mount Isa Mines 35,000ha Mining Lease is situated in the 66,640km^2 Mount Isa Inlier/Northwest highlands bioregion in north western Queensland (Figure 1). The region is typified by rugged red rocky hills, low open woodland of spinifex and snappy gum large pastoral holdings. The Mount Isa Mines operation is focused on copper, lead and zinc open cut and underground mining, multi mineral processing and smelting facilities, ancillary utilities and distribution services.

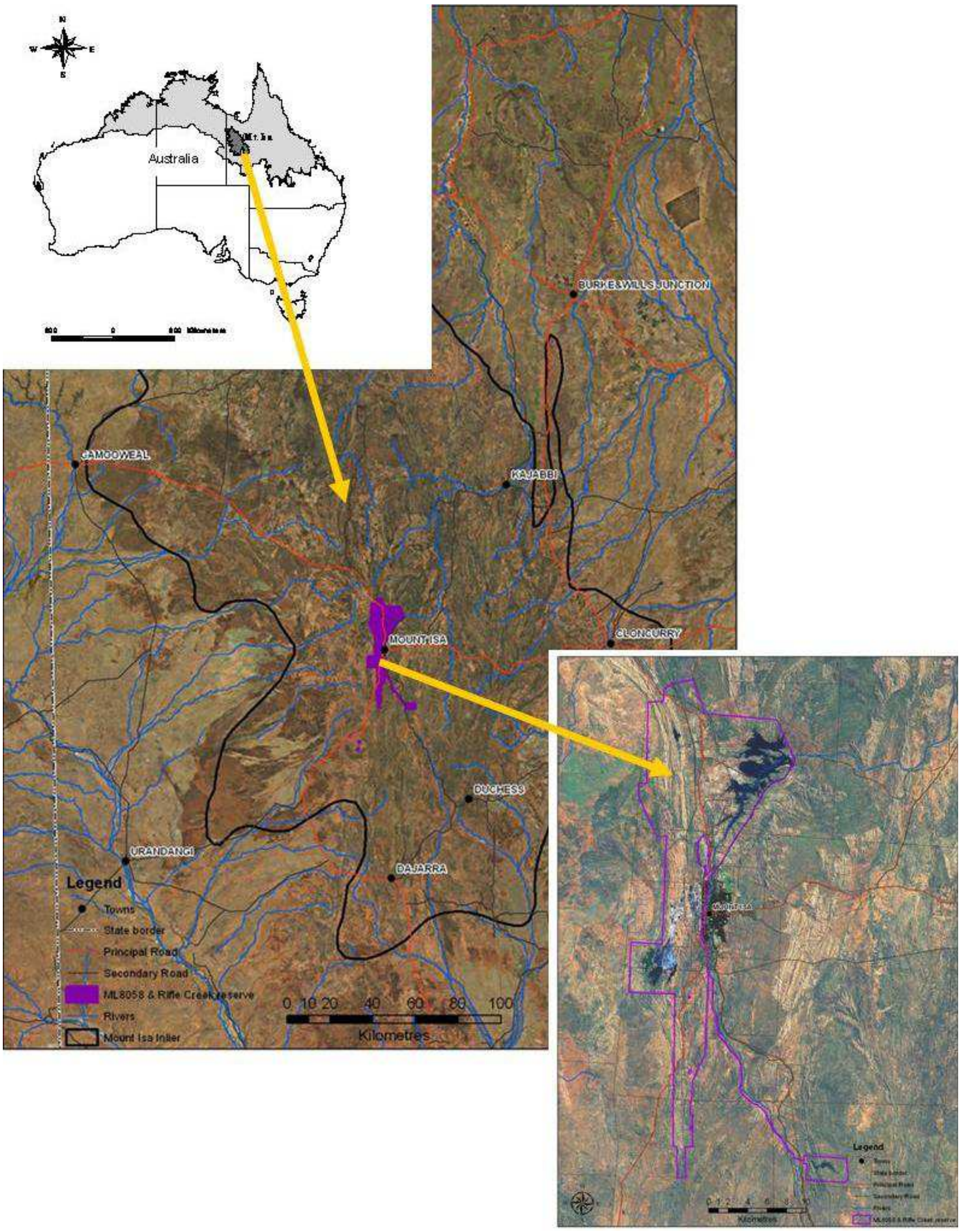

Figure 1: Location of the Mount Isa Inlier/North west highlands and Mount Isa Mines Mining Lease

Background

The 2009 biodiversity assessment conducted on the Mining Lease covering 18 regional ecosystems identified large scale and intense wildfire as a key threat to the integrity of the biodiversity in the bio-region. Fire is a natural part of the landscape and is key for providing habitat differences (Felderhof 2007). Southern Gulf Catchments (2007) state the natural fire regime for the bioregion is a mosaic of recently burnt and long unburnt patches and inter-patches. The frequency of fires has reduced with the introduction of grazing with large areas of country being long unburnt, resulting in an increased risk of higher intensity and broad scale fires when they do occur. This change in the landscape to large scale intense fires has shown in research by Murphy et al (2011) localised impacts on species the Carpentarian and Kalkadoon grass wrens which prefers dense spinifex which develops after long fire-free intervals. An example of the impact of the changed fire regime is a wildfire in 2012 (Figure 2) wildfire in the north-west of the Mining Lease included an area of “Of concern” Silver ironbark shrubland. The intensity and scale of this fire event in this area “Of Concern” has the potential to devastate to the ecosystem. Another example is the repeated and extensive fire in an area of gidgee also an “Of concern” regional ecosystem is showing signs of tree damage and death (Figure 3).

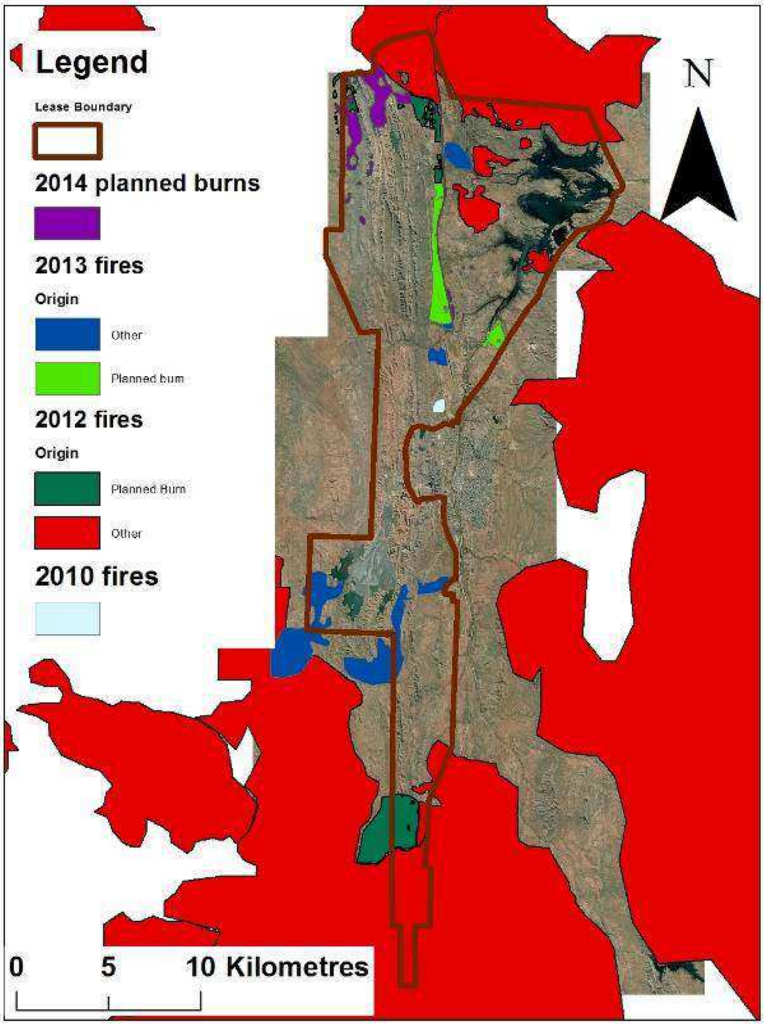

Figure 2: Fire history in the area surrounding the Mount Isa Mines Lease

Figure 3: Gidgee before (T) and after a wildfire (B)

A fire management program commenced on the Mount Isa Mines Lease in wet season of 2011/2012 and is now in its fourth year. The program undergoes a continuous improvement review each year with learnings incorporated into the planning and on ground implementation.

Method

The project has two key components:- comprehensive engagement and applying appropriate on-ground burning methods.

Engagement

Extensive engagement of stakeholders is of particular importance due to people's awareness of the detrimental impacts of fire. Engagement includes the following

- Consultation with the local Mount Isa stakeholders such as the Metropolitan Fire Brigade, local council, airport and the local Native Title Holders
- Education on importance of burning in the Mount Isa Mine 2 Market magazine
- Public notices in the local paper
- Discussions with operations managers to identify production issues such as timing (on weekends and the beginning of the month) to minimise impact potential on production

The success of engagement has been demonstrated by the willingness of operations to approve the burning program carried out in close proximity to mining infrastructure and the integration with neighbouring property holders (Figure 4). The parameters which attribute to the high rate of success with this program included no mine shut downs or production interference during the burns.

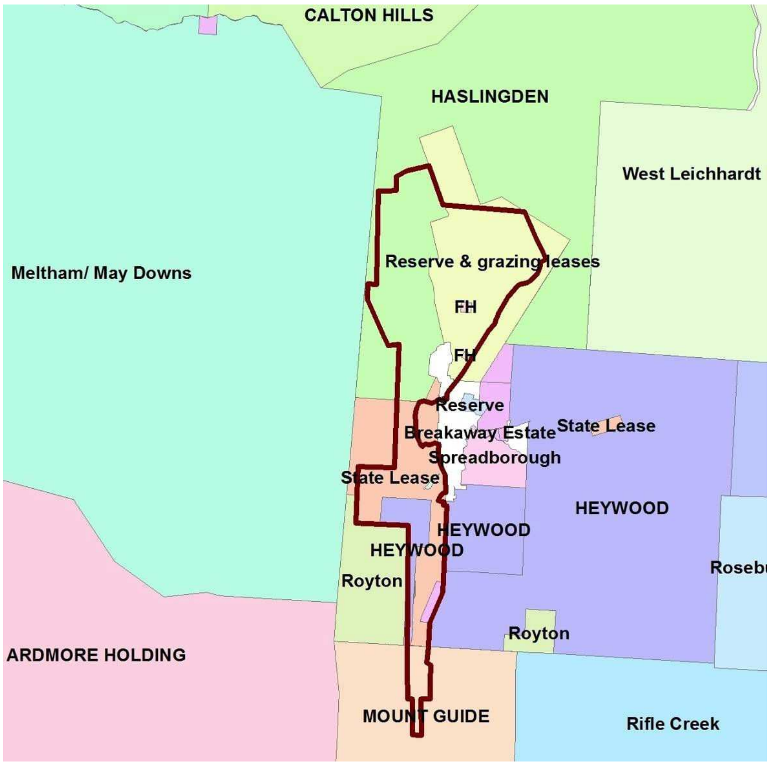

Figure 4: Mount Isa Mines Lease and surrounding pastoral properties

On-ground implementation

Significant planning is undertaken prior to conducting burning. It involves the following

- On-ground assessments of fire history and risk posed to key habitats such long unburnt areas within large recently burnt areas, ecosystem status listings to determine burn areas for biodiversity and infrastructure protection;
- Assessing the integrity of fire breaks (man-made and natural) around the proposed burn area and nearby infrastructure.
- Risk assessment requirements; emergency management and contingency planning
- Permit from the local rural fire brigade

The burning is conducted during the wet season after 150mm rainfall, low wind and high humidity conditions. This ensures a manageable slow cool patchy burn. Ignition is done by strategic aerial incendiary (condys crystals filled pingpong balls injected with glycol dropped from a helicopter) or spot ignition by drip torch.

Testing the method

The burning method hypothesis has been tested with a series of ‘experimental method’ burns to enhance fire behaviour understanding. The experiment by Williams et al (2014) is the comparison of four ignition types:- single spot ignition against the wind direction; single spot ignition with the wind; 50m continuous line drip torch ignition against the wind; 50m continuous line drip torch ignition with the wind. Measured fuel loads (disk drop method) soil temperature strips and ibuttons 5 and 10mm fire intensity (kilowatts per metre kWm^{-1}) = fuel consumed by the fire front (grams per m^2) multiplied by the speed of the fire front (metres per second) multiplied by the heat yield of the burning fuel (using the standard constant of 20 Joules per gram of fuel).

Results and discussion

All burns to date have been completed without suspending operations at the mine. Patchiness within the implementation areas was obtained and protection of infrastructure achieved due to reduction in fuel loads.

A successful burn was conducted in an area high fuel load and a fire age greater than 7 years.

Aims: Infrastructure protection from wildfire and to create a habitat mosaic.

Method: Drip torch spot ignition. The burn was conducted on a weekend at start of the month, was less than 500m from a warehouse, ore crushing plant, 320 man camp with personnel on shift, several high voltage powerlines, the Barkly Highway and underground mine fresh air intake ventilation systems (Figure 5).

Result: No interruptions to mining operations and patchiness of 40 – 80%.

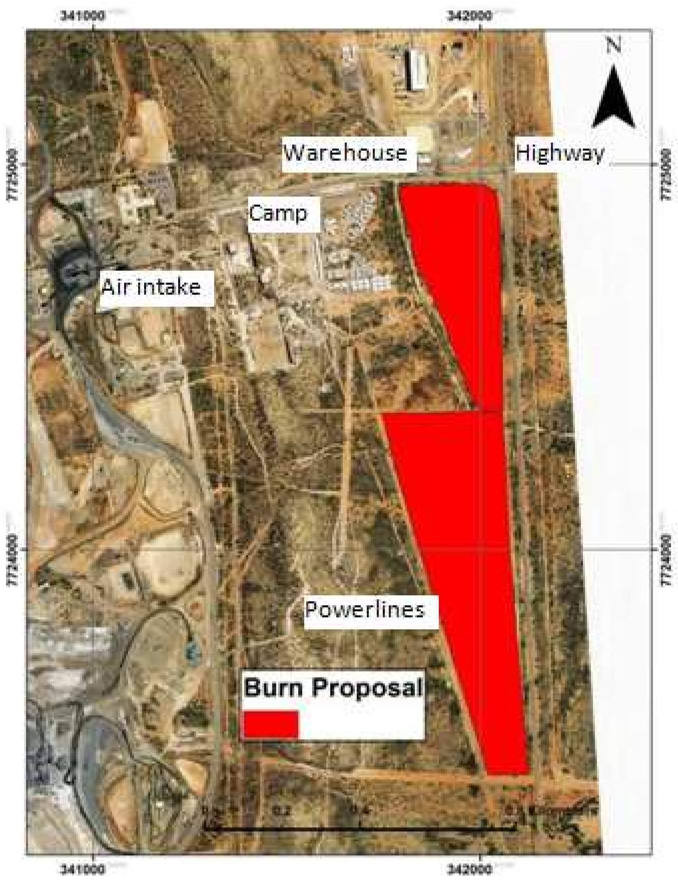

Figure 5: Burn Management Plan map for infrastructure burn in 2011

Testing the method:

Fuel loads and spinifex connectivity no significant difference. Fire intensity was significantly greater on the 50m continuous line ignition with the wind than 50m continuous line ignition against the wind and single spot ignition lit against the wind. No significant difference in soil temperatures between different ignition types.

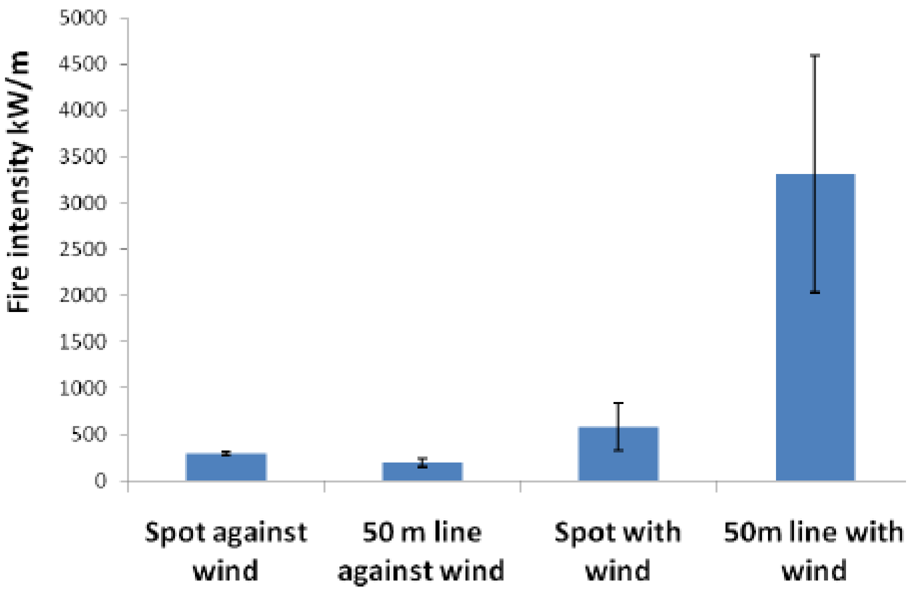

Figure 6: Average fire intensity by ignition type

The clear pattern that emerged from these trial burns was that a 50 m line ignition produced higher fire intensity than line ignition against the wind and spot ignition against the wind. Weather at the time of ignition, i.e. temperature, relative humidity and wind speed, did not provide a clear correlation with fire intensity. This study has indicated that fires with line ignition produce the highest intensity (Figure 6). This correlates with the more severe and less patchy wildfires that have occurred in the district in recent years.

The study supports the concept of using spot ignition points for producing patchy, moderate to low intensity fires. The program will continue to be successful utilising the current methodologies.

Acknowledgements

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