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UNDERSTANDING PRESENT AND FUTURE BUSHFIRE HAZARD REDUCTION BURN WINDOWS IN NSW

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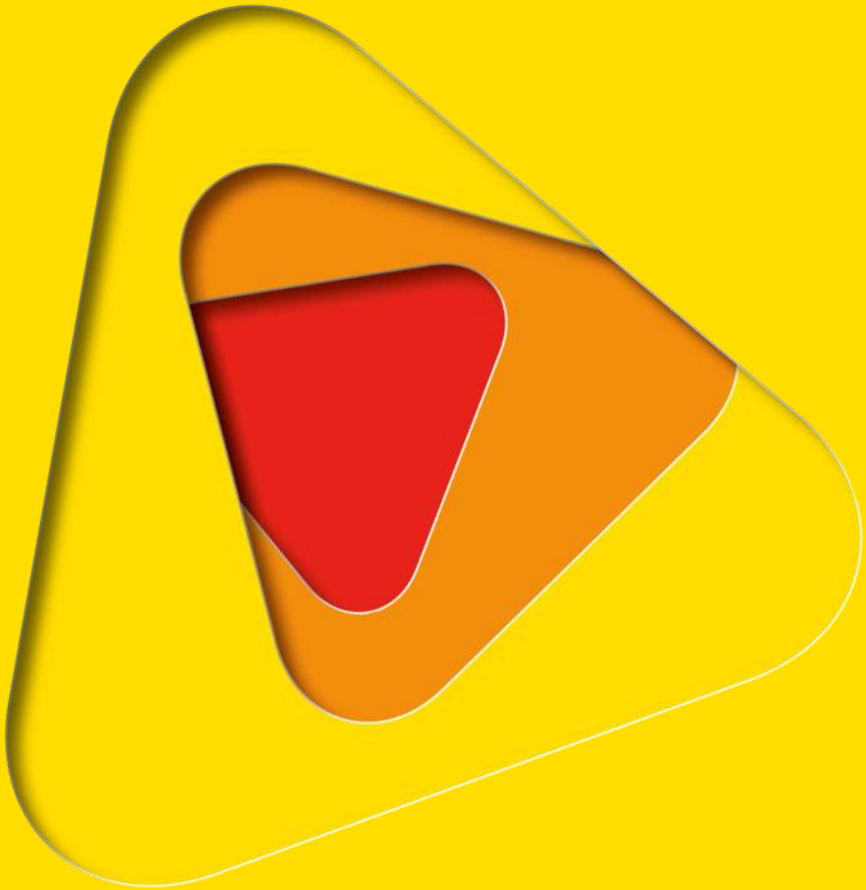

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HAZARD REDUCTION BURNING AND THE NSW CONTEXT

Fuel management is the practice of maintaining vegetation at acceptable levels with respect to the risk posed to various assets by bushfires (Office of Environment and Heritage, 2013). A key aim of fuel management activities is to modify fuel characteristics in order to reduce fire behaviour, thus improving the ability to suppress bushfires. One method for managing fuel is hazard reduction (HR) burning, also known as prescribed burning: the planned use of fire, under specified weather conditions and in defined areas, to manage fuel. As part of its response to the 2009 Victorian Bushfires Royal Commission Final Report, the NSW Government committed to treating an average of 135,000 hectares per year of parks estate, largely through HR burning (NSW Government, 2010). The plan acknowledges that a narrow window of opportunity exists in NSW for burning safely and effectively, and that achieving burn targets depends on the presence of these windows of suitable weather conditions.

HR BURN WINDOWS IN PRACTICE

National Parks and Wildlife Service (NPWS) HR burn plans require preferred fire behaviour and weather to be specified. Fire behaviour properties include the planned fire intensity, the desired average flame height and the desired scorch height. Relevant weather elements include wind speed, wind direction, fuel moisture, relative humidity, soil moisture deficit and temperature. NPWS supplies some generic values of these quantities as a starting point, but staff are authorised to adapt these to local conditions (e.g. local vegetation) and the aims of the burn. An alternative to these generic guidelines stems from a pilot tool aimed at forecasting conditions suitable for HR burns (Rural Fire Service, 2013). However, despite recognition of the pivotal nature and relative infrequency of HR burn windows, there has been little quantification of just how frequently these windows occur, and other properties related to their spatiotemporal distribution in NSW. Moreover, it is unclear how closely the theoretical weather condition guidelines match those observed in practice i.e. during actual HR burns.

AN OBJECTIVE CLIMATOLOGY OF HR BURN WINDOWS

An aim of this research is to develop an objective climatology of HR burn windows in NSW, including their frequency, duration, variation and timing. In order to capture as many aspects of the phenomenon as possible, three measures of HR burn windows will be used: thresholds based on existing fire managers guidelines; thresholds based on extended burning seasons of autumn (March to June) and spring (July to October), during which the majority of burns take place; and reverse-engineered thresholds, based on prevailing weather conditions at the time that HR burns have taken place. This analysis required weather observations and records of prescribed burning from fire agencies. Because fire weather plays a key role in determining the suitability of weather conditions, observations of the McArthur Forest Fire Danger Index (FFDI; Luke and McArthur, 1978) are required. This limits the nature (point based rather than gridded), length (beginning 1973) and spatial coverage (a subset of the overall station network) of observations (Lucas, 2010). HR burn records are drawn from the Bushfire Risk Information Management System (BRIMS), in which high quality records commence around 2003.

PROJECTING THE IMPACT OF CLIMATE CHANGE ON HR BURN WINDOWS

Although multiple studies have investigated the impact of climate change on extreme and average fire weather conditions in Australia (Clarke et al., 2011; Fox-Hughes et al., 2014) and overseas (Yue et al., 2013; Lehtonen et al., 2014;), the authors are not aware of any studies projecting changes to fire weather conditions specifically conducive to prescribed burning. This study applies the HR burn window definitions discussed above to output from the NSW and ACT Regional Climate Modelling project (NARCliM; Evans et al., 2014). NARCliM utilises an objectively designed regional climate model (RCM) ensemble to project future changes in climate for NSW and the ACT. This ensemble is drawn from four global climate models and three RCMs, all selected for their skill in simulating the climate of NSW, their independence as models, and their ability to span the range of future climate change. Each RCM is based on the Weather and Regional Forecasting (WRF) regional climate modelling system (Skamarock et al., 2008). Model output has a horizontal resolution of 10 km. All models are supplied greenhouse gas concentrations corresponding to the A2 Special Report on Emissions Scenario (SRES) scenario (Nakicenovic et al., 2000).

WRF has previously been evaluated for its ability to simulate fire weather (Clarke et al., 2013) and the general climate (Evans and McCabe 2010) of southeast Australia. In general, WRF captures the broad distribution and spatial gradient in average and extreme FFDI well, but has an overall tendency towards overestimating FFDI. The evaluated simulations were forced by a reanalysis (also used in NARCliM), not a global climate model (GCM). This suggests that WRF does not introduce large biases to reasonable boundary conditions (i.e. reanalyses), but it does not address biases in the GCMs used to supply boundary conditions in this study.

SCOPE OF RESEARCH AND END USER FOCUS

There is already an active research community investigating the impacts of prescribed burning on bushfire risk (e.g. Price & Bradstock 2012; Cochrane et al., 2012; Burrows and McCaw, 2013). This study does not aim to critique current HR burning practices nor suggest solutions. Fire weather conditions are just one factor, albeit a very important one, that contributes to the decision to conduct HR burns. The aim of improving our understanding of present and future HR burn windows, in both theory and practice, is to give fire management agencies the best possible evidence for supporting decision making in this key area of bushfire risk management. To that end, fire managers have been involved in this project from conception to methodological design and are a critical part of ensuring the findings are useful and used by the fire management community in NSW.

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