INDEPENDENTBUSHFIREGROUP

Fire Study 11: Bees Nest fire, Northern Tablelands
Issue: Inadequate fire behaviour modelling can lead to flawed strategies
Period: Around 9 September 2019

The effect of poor fire behaviour modelling can be illustrated by examining the Bees Nest fire, north of Dorrigo, NSW.

Situation

On 9 September 2019 the fire reached an area of very long unburnt (~700 years) North Coast Wet Sclerophyll Forest (Keith 2004) with a canopy of tallow wood and brushbox. The long-unburnt history of the forest had enabled a rainforest understorey to develop, with a dense sub-canopy dominated by coachwood over a tall but sparse shrub layer. It had also allowed a litter layer of about 20 tonnes per hectare to be maintained. Considering this along with the tall shrubs, both the McArthur and Project Vesta models predict flame heights of 4-6m for the mild weather conditions of the 9 September.

However, the weight of surface litter has no bearing on overall flame height (Zylstra et al 2016). Old-growth tallow wood forest is also markedly different to young regrowth jarrah; the shrubs for example are far less dense because there has been no recent disturbance. They are also mesic species with high moisture contents that make them slow to ignite. Their foliage is sparse because they grow in shade, and the base of the shrub canopies is high above the ground. Based on these and other factors such as the slow wind speeds beneath the dense mid-storey, FRaME modelling indicates that the shrubs were very unlikely to ignite, so that flame heights would generally be less than one metre in height.

Following the event, satellite measurements of fire severity *(Figure FS31)* found that fire impacts on vegetation were undetectable through the tallow wood forest and the core of true rainforest[1]. Heat signatures were however detected by other satellites (Geoscience Australia 2019) through the tallow wood, but not the rainforest. Together, these indicate that the tallow wood did likely burn, but at a severity that was undetectable by the post-fire satellite measurements of vegetation.

The contrast between predictions made using McArthur and Vesta and what was modelled in FRaME and measured by satellite underpin contrasting options for controlling such a fire. The small flames predicted by FRaME and shown by satellite measurements can be contained using direct or parallel attack by RAF crews or by using tankers along fire trails. If large flames as predicted by McArthur and Vesta were expected, these would generally need to be contained with an indirect backburn. Backburning can be less successful than direct attack and more likely to inadvertently advance the fire front through escapes. A decision to backburn rather than direct attack would result in the burning of the long-unburnt tallow wood forest. (It is not known what action was taken with this fire, as records have not yet been obtainable).

FRaME modelling indicates that, even though many of the rainforest trees would not have been scorched, heat would have penetrated through the thin bark into the cambium, resulting in girdling and death of coachwood and other such trees. This would

[1] *Data available at:* https://datasets.seed.nsw.gov.au/dataset/fire-extent-and-severity-mapping-fesm

significantly increase the flammability of the site for decades. Tree death allows more sunlight to reach the forest floor to stimulate shrub growth, create drier conditions allowing more frequent fire spread and favouring drier, denser shrubs. Reduced canopy and understorey density will allow more wind access when fires are burning. The impact of burning this forest with a slow, low-severity fire is that the next fire is likely to be far more severe.

Potential lesson

Faulty models for bush fire behaviour can misrepresent expected fire behaviour leading to inappropriate strategies and more impact on natural values, especially moist forest types which are desirable to maintain as natural moderators of bushfire.

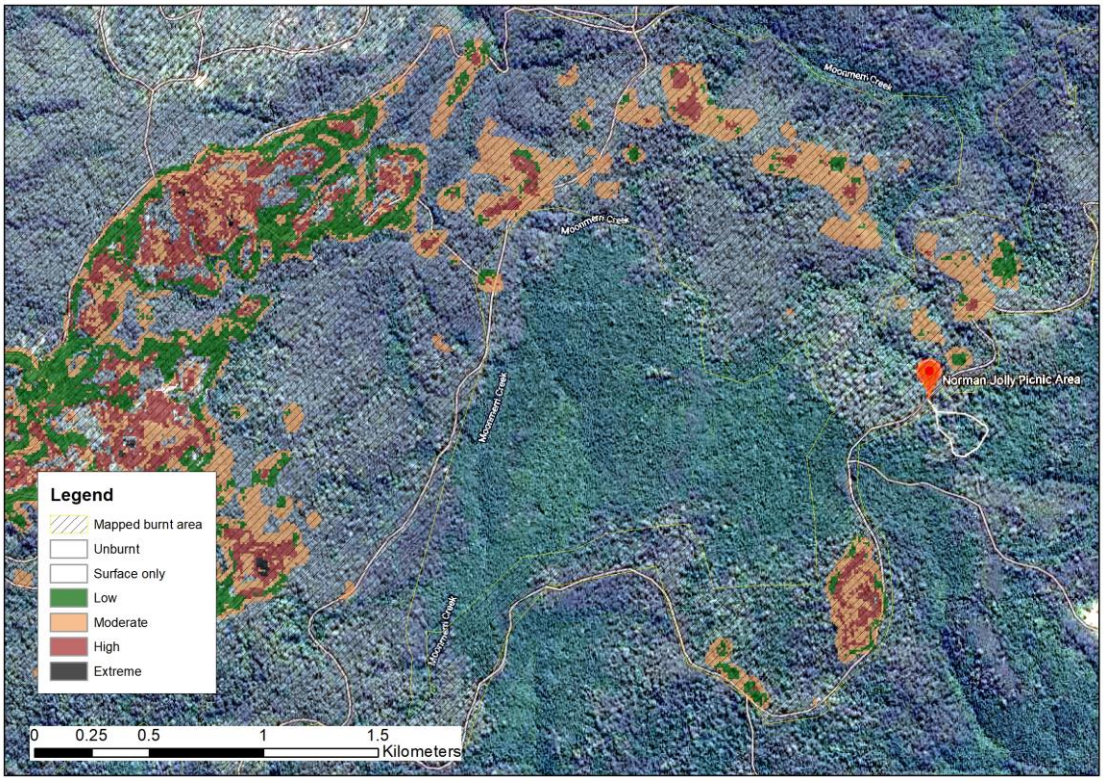

Figure FS31: Fire impacts in the tallow wood study area. Dark green areas in the air photo show rainforest patches, predominantly surrounded by the lighter coloured wet sclerophyll. The hatching indicates the area that was mapped as burnt, and the coloured overlay indicates the areas where the severity of the burn was detectable and could be mapped by satellite. Source: https://datasets.seed.nsw.gov.au/dataset/fire-extent-and-severity-mapping-fesm

Fire Study Author

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Phil Zylstra is an Adjunct Associate Professor at Curtin University (WA) and an Honorary Fellow at the University of Wollongong. Phil worked in fire management across the Snowy Mountains from 2002-2012 and again in 2017, where he was one of NSW's first fire behaviour analysts. He combined management with research starting in 2004, to develop FRaME (Fire Research and Modelling Environment), which is the only peer-reviewed fire behaviour model in Australia for forests other than West Australian jarrah, the only existing model showing species' effects on fire behaviour, and the only model for first-order fire effects on wildlife. Phil now combines these mechanistic approaches with empirical analyses of fire history to understand what drives flammability in Australian forests, and what new thinking is needed to mitigate the increasing fire risk posed by climate change.