

Developing risk modelling for determining the extent and location of prescribed fire to mitigate bushfire impact.

Many jurisdictions are moving from area (hectares) targets to the development of a risk based framework to determine the priorities for prescribed burning for wildfire mitigation works.

Historically the location and extent of prescribed burning was based on good local knowledge, a history (mostly oral, some documented) of what worked (or didn't) in the past, practical experience from working in the bush, some scientific research and a *fair let's have a crack and do what we can under these conditions* attitude.

It is time we now consider exactly what risks and whose risks are we measuring.

How do we currently measure risk?

With the advent of simulation software, such as PHOENIX Rapidfire (Tolhurst, Shields & Chong, 2008,) there has been rapid developments in using modelling to simulate how bushfires are likely to behave and how assets and values may be impacted. These models are now being used to make calculations on community bushfire risk and determine the location and extent of prescribed fire.

The Victorian Safer Together program uses scenario modelling developed by Department of Environment, Land, Water and Planning (DELWP 2015) to develop a landscape residual risk profile. This compares the current or future risk against a maximum risk scenario which assumes that all the fuel in the landscape is at the highest possible level. DELWP are able to project future levels of residual risk, by modelling the impact of planned burn activities which have been scheduled over the next three years. Using this modelling DELWP compares the effectiveness of different bushfire management regimes. This system has the ability to simulate and assess many thousands of potential bushfires, however the limitations of the system need to be understood and comprehended by fire planners / managers, politicians and the general public. DELWP (2015) have documented some of the major limitations used in their Bushfire Landscape modelling, in essence:

- All bushfires have been simulated using the same weather scenario – a typical worst case day.
- The modelling is restricted to a one day fire, igniting and running under the scenario weather conditions until approximately 23:00 hours (Gazzard et al 2020.)
- The only risk considered is that posed to human life and property
 - where property is defined as an address point, ie a potential residence and
 - human life loss is a factor of property loss. (This ratio is based on historical data most of which was collated prior to the change in evacuation policies, etc.)
- All ignitions are considered equally likely. Although there is some more recent work where ignition likelihood is being modelled.
- Modelling is only gives an approximation of reality and
- The outputs depend on the quality of inputs and datasets in current use vary considerable in accuracy and quality.

Cirulis et al (2020) document some advances in modelling where various weather scenarios are used and a probabilistic approach to ignition is used for modelling in the ACT and Tasmania. However their modelling only estimated impacts six values: area burnt, house loss, life loss, powerlines damaged, roads damaged and area burnt below the tolerable fire interval.

The Western Australian approach to bushfire risk is totally different. Their levels of acceptable risk are based around the proportion of fuel that is in a condition such that it will burn with no more than double the intensity at which machine and tanker attack on the head fire is possible under 95th percentile weather conditions (Howard et al, 2020.)

What about other risks?

Some attempts have been made to take into account a far wider set of values. Gazzard et al (2020) documents the structured decision making process used in the Otway Ranges to develop an optimised set of multi-objective fuel management strategies. Here they considered the effects on agriculture, plantations, tourism, public infrastructure, water, cost of treatments, and non-monetary consequences on cultural heritage, community support, threatened and non-threatened fauna, etc.

I was a member of the stakeholder advisory group which informed the land-management group decision making process which is documented by Gazzard et al. When the stakeholder advisory group were presented with trade-off alternatives, they chose one with a relatively higher number of lives lost than some of the other options. This may have been due to the framing of the alternatives. The stakeholder group were asked to compare the alternative strategies with the control which was the maximum risk scenario. The difference between the control, with over 300 lives lost, was materially greater than the other alternatives with 40 to 80 lives lost. Perhaps people were more willing to place a higher value on other values such as biodiversity, economic or cultural heritage when presented with such a contrasting control? I note that in the Stage two of the regime selection process, the land managers were given the current regime rather than maximum risk regime as the control.

Equity in fire risk management

Another area that needs exploration in risk management is how do we judge what is equitable? The current modelling naturally would preference risk reduction where we can avoid the greatest number of lives lost or homes burnt. But is this fair? This leads to an emphasis on areas of greater population, potentially to the detriment of rural and remote areas.



Figure 1 The community of Cudgewa in North East Victoria

The small community of Cudgewa (see Figure 1) in north east Victoria lost 14 homes in the Green Valley / Walwa fire on the 30th December 2019. The impact of the loss is likely to have a far greater impact on the local community than the equivalent loss on the edge of a much larger town. The local publican¹ says that their biggest problem is depression and people struggling. “*Everyone in town that comes into the pub now, you can see in their eyes – and some of them even talk about it when there’s only just a couple of us there – that they’re really struggling with mental health.*” The loss of lives, homes, community facilities and rural businesses in rural communities can be devastating.

Plantation loss and regional social & economic health

Plantations play a role in generating significant employment and economic wealth in regional areas. Shirmer et al (2017a, 2017b, 2018) document the socio-economic impacts of the timber industry in south east Australia. They show that within a number of local government areas (LGA) the timber industry is a major employer. Forest industry directly generates 8% of the jobs in the South Australian part of the Green Triangle and in southern NSW it contributes 22% of the employment in the Bombala Shire and 18% in the Snowy Valleys Council area.

The loss of nearly 30% (~52,000 ha) of the softwood estate in the Murray Valley region (north east Victoria and southern NSW – Snowy Valleys) will significantly impact on the ability of the region to produce over two million tonnes of sawlogs per year (ABARES 2016,) much of which is processed within the region. These 2020 bushfires will have long term impacts on the availability of jobs within regions. We may be able to save their lives but not their jobs! The loss of 158 jobs in 2017, following the closure of the Carter Holt Harvey, Morwell, was directly linked to the 2009 fires which burnt 10,600 hectares of plantation in in the Gippsland region.

Despite their importance, plantations (and other private property / agricultural assets) are often seen negatively or not well incorporated into fire risk planning. In the Barwon South West Bushfire Management Planning (Safer Together, 2019b) public consultation, one of the proposed strategies was specifically labelled as *Protect commercial forestry plantations*. The public consultation concluded, the least favoured strategies were the current fuel management strategy and the strategy which specifically provides protection to the plantation industry and jobs associated with that industry. This was despite the plantation strategy delivering similar outcomes across the different values as the favoured strategy - *Burning big blocks inside forests*. The plantation strategy was disliked by 42% of the respondents.

Discussion

How do we, as fire managers, ensure that people in the bush are given a fair go? And what about the longer term impacts of the loss of forestry and agricultural production and the loss of the genetic resources in 50 years of breeding stock? Rural communities want their knowledge and experience in fire and fire management to be understood and valued by fire and land management agencies. Rural landholders also report confusion and concern about regulatory constraints and their ability to undertake fuel management activities on private land (Safer Together 2019.) We need to develop fire management planning, fuel management and prescribed burning programs that don’t just favour the most populous cities and towns.

Public surveys do need to be taken with a grain of salt, especially ones that require rural people to engage on line. The total number of respondents to the Engage Victoria Bushfire Management Planning was 3167 (Figure 2) out of a State population of over 6 million and some of these may have

¹ The Age 10 March 2020

been the same respondents over the different stages. It is interesting to note that a postal survey during Phase 2 of the Barwon South West plan, received more than 600 responses whereas the online survey received 49. So although a valid form of engagement, we need a considered approach to ensuring a wide range of values are factored into fire management planning.

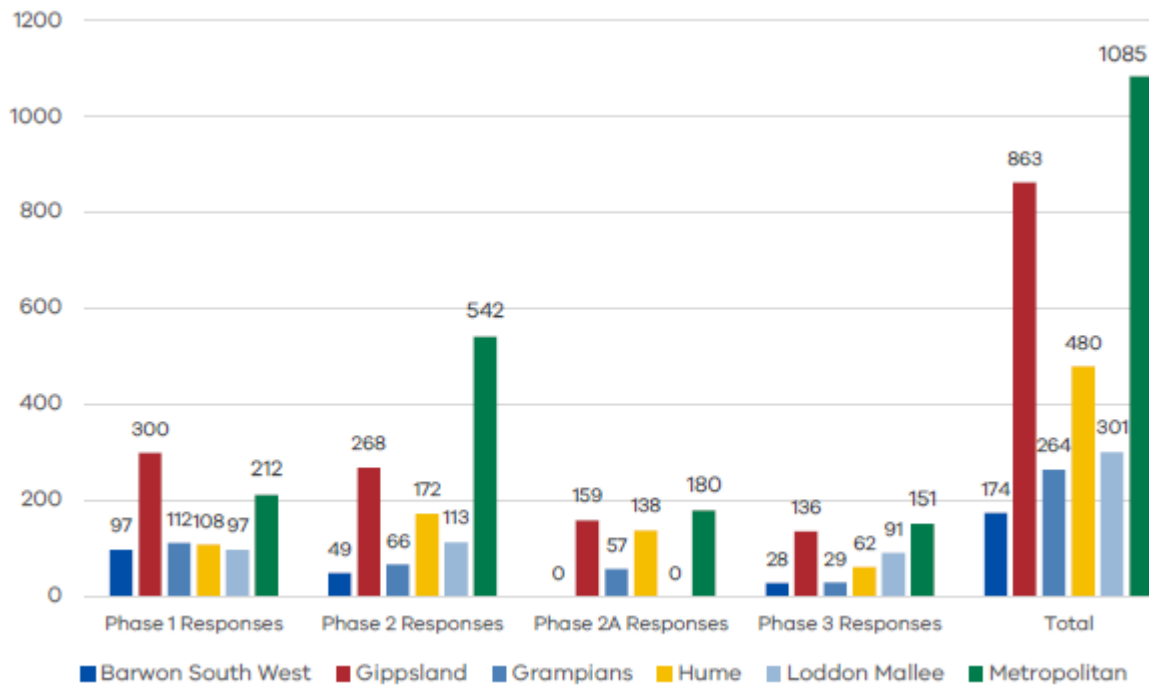


Figure 2 Respondents to Engage Victoria Bushfire Management Planning on line surveys (from Safer Together 2019a)

Castellnou et al (2019) discuss how, in recent years, fire services have been overwhelmed by extreme wildfire behaviour and as a consequence fire management has moved to reactive and defensive strategies, with a focus only on the known risks – lives and property at immediate risk (the fear trap.) The response resources quickly become overwhelmed and are ineffective in stopping the wildfire spread which in turn leads to the endangerment of more lives and property.

In both our fuel management and fire response we have to start thinking more strategically. How do we increase the success of first attack on those remote area fires to prevent them from becoming major campaign fires? There are numerous examples from 2019/20 where the major impact was a number of days after the ignition. The Green Valley / Walwa fire which killed one firefighter, impacted over 300,000 hectares and many small communities and the South Coast NSW fires which destroyed over 450 homes are just two examples. This fire season has shown that fuel management concentrated in areas close to the wildland urban interface may become ineffective when overwhelmed by large fire fronts.

It is also good to remind ourselves of previous research that illustrates very clearly the difference between land management with lots of small ignitions and a society that tried to eliminate fire altogether. Minnich and Chou (1997) mapped historical fires in the chaparral north and south of the USA / Mexico border (Figure 3.) Their conclusion was “*Land managers of Mediterranean wildlands*

should critically examine the ‘well managed’ status of chaparral in Baja California (Mexico) as a ‘showcase’ for ecosystems functioning under natural disturbance.”

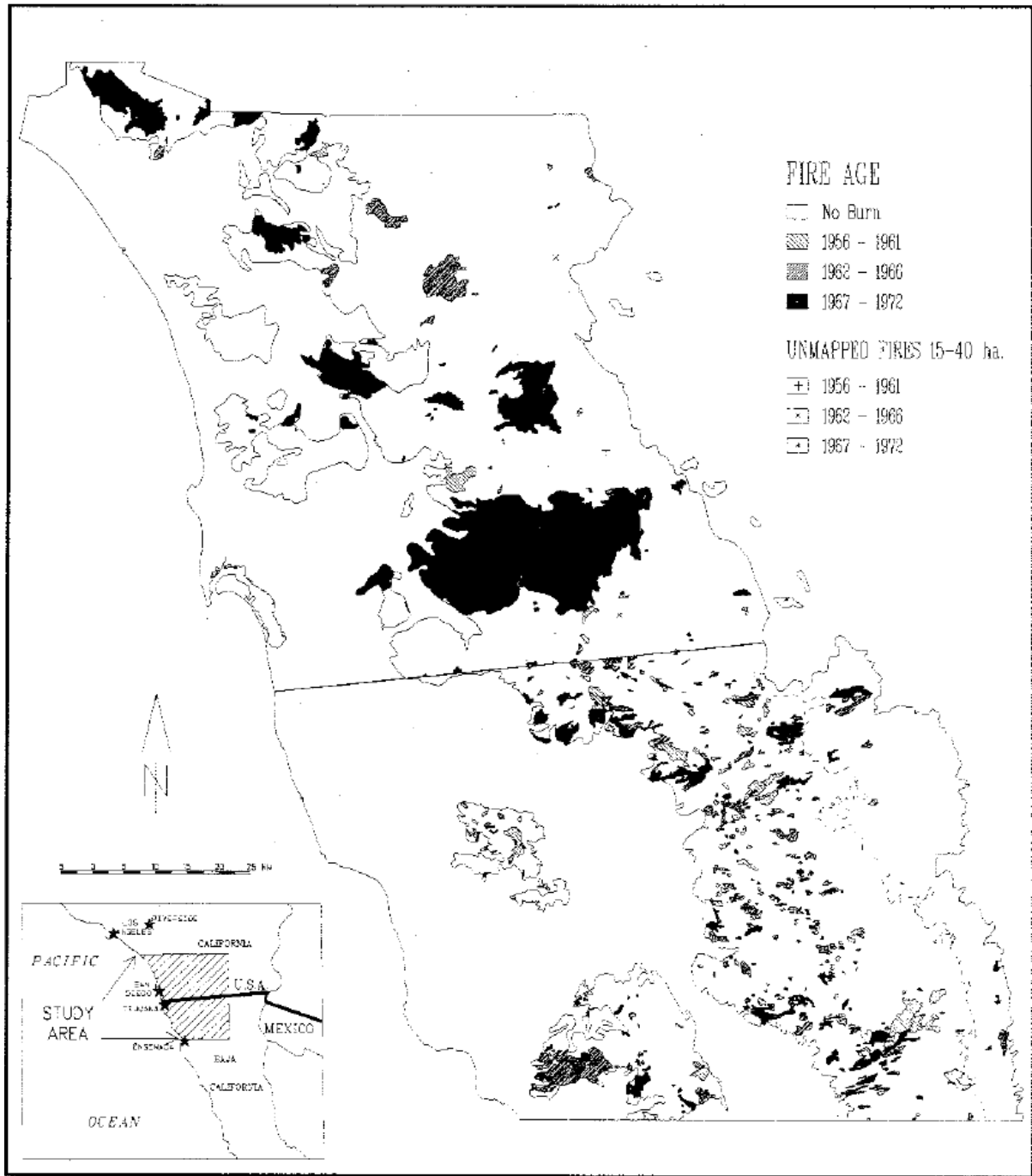


Figure 3 Fire perimeters in chaparral north and south of the USA / Mexico border between 1956 and 1971 (from: Minnich and Chou 1997)

Conclusions

The science of burning is as much about social science as it is about physical science. There are currently no easy solutions to determining exactly where and when we should burn. We must be careful in framing decision making around computer modelling. We need to understand the limitations of our systems and what and whose risk we are measuring. We need to carefully frame our community communication strategies and ensure that rural and remote people have a voice.

Some areas where more research and investigation is needed include:

- Developing fire modelling systems that better reflect the campaign fires that burn over multiple days rather than single day simulations;
- Looking at the importance of equity in fire risk assessment and how as a community we can better support people in rural and remote locations; the small communities and scattered farmhouses;
- Modelling the socio-economic losses of long-term crops, such as horticulture and timber plantations and potential massive impacts on regional employment and prosperity, five to ten years down the track;
- Developing strategies that enhance the probability of success of first attack in remote locations
- The risk trade-offs between:
 - Wide-spread remote area prescribed burning
 - The safety of first responders and their ability to mount an aggressive fire attack and
 - Emergency services spiralling into the fear trap.

About the Author

Ruth Ryan AFSM is Corporate Fire Manager for HVP Plantations where she oversees the activities of seven Country Fire Authority Forest Industry Brigades and fire management of over 160,000 hectares of softwood and hardwood plantations in Victoria. She has over 35 years' experience in forestry and fire in Victoria and has worked in a variety of locations across Victoria, including East Gippsland, the North East, the Murray Plains, The Green Triangle (SW Vic / SE SA) and Central Highlands. She is an experienced firefighter, with operational roles in major and minor fires since the 1983 Ash Wednesday Fires.

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