RESPONSE TO QUESTIONS ON NOTICE

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ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE

Environment Protection and Biodiversity Conservation Amendment (Regional Forest Agreements) Bill 2020

Professor David Lindenmayer

Fenner School of Environment and Society

The Australian National University

Canberra, ACT 2601

Senator McKenzie: Randomness and the design of long-term monitoring program in the Central Highlands of Victoria

Senator McKenzie asked a question regarding the design of long-term monitoring program in the Central Highlands of Victoria. She inquired about whether the program was based on the random selection of sites. The answer to this question is that site selection is not random. There is good reason for this. That is, approximately 98.8% of the forest cover in the Central Highlands is comprised of forest aged ~ 80 years or younger (Lindenmayer and Taylor 2020). A random selection of sites would in turn be heavily biased towards sites of this age (because that is the predominant age class in the Mountain Ash and Alpine Ash ecosystem) (Burns et al. 2015) (Lindenmayer and Taylor 2020). A biased focus on young forest would limit inference from the long-term data collection to young forests, with the results unable to be extrapolated to other forest conditions such as old growth. On this bases, the statistical basis for the design of the long-term monitoring program was to ensure that the full range of environmental and biophysical conditions in the landscape were encompassed in the array of site types that are targeted for sampling and resampling on a regular basis (Lindenmayer et al. 2003). Therefore, the suite of sites in the monitoring program includes young forest, old growth forest, steep slopes, flat terrain, burnt forest, unburnt forest, forest on north and other aspects, forests with a high value for topographic wetness and low values for this measure, forests at high, low and intermediate elevation, forests with numerous hollow-bearing trees versus forests where these keystone structure are rare (Lindenmayer et al. 2020a). Hence, as a result of the array of conditions sampled in the monitoring program, the basis for ecological and statistical inference is broad across the ash-type forests in the Central Highlands of Victoria. Notably, the sites span wood production forests and national parks/closed water

catchments in equal measure – enabling inference across tenures – as was explained in response to questions from Senator Abbetts.

This design for the monitoring program in the Central Highlands of Victoria has been published in the peer-reviewed scientific literature (Lindenmayer et al. 2003) and is widely recognized as best practice for monitoring design. Notably, the design was guided by three leading statistical scientists – Professor Ross Cunningham, Professor Alan Welsh (who [like me] is a member of the Australian Academy of Science) and the late Associate-Professor Jeff Wood. The monitoring work is now guided by Dr Wade Blanchard whom has more than 30 years of experience in experimental design and the analysis of high quality ecological and other datasets (e.g. see (Lindenmayer et al. 2013, Lindenmayer et al. 2014a, Lindenmayer et al. 2018a, Lindenmayer et al. 2018b, Lindenmayer et al. 2019b) (Lindenmayer et al. 2020a)). We have published extensively on the statistics underpinning large-scale experiments and quasi-experiments as well as observation studies (e.g. see (Cunningham and Lindenmayer 2016)) as well as produced several seminal papers and books on how best to design, implement and maintain high quality monitoring programs (Lindenmayer and Likens 2010a, b, c) (Lindenmayer et al. 2014b) (Legge et al. 2018, Lindenmayer et al. 2020c) (Lindenmayer and Likens 2018).

Senator McKenzie requested a map of the locations of field sites. This map is shown in Figure 1 below which has been reproduced from a paper on temporal changes in site occupancy by arboreal marsupials (Lindenmayer et al. 2020a).

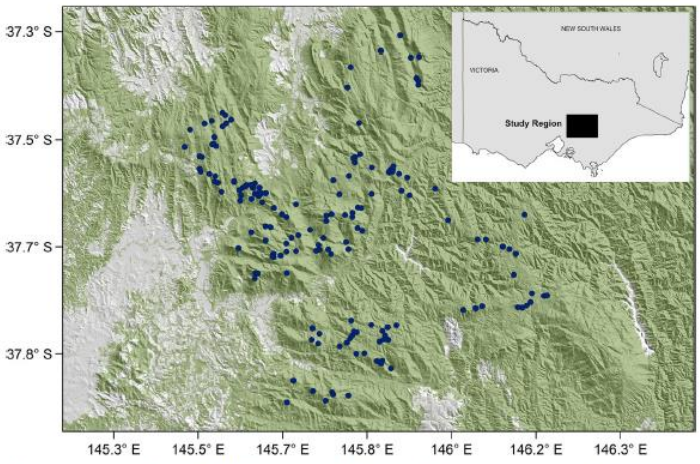


Figure 1 The location of the study area in the Central Highlands of Victoria, south-eastern Australia. The black dots show the location of field survey sites.

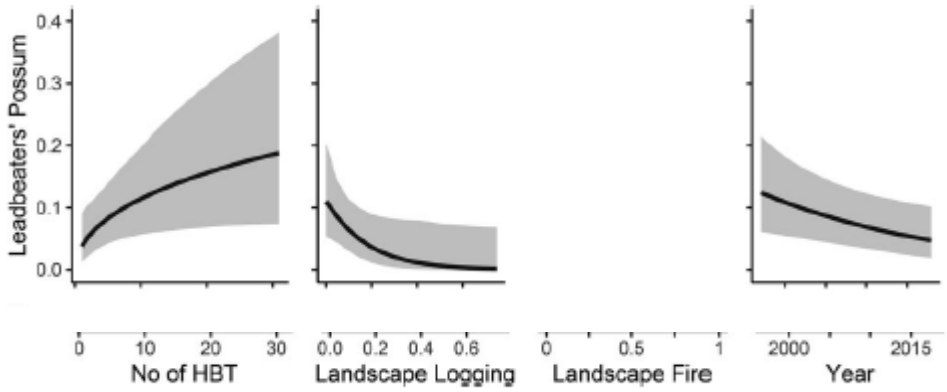
Senator McKenzie: Leadbeater's Possum and patterns of site occupancy on burnt sites

Senator McKenzie asked a question about the occurrence of animals on sites burnt in the 2009 wildfires. This is a good question. The long-term data show that levels of site occupancy by Leadbeater's Possum have declined by 50% since 1997 (Lindenmayer et al. 2020a). This includes a highly significant decline on burnt sites. The decline is also linked to

a decline in the abundance of hollow-bearing trees and the increasing amount of logging in the landscape (Lindenmayer et al. 2020a). Importantly, it is also indirectly linked to whether sites have been burnt both due to direct mortality (Lindenmayer et al. 2013) and the accelerated loss of hollow-bearing trees on sites following wildfire (Lindenmayer et al. 2012) (Lindenmayer et al. 2019a). Therefore, many of the sites which used to support Leadbeater's Possum, no longer support the species – in part because of the loss of nesting and denning sites due to fire and the amount of logging in the surrounding landscape (Lindenmayer et al. 2020a).

A key issue is the state of the forest at the time it was burnt. Where fire burns in old growth forest, then there are more biological legacies such as large fire-scarred dead and living large old trees and these in turn may eventually provide nesting sites for animals (Lindenmayer et al. 2019c). The key problem in the Central Highlands of Victoria is that just 1.16% of the landscape in Mountain Ash and Alpine Ash ecosystems is old growth and therefore subsequent wildfires will NOT produce the pulses of large old trees needed to ensure the long-term persistence of animals (Lindenmayer et al. 2020b). The solution to this problem is to protect existing regrowth forest and maximize its chances of growing through to become old growth forest (Blair et al. 2018). Indeed, old growth forest is where fire severity is lowest (Taylor et al. 2014) (Lindenmayer et al. 2021). Ongoing logging is not only concentrated in areas of high conservation value for animals such as Leadbeater's Possum (and other threatened species like the Greater Glider, see (Taylor and Lindenmayer 2019)), but also further fragments Mountain Ash and Alpine Ash ecosystems (Taylor and Lindenmayer 2020) which has major negative impacts on biodiversity (including Leadbeater's Possum) (Lindenmayer et al. 2020a) – see figure below which shows the relationships between site occupancy and the amount of logging in the landscape.

Figure 2. Relationships between key covariates and site occupancy by Leadbeater's Possum (from (Lindenmayer et al. 2020a)).



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