Second report on the potential impact of the 2014 'Orbost Fire Complex' on Large Forest Owls in the East Gippsland Forest Management Area

By

Rohan J. Bilney

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Report for

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Front Cover Images: Top – Burnt forest along Bonang Highway north of Goongerah categorised as Moderate Canopy Scorch following the Orbost Fire Complex [Image taken 5/4/15, approximately 14 months post burn]. **Below** – left to right – male Masked Owl, male Powerful Owl, male Sooty Owl. All photos by the author.

Rohan John Bilney

I have read and understand the Expert Witness Code of Conduct and agree to be bound by it.

Education

2005-2009	**Doctor of Philosophy**
	Deakin University, Burwood Campus
2004	**Bachelor of Environmental Science (Honours)**
	Deakin University, Burwood Campus
2001-2003	**Bachelor of Science (Zoology, Ecology & Evolution)**
	Monash University, Clayton Campus

Qualifications and Experience relating to owls

Since 2002 I have been undertaking research into the ecology of Sooty Owls and Powerful Owls in East Gippsland. This research contributed towards my Honours degree (in 2004) and eventually PhD (2005-2009). The ecological attributes that I have investigated included diet, roosting, breeding, habitat utilization, and home-range. This research culminated in amongst the most detailed ecological studies undertaken on these owls. In contrast, the ecological information I have collected on Masked Owls is limited, and mainly includes short-term radio-tracking of several individuals and general observations of the species while undertaking research on Powerful Owls and Sooty Owls. From my research on owls I have written 11 papers published in scientific journals (see list below), with several more papers expected. Since completing my PhD I periodically visit some long-term study sites to monitor owl activity and collect dietary items (for a long-term dietary study). In recent years I have also undertaken work for various clients conducting call-playback surveys and dusk listening surveys to detect owls throughout East and South Gippsland and south-eastern NSW.

Publications relating to owls

Bilney, R.J. and Bilney, R.J. (submitted). Diet of a Masked Owl from a sub-alpine roost. The Victorian Naturalist

L'Hotellier, F. and Bilney, R. (submitted). The diet and roosting sites of Sooty Owls from coastal habitats at Cape Conran, Victoria. The Victorian Naturalist

Bilney, R.J. (2014). Poor historical data drive conservation complacency: the case of mammal decline in south-eastern Australian forests. *Austral Ecology* **39**, 875-886.

Bilney, R.J. (2013). Geographical variation in the diet of the powerful owl *Ninox strenua* at a local scale. *Australian Journal of Zoology* **61**, 372-377.

Bilney, R.J. and L'Hotellier, F. (2013). Observations of Masked Owls *Tyto novaehollandiae* in East Gippsland, Victoria. *Australian Field Ornithology* **30**, 113-125.

Bilney, R.J. (2013). Home-range, diet and breeding of a Powerful Owl *Ninox strenua* in East Gippsland. *Australian Field Ornithology* **30**, 40-46.

Bilney, R.J. (2012). A reassessment of the predator responsible for Wakefield's 'Natve Cat den' sub-fossil deposits in the Buchan district: Sooty Owl, not Eastern Quoll. *The Victorian Naturalist* **129**, 138-143.

Bilney, R.J., White, J.G. and Cooke, R.. (2011). Reversed sexual dimorphism and altered prey base: the effect on sooty owl (*Tyto tenebricosa tenebricosa*) diet. *Australian Journal of Zoology* **59**, 302-311.

Bilney, R.J., Cooke, R. and White, J. (2011). Potential competition between two top-order predators following a dramatic contraction in the diversity of their prey base. *Animal Biology* **61**, 29-47.

Bilney, R.J., White, J., L'Hotellier, F.A. and Cooke, R. (2011). Spatial ecology of sooty owls in south-eastern Australian coastal forests: implications for forest management and reserve design. *EMU* **111**, 92-99.

Bilney, R.J., Cooke, R. and White, J. (2010). Underestimated and severe: Small mammal decline from forests of south-eastern Australia since European settlement, as revealed by a top-order predator. *Biological Conservation* **143**, 52-59.

Bilney, R.J. (2009). Sooty Owl secrets. *Wingspan* **19**(3), 16-19.

Bilney, R.J., Kavanagh, R.P. and Harris, J.M. (2007). Further observations on the diet of the Sooty Owl *Tyto tenebricosa* in the Royal National Park, Sydney. *Australian Field Ornithology* **24**, 64-69.

Bilney, R.J., Cooke, R., and White, J. (2006). Change in the diet of Sooty Owls since European settlement: from terrestrial prey to arboreal prey and increased dietary overlap with Powerful Owls. *Wildlife Research* **33**, 17-24.

Theses

Bilney, R.J. (2009). Sooty Owl ecology and recent small mammal decline. (Unpublished PhD Thesis. Deakin University, Melbourne)

Bilney, R.J. (2004). Dietary change of Sooty Owls (*Tyto tenebricosa*) since European settlement: their response to fox control and dietary overlap with Powerful Owls (*Ninox strenua*) in East Gippsland, Australia. (Unpublished Honours Thesis. Deakin University, Melbourne).

1) Please conduct the visual site inspections referred to on page 11 of your first Report in response to question 11 (which asked whether you can determine which, if any Sooty Owl, Powerful Owl and/or Masked Owl Management Areas have been affected by the 2014 bushfires in East Gippsland on the basis of spatial data analysis). In your response you note that "[i]t would also be important to visually inspect (on-ground) some sites to understand how the fire severity mapping relates to reality". Please:
(a) conduct site inspections of Sooty Owl, Powerful Owl and/or Masked Owl Management Areas affected by the 2014 bushfires in the manner you consider appropriate,
(b) explain why you conducted the inspection in that manner, and
(c) explain your findings.

An inspection of the area burnt during the Orbost Fire Complex was undertaken during 4th-6th April 2015. The primary purpose of this inspection was to understand how the fire severity mapping related to reality, especially regarding the extent of mid- and understorey vegetation burnt in areas mapped as burnt by low severity fire. The initial map I inspected during my 2014 report was based upon Landsat images, with four categories of fire severity. Subsequently another fire severity map created using Orthoimages (high resolution aerial images) showing five fire severity classes was available (Appendix 1), and it was this map that I used during field inspections.

The area assessed was primarily within close proximity to the Bonang Highway (from Bonang, south to the southern entrance of Serpentine Road). Numerous locations within each burn severity was inspected. This included inspections of at least two burnt Sooty Owl Management Areas (SOMA), Masked Owl Management Areas (MOMA) and Powerful Owl Management Areas (POMA). Each Owl Management Area (OMA) selected for inspection incorporated all categories of fire severity, and were also within close proximity of the Bonang Highway. There was sufficient locations visited within these areas to become confident of how the mapping related to reality (Appendix 2).

The upper three categories of fire severity (Moderate Crown Scorch, Crown Scorch and 100% Crown Burn) appeared spatially very accurately mapped (evident based upon extent of burnt tree trunks, epicormic shoots and mortality of upper branches of trees). The lower two categories of fire severity (Light Crown Scorch and No Crown Scorch) appeared less accurately mapped, and was spatially rather variable with regard to the consumption of mid- and understorey vegetation. The burn boundary was sometimes incorrect, with many areas marked as unburnt having actually been burnt. It is possible, however, that this inconsistency was due to back-burning or subsequent prescribed burning, rather than the main fire event itself. Due to the sometimes similar appearance between the No Crown Scorch and Light Crown Scorch forest, and their marked difference compared to areas subjected to Moderate Crown Scorch or hotter, this provided a suitable boundary to distinguish between low and severe impacts of fire with regard to owl habitat and survival of critical resources.

The main outcome of my inspections was confirmation that even in areas subjected to the lowest category of fire severity (No Crown Scorch) included considerable consumption of the understorey, the killing of many midstorey plants and the loss of many large hollow-bearing trees. In such landscapes, however, survival of riparian vegetation remained high. In areas subjected to higher severity fires, the mid- and understorey was usually completely killed or consumed, including riparian areas (Appendix 2).

My interpretation of the impacts of the fire on resources required by owls is detailed in Questions 3 and 4.

2) Please provide additional or supplementary responses to questions 11, 12, 13, 14 and 15 of our 16 June letter on the basis of information obtained by your site inspections, coupled with any spatial data analysis referred to in those questions. We note that you did not provide a separate answer in your first Report to question 12 in our 16 June letter. Please explain.

In my original expert witness report (Bilney 2014), an estimate of the number of OMAs burnt was based upon individual separate maps of fire severity and the location of OMAs. Without the ability to overlay the two together I was not confident that my assessment was completely accurate. Since recently obtaining electronic spatial data of the OMAs and fire severity mapping it has been possible to accurately calculate the extent of each OMA affected by fire. This analysis was undertaken using ArcMap 10.2 (Table 1 and Appendix 3-5).

From these results, there were some differences between my original assessments of the number of OMAs burnt. The main differences being several additional OMAs having experienced minimal burning (<15%: three POMAs, three SOMAs), but two additional SOMAs had experienced extensive burning (>60%) (Table 1 lists all OMAs affected by fire). To summarise, the percentage of OMAs in East Gippsland affected by a considerable proportion of fire (>15%) is 15% of POMAs, 9% of MOMAs and 18.3% of SOMAs.

Question 12 was:

> "Can you ascertain the severity and/or the extent to which Sooty Owl, Powerful Owl and/or Masked Owl Managements Areas have been affected by the 2014 bushfires in East Gippsland on the basis of spatial data analysis?
> (a) Can you form such a view on the basis of the maps enclosed with this letter? If so, please do so and explain you answer.
> (b) If you are unable to form a view on the basis of the maps enclosed, please explain why, and specify the nature of any limitations and what additional data is required to enable a greater degree of confidence in your determination. If you have access to that data, please use it to provide your answer."

I'm unsure why I failed to address this question originally, possibly because I was unable to determine the extent to which each OMA had been affected by fire of differing severity. This has now been rectified following my analysis of the spatial data of fire severity maps and OMAs (Table 1 and Appendix 3-5).

Based on the spatial analysis and ground inspection, my opinions hasn't really changed regarding the impacts to the owls from the fires. Owls are likely persisting in the burnt areas at reduced population densities (Lumsden *et al.* 2013), with population densities and breeding rates likely correlated with fire severity. Ultimately, to assess whether owls are occupying the burnt landscapes call playback surveys could be conducted (but the owls may be less territorial and therefore less responsive owing to probable changes in home-range and territory size).

Further detailed response of how owls were probably affected by fire is provided in Question 3 and 4 below.

Table 1. The extent of each Owl Management Area affected by differing fire severity. The categories Crown Burn, Crown Scorch, Moderate Crown Scorch were lumped under 'High severity' while Light Crown Scorch and No Crown Scorch are lumped under 'Low severity'. Sites highlighted in grey represent OMAs not originally identified as being burnt in Bilney (2014).

Powerful Owl Management Areas			
	High severity	Low severity	Total burnt
POMA_0032	22.0	25.3	47.3
POMA_0033	77.7	22.3	100
POMA_0034	24.5	75.5	100
POMA_0035	96.8	3.2	100
POMA_0036	99.9	0.1	100
POMA_0037	70.4	14.9	85.3
POMA_0038	100	0	100
POMA_0047	65.1	34.8	100
POMA_0048	27.0	72.9	100
POMA_0049	18.7	27.1	45.8
POMA_0050	0	0.9	0.9
POMA_0051	0	0.7	0.7
POMA_0053	41.9	34.8	76.7
POMA_0054	43.3	56.7	100
POMA_0128	45.8	54.2	100
POMA_2012_0011	0.1	11.2	11.3
POMA_2012_0012	100	0	100
POMA_2012_0022	57.7	41.8	99.5

Masked Owl Management Areas			
	High severity	Low severity	Total burnt
MOMA_0002	84.9	15.1	100
MOMA_0003	36.2	<01	36.2
MOMA_0004	73.8	26.1	100
MOMA_0005	95.3	4.6	100
MOMA_0014	98.9	1.0	100
MOMA_0048	29.7	70.2	100
MOMA_0049	63.6	36.2	100
MOMA_0092	46.0	53.9	100
MOMA_2012_0005	39.4	34.2	73.6

Sooty Owl Management Areas			
	High severity	Low severity	Total burnt
SOMA_0004	80	19.9	100
SOMA_0005	67.5	32.4	100
SOMA_0117	44.3	55.6	100
SOMA_0118	36.9	28.1	65.0
SOMA_0119	32.2	67.6	100
SOMA_0120	3.0	17.2	20.2
SOMA_0121	0.4	3.4	3.8
SOMA_0123	0	0.6	0.6
SOMA_0124	7.3	56.6	63.9
SOMA_0126	30.5	37.7	68.2
SOMA_0128	26.8	72.6	99.4
SOMA_0129	43.4	54.2	97.6
SOMA_0136	57.4	30.3	87.7
SOMA_0138	28.8	48.4	77.2
SOMA_0139	6.0	1.4	7.4
SOMA_0140	79.1	20.8	100
SOMA_0141	100	0	100
SOMA_0142	100	0	100
SOMA_0143	20.2	41.5	61.7
SOMA_0144	39.7	60.2	100
SOMA_0145	17.8	77.2	95.0
SOMA_0149	61.0	38.9	100
SOMA_0150	43.1	56.8	100
SOMA_0151	100	0	100
SOMA_0152	99.8	0.1	100
SOMA_2012_0002	27.4	40.6	68.0
SOMA_2012_0023	75.0	24.4	99.4

3) Please read the Conservation Guideline for Birds on pages 30 – 31 of the East Gippsland FMP, the Action Statements for the Powerful Owl (p6), the Sooty Owl (pp4-5) and the Masked Owl (pp6-8), and the fixed-FMZ rules for each of the Masked, Sooty and Powerful Owls on pages 24 - 26 of the Planning Standards enclosed with this letter. Please assume that each Owl Management Area (OMA) comprised good quality or suitable habitat for the relevant species prior to the 2014 bushfires in East Gippsland, having regard to the definitions or descriptions of "good quality habitat" in the East Gippsland FMP and "suitable habitat" (if any) set out in the Action Statements and the fixed-FMZ rules in the Planning Standards. In light of each of those definitions or descriptions of good quality or suitable habitat (if any), your understanding of what constitutes suitable habitat for each species, the information arising from your site inspections and any spatial data analysis of the bushfire affected areas, please explain whether a:
(a) Masked Owl Management Area;
(b) Powerful Owl Management Area; and
(c) Sooty Owl Management Area,
affected by:
v. severe burn;
vi. moderate burn;
vii. light burn; and
viii. light/unclassified burn,
continues, or is likely to continue, to comprise suitable habitat for the relevant species.
Please explain your answer, including (if relevant):
(d) the period for which an area will not, or is no longer likely to, comprise suitable habitat; and
(e) any limitations on the certainty with which you can answer the question.

The abundance of critical resources for owls (small mammals, foliage roosts and hollow-bearing trees) is likely to be negatively correlated with fire severity (i.e., areas subjected to low severity fire will support more resources than areas subjected to high severity fire) (e.g. Russell *et al.* 2003; Eyre 2005; Recher *et al.* 2009; McLean 2012; Lindenmayer *et al.* 2013; Lumsden 2013). In particular, it is important to recognise that some areas burnt by low severity fire may still support suitable densities of critical resources at levels sufficient to constitute good owl habitat. Some burnt areas may actually still support higher densities of resources compared to unburnt areas that exist in less productive landscapes. Therefore, understanding the severity and extent of fires within each OMA is critical for evaluating potential impacts of the fire.

The majority of OMAs affected by fire in East Gippsland have experienced extensive burning and at high severity (Figure 1 and 2, Table 2), and such sites are unlikely to be currently harbouring suitable resources at levels that would constitute 'good habitat' for breeding pairs as intended by the objectives of the OMA reserve design (e.g., Webster *et al.* 1999; Silveira *et al.* 2003; Schedvin *et al.* 2003). It is also important to recognise that the size and effectiveness of the OMAs is highly questionable anyway (Bilney *et al.* 2011c), so any reduction of resources potentially further compounds the effectiveness of the OMA (especially overlapping OMAs where species are expected to share resources). Additionally, it was concerning to discover that while undertaking the analysis for this report that the size of POMAs only averaged 647 ha (± 127 SD), whereas they are supposed to exceed 800 ha (DCNR 1995; Webster *et al.* 1999; DEPI 2014).

It is also important to recognise that each owl species will have a different response to the fire severity, owing to differing survival rates of their critical resources. For example, in areas affected by low severity fire, survival rates of arboreal mammals is likely higher compared to terrestrial mammals. Therefore, in such landscapes Powerful Owls may be less affected compared to Masked Owls (due to their differing dietary requirements).

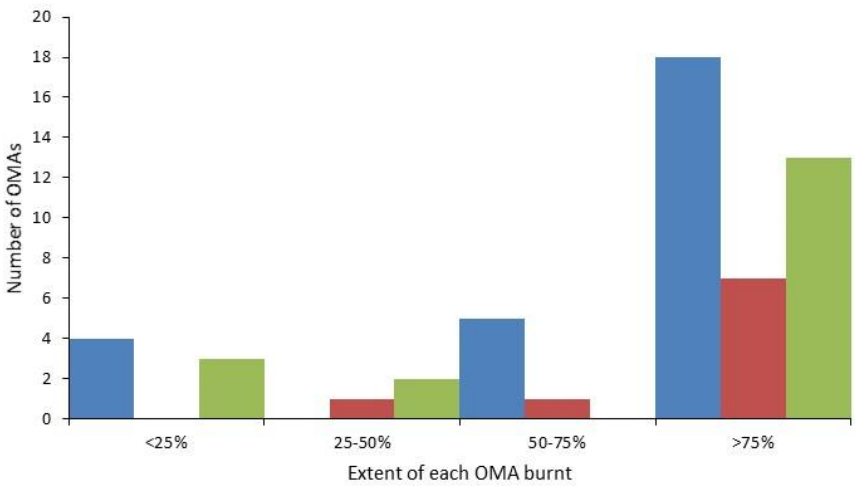

Figure 1. The extent of fire coverage within all Owl Management Areas. Sooty Owl = Blue, Masked Owl = Red, Powerful Owl = Green.

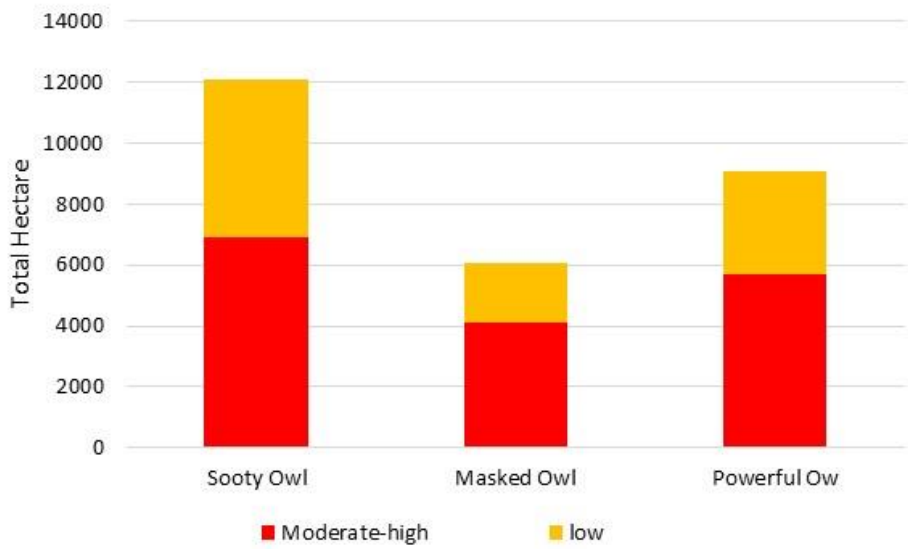

Figure 2. The total hectares burnt within all Owl Management Areas at differing fire severity.

Table 2. Estimated survival rates of critical resources for owls in relation to fire severity.

Owl critical resource	Fire severity	
	No or Light canopy scorch	**Moderate Crown Scorch to Crown Burn**
Terrestrial mammals	Low survival rates, but some refuge exist (e.g. riparian areas).	Very low survival rate.
Arboreal mammals	Highly variable survival rates - higher survival in riparian areas.	Very low survival rate.
Foliage roosting sites	Moderate to high survival rate – many suitable trees persist in unburnt riparian areas.	Very low survival rate.
Eucalypt roosts/nests	High survival rates. Many large hollow-bearing trees have survived.	Very low survival rate.

Impact of low severity burn

Densities of critical resources will be higher in habitat burnt at low severity compared to high severity, primarily due to the patchy nature of fire and many unburnt areas persisting (e.g. riparian areas). Areas subjected to low severity fire are still likely to experience a considerable short-term decline in terrestrial and scansorial mammals (Bush Rats, Dusky Antechinus, Agile Antechinus, Long-nosed Bandicoot and Common Ringtail Possum) (Lunney *et al.* 1987; Russell *et al.* 2003; Recher *et al.* 2009). Although low severity burns have resulted in the loss of many hollow-bearing trees, there would have been reasonable survivorship of many hollow-dependent mammals (e.g., Sugar Glider *Petaurus breviceps*, Yellow-bellied Glider *Petaurus australis* and Greater Gliders *Petauroides volans*). However, some studies have noted considerable decline in species such as Sugar Gliders and other hollow-dependent mammals following low severity fires (Lindenmayer *et al.* 2013). Considering the reproductive capabilities of terrestrial small mammals, their population densities are likely to return to pre-burn population densities within several years (probably <5 years: e.g. Recher *et al.* 2009). Therefore, any impacts of fires to the food supply of Sooty Owls and Masked Owls is only likely to be short-term. The recovery of arboreal mammals will be longer, owing to slower breeding rates and slower recovery of midstorey plant species that are required by many arboreal and scansorial mammals.

Impacts of moderate to high severity fire

Very few critical resources are likely to survive high severity fire. Mortality rates of mammals and the owls will be very high, and those individuals that survived the fire are likely to perish soon after, owing to the loss of their critical resources. For example, arboreal folivorous mammal (Greater Glider and Common Ringtail Possum) that survived a fire will be unlikely to survive long-term in areas with crown scorch (following the loss of leaves: their main food). Large numbers of hollow-bearing trees will have been consumed by the fire, but consequently many new hollows will form following fire (Gibbons and Lindenmayer 2002; Eyre 2005; McLean 2012). The recovery of small mammal populations will be much slower in such landscapes, especially if unburnt refuge areas are not within close proximity (from which recolonisation can occur) (Robinson *et al.* 2013; Berry *et al.* 2014). The population densities of many mammal species, especially arboreal mammals may take decades to recover (e.g. McLean 2012; Andrews *et al.* 2014).

In summary, the extent and severity of the fires within most OMAs has compromised their effectiveness for providing good quality habitat in the short-term (and many for the long-term).

4) We note that in your answer to question 14 in your first Report you state "any OMA impacted by fire, even to a small extent, has resulted in a temporary reduction in the availability of critical resources."
(a) Are you able to predict the period for which any reduction in the availability of critical resources will persist, including having regard to the information obtained in your site inspections referred to above? Please explain your answer.
(b) Do you consider that a reduction in the availability of critical resources renders an area no longer good quality or suitable habitat for a Masked, Powerful or Sooty Owl having regard to the definitions or descriptions of "good quality" or "suitable habitat" (if any) set out in the documents referred to in Question 1 above, and having regard to your understanding of what is suitable habitat for these species? Please explain your answer.
(c) Other than reductions in the availability of critical resources, have the 2014 bushfires caused any other detriment to the quality of Masked, Sooty and Powerful Owl habitat in the OMAs affected by the bushfires? If so, please explain each detrimental impact upon habitat quality.

Much of this question has been answered within Question 3.
Although the fire may have converted good quality owl habitat to low quality habitat (sometimes rendering habitat unsuitable), the effects are only likely to be temporary. The definition of 'temporary' is likely to vary widely for some critical habitat elements, and could range between several years and several decades. The recovery of critical resources is likely to be correlated with fire severity and the proximity to unburnt or low severity burnt areas that provide refuge for species to repopulate from (Robinson *et al.* 2013; Berry *et al.* 2014). Ultimately, the lower the fire severity, the lower the loss of resources will be, and their recover will be quicker.

The time span for recovery of owl populations post-burn is also likely to vary for each species, and in relation to factors such as rainfall. With small terrestrial mammals having relatively fast reproductive rates their recovery is likely to be fast and correlated with vegetation recovery (likely to reach high densities within 5 years) (e.g. Monamy and Fox 2000; Recher *et al.* 2009) and therefore providing suitable food source for Masked Owls and Sooty Owls. However, the recovery of arboreal mammals will be considerably slower, owing to their slower breeding rates, slower recovery of midstorey vegetation and the long timeframe for hollow formation. With the highest densities of many hollow-dependent mammals, such as Greater Gliders, being in long-unburnt habitat (e.g. >30 years), their recovery after fire can take decades (van de Ree and Loyn 2004; McLean 2012; Andrew *et al.* 2014), thereby the recovery of Powerful Owls could also take decades.

To ensure that all OMAs within East Gippsland comprise good quality owl habitat, there would be strong justification in temporarily conserving additional good quality owl habitat in unburnt areas, at least until habitat quality improves within burnt OMAs. But this highlights a very important state-wide conservation management issue. As fire is a prominent feature throughout forested landscapes, it is highly probable that there will always be numerous OMAs throughout the state that have been recently burnt and their habitat quality compromised. Therefore, as the goal of OMAs is to provide good quality habitat to support a minimum owl population (e.g. 500 pairs for Sooty Owls and Powerful Owls), and good quality owl habitat is generally long-unburnt (e.g. >10 years), then there is strong justification for increasing the number of OMAs throughout the state. For example, if an average fire interval period is 30 years, this on average would equate to 1/3 of all OMAs comprising habitat burnt within 10 years and possibly constituting low quality habitat. It is therefore arguable that increasing the number of OMAs is essential for meeting the objectives of Action Statements (e.g. even an increase of ¼ of OMAs would equate to an additional 125 sites each for Powerful Owls and Sooty Owls).

5) If the information gathered by your site inspections varies any other responses to the questions in your first Report, not already referred to above, please explain how so.

The inspection primarily confirmed my assumptions, but more importantly provides me with greater confidence in my answers.

6) To the best of your knowledge, has –
(a) the survey and monitoring referred to on page 8 of the Powerful Owl Action Statement taken place since 2004? If so, how and to what extent.
(b) the monitoring referred to at paragraph 6 on page 5, and the research referred to at paragraphs 13, 14, 15 on page 6 of the Sooty Owl Action Statement taken place since 2001? If so, how and to what extent.
(c) the monitoring referred to at paragraph 5 on page 7, and the research referred to at paragraphs 14, 15, 16 and 17 on page 87 of the Masked Owl Action Statement, taken place since 2003? If so, how and to what extent.

To my knowledge there has never been systematic long-term monitoring of owls as outlined in the Action Statements, especially regarding monitoring of owl presence within OMA's, breeding success or demographic features. Nor has there ever been monitoring to assess the effectiveness of OMAs.

Most of the research on Powerful Owls that has occurred in Victoria since 2004 includes post-graduate studies undertaken at Deakin University (supervised by Rayene Cooke), primarily on their genetics (Hogan 2007), various ecological attributes in East Gippsland (Bilney 2009) and habitat suitability modelling around Melbourne (Isaac 2012). DSE staff have undertaken some call playback surveys to monitor population trends following fire in South Gippsland (Willig and Atkin 2013), the Central Highlands (Lumsden *et al.* 2013) and Goulburn Broken catchment (McNabb *et al.* 2012). Other published studies include a small dietary study in Melbourne (Fitzsimons and Rose 2010), a short note on an individual utilizing a nest-box (McNabb and Greenwood 2011) and results from short-term radio-tracking a subadult (McNabb and McNabb 2011). Some research undertaken prior to 2004 that was only published after 2004 includes radio-tracking of four individuals in central Victoria (Soderquist and Gibbons 2007), diet in relation to habitat variables in Melbourne (Cooke *et al.* 2006), diet in urban Melbourne (Menkhorst *et al.* 2005), and aspects of breeding (McNabb *et al.* 2007). I am unaware of any additional research on Powerful Owls that remains unpublished.

Most Sooty Owl research in Victoria has been undertaken by myself and Felicity L'Hotellier (see References), which does include research into some ecological aspects outlined in the Action Statement, including nesting, roosting, foraging habitat requirements and home-range size. It is important to note that of some ecological attributes measured, samples sizes were often small and further ecological research is required, especially from different habitat types and from throughout their range (specified as required in the Action Statement). Also, this research was only undertaken due to my personal volition, whereas the Action Statement specifies this is supposed to be a DSE (now DELWP) responsibility (Silveira *et al.* 2003). Aspects such as demographic studies, mortality rates and dispersal habitats have never been investigated. The only additional monitoring/research regards call playback surveys undertaken by the Department (DSE) to assess the impacts of fire in the Central Highlands (Lumsden *et al.* 2013) and Goulburn Broken catchment (McNabb *et al.* 2012).

The only Masked Owl research that has occurred within the state since 2003 has been undertaken by myself and Felicity L'Hotellier, involving a failed attempt at radio-tracking several individuals and only resulted in a meagre amount of ecological information collected (Bilney and L'Hotellier 2013).

Further questions relating to coupes in the East Gippsland Forest Management Area containing Sooty, Masked and Powerful Owl detections

7) Answering questions 16 and 17 in your first Report you were asked to assume a number of matters in relation to coupes in the East Gippsland Forest Management Area. Please now instead assume the following in relation to coupes listed on VicForests' current Timber Release Plan:
(a) There are 28 coupes to be logged (23 by the Seed tree method, 1 by clearfelling and 3 by thinning from below and 1 by thinning from above) which contain detections of Sooty Owls either within, or in close proximity to the coupe boundary.
An additional 46 coupes scheduled to be logged are adjacent or in close proximity to these coupes with detections;
(b) There are 12 coupes to be logged (all by the Seed tree method) which contain detections of Powerful Owls either within, or in close proximity to the coupe boundary. An additional 18 coupes scheduled to be logged are adjacent or in close proximity to these coupes with detections;
(c) There are 2 coupes to be logged (both by the Seed tree method) which contain detections of Masked Owls either within, or in close proximity of, the coupe boundary. An additional 3 coupes scheduled to be logged are adjacent or in close proximity to these coupes with detections; and
(d) in 2013 or 2014 coupes 830-510-0006, 830-510-0004 and 836-516-0005 described in the Schedule of Coupes at paragraphs (c), (e) and (j) were partially logged using the seed tree method.
Do the above assumptions, including the details about the detections set out in the Schedule of Coupes, alter your answers to questions 16 and 17 in your first Report? Please explain how.

This new information (detailing substantially more scheduled coupes with known owl detections nearby) only adds to my concern for owl conservation. My main concern is that we have limited knowledge on current owl population levels, especially post major wildfires since 2002 (over 3 million hectares and approximately 2/3 of Sooty Owl distribution) and long-term drought during the 2000s. Some studies have detected substantial Powerful Owl population decline in recent years (Lumsden et al. 2013; Willlig and Atkin 2013; Bilney 2013; Bilney unpublished), so it is possible that current owl population levels are below conservation population targets. So it is therefore concerning that highly important owl habitat near known resident pairs continues to be modified and potentially disturbing breeding success. Additionally, with most harvesting occurring within highly suitable habitat for Sooty Owls and Powerful Owls anyway (see Question 8 and 13 for more details), a detection of an owl within or nearby to proposed logging coupes is not surprising.

8) A number of the coupes listed in the Schedule of Coupes have been subject of surveys by VicForests and by community members. Please find enclosed copies of those surveys (listed at documents 5 and 6 of the Schedule of Documents). Please read those documents and assume that the factual content of each document is true.
Having regard to the detections described in the coupes listed in the Schedule of Coupes and the surveys, can you determine whether the coupes listed in the Schedule comprise, or are likely to comprise, good quality or suitable habitat for the Masked, Sooty and/or Powerful Owls? Please explain your answer. In answering this question, please refer as necessary to any extrinsic material (including spatial data), ensuring the sources are identified in your report.

Of the 14 survey reports undertaken by community members that had been provided to me, I personally inspected 10 of these areas/coupes (see Question 11, Table 3). Additionally, I also undertook many of the pre-logging surveys for Wildlife Unlimited Pty Ltd (the company contracted to VicForests) so have visited many of the coupes surveyed in those reports. Although from memory I cannot remember precisely which coupes I surveyed and their suitability as owl habitat, they

generally shared similar characteristics, often being within mature Damp or Wet Forest, in areas with minimal disturbance (logging or fire), and often supporting considerable 'old-growth' or numerous hollow-bearing trees. The sites appeared to have been chosen for survey based upon their potential for providing important habitat for various threatened species, including owls. Virtually all areas I have surveyed or observed comprise high quality Sooty Owl and Powerful Owl habitat. Many of the sites, particularly those south of the Princes Highway were also good quality Masked Owl habitat. It is also important to recognise that forest typically selected for logging (especially seed-tree or clear-fell harvesting) is usually good quality owl habitat (fertile, tall forests of mixed age – also see further information outlined in Question 13).

Roost detections and Coupe inspections

9) On the basis of the content of each document, please explain whether you consider that a roost site exists, or is likely to exist, at the relevant location identified in each survey. Please explain your answer separately for each document and possible roost site.

This question has been answered based on information obtained by site visits, rather than relying purely on the written descriptions. [This also follows the request from an additional letter on the 2/4/15 – "When inspecting coupes 890-503-0014 [Errinundra - Gunmark Rd] and 891-516-0037 [Bonang] pursuant to question 11 in our 20 March letter, please include an inspection of the location where a roost site is said to be detected for verification. Please explain your findings. If you cannot find evidence of a roost site upon your inspection, does this mean that no roost site is present or likely to be in regular use at the location?"]

Gunmark Rd – Errinundra [890-503-0014]
A visual inspection at this proposed coupe and possible roosting site reveals high quality roosting habitat (foliage and eucalypt hollows) for Sooty Owls, being mostly Wet Forest with high density of large hollow-bearing eucalypts and high densities of tree ferns (mostly *Dicksonia antarctica*) and other potential foliage roosting sites (e.g. Southern Sassafras *Atherosperma moschatum*). Based on this habitat quality, the regurgitated pellets identified were most likely from a Sooty Owl, rather than a Masked Owl. The location where multiple regurgitated pellets were located was an atypical roosting location for an adult (appeared to be under the foliage of a eucalypt), but instead the most likely scenario is a roost used by a recently fledged juvenile, or a frequently used perch location near a nest. This assumption is based on the fact that multiple pellets at the same location indicates repeat visitation, and that an important feature exists nearby. With numerous large hollow-bearing trees nearby, a nest site could easily exist within close proximity to this site. My inspection around the site and nearby hollow-bearing trees failed to detect any further owl sign, but it is important to recognise that sign is rare around Tyto nests, except soon after juveniles have fledged (pers. obs.)

Kuark – Larrissa Lane [830-510-0006/830-509-0004]
A visual inspection at this proposed coupe and possible roosting site reveals high quality roosting sites available for Powerful Owls throughout the coupe (highest concentration within riparian vegetation). This includes individual trees and stands of highly suitable roost trees including Black-olive Berry *Elaeocarpus holopetalus*, Lilly Pilly *Syzygium smithii* and Sassafras. The actual site where an owl was flushed was not a typical roosting area, but there were highly suitable roosting sites nearby (20-30m). The most logical explanation is that the owl was flushed from a roost site nearby (perhaps several times before being observed, and could have been considerable distance from the actual roost site). It is important to note that Powerful Owls can virtually roost in a wide range of tree species and sometimes in seemingly rather atypical locations, but usually that only occurs in

landscapes where high quality roosting opportunity is scarce or they have killed a large possum/glider that is seemingly heavy to carry. My inspection of the site failed to detect any owl sign, but my inspection was rather limited in extent, and many potentially suitable roosting sites were not inspected (due to a combination of time constraints, dense vegetation and rather steep difficult terrain impeding easy access).

Bonang [891-516-0037]
A visual inspection at this proposed coupe and possible roosting site reveals medium quality roosting sites for Powerful Owls. This assessment was because there appeared to be low density of highly suitable roosting trees throughout the gully (e.g. dense midstorey tree species). The description of the faeces and prey item (glider hand) could have been a roost or a nocturnal feeding perch of a Powerful Owl, but the site was a small grove of Silver Wattles *Acacia dealbata* and appeared to the most logical roosting habitat available along the creek, suggesting that it was a roost site. No additional owl sign was detected during my site visit, suggesting the site is not frequently used as a roost.

10) Please inspect coupes 830-510-0006 and 830-509-0004 [Kuark - Larrissa Lne], including the location where a roost site is said to be detected for verification. Please explain your findings, and include a description of the habitat quality for each of the Masked, Sooty and Powerful Owl at both coupes. If you cannot find evidence of a roost site upon your inspection, does this mean that no roost site is present or likely to be in regular use at the location?

[The answer to part of this question has been incorporated within questions 9].

The location supports very high quality Sooty Owl habitat, and more broadly in the area, is amongst the highest quality habitat in existence. The vegetation is predominantly Wet Forest, but incorporates elements of Warm and Cool Temperate Rainforest (areas of rainforest community overlap) and supports very high densities of large hollow-bearing trees, on what appears to be very fertile soil/geology. There are numerous roosting opportunities within foliage and eucalypt hollows, undoubtedly high densities of prey (especially hollow-dependent prey) based upon the densities of hollow-bearing trees, and potentially numerous suitable hollows for nesting. For the reasons previously stated, the area is also of very high quality for Powerful Owls, due to supporting numerous potential locations for roosting, nesting and high quality habitat for their preferred prey (arboreal mammals). The habitat is not highly suited to Masked Owls, as they reach highest densities in coastal drier and sometimes more open habitats. The rather dense understorey and midstorey vegetation may limit hunting opportunity for them, but, the area would support high densities of their preferred prey (terrestrial mammals). So Masked Owls could exist there, but I would suspect probably at low densities. The description of the Powerful Owl sighting by Andrew Lincoln and Owen Hanson in their report suggests that the observation site may not have been the actual roost tree, but obviously a roost existed nearby and that the coupe incorporates the territory/home-range of the owl. Based on the numerous potential roost sites within close proximity to the sighting (<100m) and my inability to inspect them all, it is therefore not surprising that I failed to locate evidence of a roost. The failure to find Powerful Owl evidence at the suspected roost sites does not suggest that a roost site is not present somewhere nearby.

11) Please inspect the coupes listed at subparagraphs 11(a) - (c) below, and at least a further 5 of the coupes listed at subparagraphs 11(d) - (k) below, all being coupes mapped on VicForests Timber Release Plan enclosed with this letter and listed on the Schedule of Coupes:
(a) 890-503-0014 [Errinundra - Gunmark Rd];
(b) 830-506-0013 [Kuark - Pikes Hill];
(c) 891 516 0028 and 891-516-0037 [Bonang];
(d) 893-504-0002[Old Bendoc-Bonang Rd];
(e) 885-503-0003[Hensleigh Ck];
(f) 836-516-0005[Martin's Ck];
(g) 830-509-0011[Kuark - Greens Rd];
(h) 842-516-0010 and/or 842-516-0016[Rich - Bruce's Track];
(i) 893-507-0013 [The Pines];
(j) 890-502-0001 [Errinundra - Alstregens Rd];
(k) 892-509-0002 [Errinundra - Seller's Rd].
Please describe the habitat quality for each of the Masked, Sooty and Powerful Owl in each coupe you have visited.

The sites inspected share many similarities and are therefore worth discussing together, rather than separately, but a summary of key habitat quality is provided in Table 3.

All sites inspected, that had not been recently burnt, harboured high to very high quality habitat for Sooty Owls and Powerful Owls (Table 3). This is because there was a high density of large hollow-bearing trees due to minimal recent major disturbances (wildfire or logging history) and most comprised either Damp or Wet Forest. Such forest comprises amongst the highest quality Sooty Owl habitat and very high quality Powerful Owl habitat (Higgins 1999; Kavanagh 1997; Loyn *et al.* 2001, McIntyre and Henry 2002). On the other hand, such forest is not typically associated with optimal Masked Owl habitats, which is instead coastal forests and drier forest types (Peake *et al.* 1993; Debus and Rose 1994). The dominant eucalypt species throughout the sites often comprised Errinundra Shining Gum *Eucalyptus denticulata*, Messmate *Eucalyptus obliqua*, Brown Barrel *Eucalyptus fastigata*, and Mountain Grey Gum *Eucalyptus cypellocarpa*. The midstorey plant species and availability of potential foliage roosting trees varied between coupes and spatially within coupes. Potential species considered highly suitable for foliage roosting by Sooty Owls primarily comprised Tree Ferns (*Dicksonia antarctica* and *Cyathea spp*.,) with some sites also harbouring rainforest species such as Lilly Pilly and various other dense midstorey species (e.g. Kavanagh 1997; Higgins 1999; Bilney *et al.* 2011a). High quality roosting habitat for Powerful Owl primarily comprised numerous midstorey species of considerable height (>6m) and included Blackwood *Acacia melanoxylon*, Montane Wattle *Acacia frigescens*, Silver Wattle, Black-olive Berry, Sassafrass, Lilly Pilly, Sweet Pittosporum *Pittosporum undulatum* and various eucalypt species with dense or large foliage. Highly suitable roosting sites for Masked Owls primarily include either dead eucalypts or individuals that have suffered severe damage with vertical hollows (e.g. Bilney and L'Hotellier 2013). Such trees were often sparse, but still present in many sites, but the Kuark-Pikes Hill site harboured an exceptionally high density of highly suitable roosting trees.

Table 3. Summary of habitat quality for Large Forest Owls within proposed logging coupes in East Gippsland.

WF = Wet Forest, DF = Damp Forest, CTR = Cool Temperate Rainforest, MDW = Montane Damp Woodland, VH = Very High, H = High, M = Moderate, L = Low, N = not evident, P.O. = Powerful Owl, S.O. = Sooty Owl, M.O. = Masked Owl.

Site	EVC †	Density hollow-bearing trees	Foraging habitat			Roosting habitat				Nesting habitat		
			P.O.	S.O.	M.O.	P.O.	S.O.		M.O.	P.O.	S.O.	M.O.
							Euc.	Fol.				
890-503-0014 Errinundra - Gunmark Rd	WF	Very High	VH	VH	L	VH	VH	VH	H	VH	VH	H
830-506-0013 Kuark - Pikes Hill	DF	Exceptionally high	VH	VH	H	L*	VH	N*	VH	VH	VH	VH
891 516 0028# & 891-516-0037 Bonang	DF	Moderate	H	H	M	M - H	H	N	H	H	H	H
893-504-0002 Old Bendoc-Bonang Rd	WF/DF	Moderate-High	VH	VH	L	M - H	H	N	H	H	H	H
885-503-0003 Hensleigh Ck	WF/CTR	SITE WAS NOT INSPECTED										
836-516-0005# Martin's Ck	DF/WF	Moderate	L	L	L	VH	VH	VH	M	H	H	H
830-509-0011 Kuark - Greens Rd	WF	High	H	H	H	M	H	N	M	M	H	M
842-516-0010 & 842-516-0016 Rich - Bruce's Track	DF	SITE WAS NOT INSPECTED										
893-507-0013 The Pines	MDW	High	H	H	H	M	H	N	M	H	H	M
890-502-0001 Errinundra - Alstregens Rd	WF	SITE WAS NOT INSPECTED										
892-509-0002 Errinundra - Seller's Rd	WF	Very High	VH	VH	L	VH	VH	H	L	VH	VH	L

Site was burnt during 2014, *I was unable to inspect riparian habitat, which typically supports higher quality roosting habitat, †Based on a combination of visual inspection and DELWP Ecological Vegetation Class mapping.

13) Having regard to your inspections can you determine whether any other coupes listed in the Schedule of Coupes are, or are likely to, comprise good quality or suitable habitat for the Masked, Sooty and/or Powerful Owls? Please explain your answer. In answering this question, please refer as necessary to any extrinsic material (including spatial data), ensuring the sources are identified in your report.

If possible, please also inspect any additional coupes listed on the Schedule of Coupes that you consider may assist you to answer questions 7 and 8 in this letter.

The document 'Schedule of Coupes' lists 93 coupes with owl detections within or nearby. It is difficult to evaluate the habitat quality within each of these sites separately without visiting the sites or having spatial information detailing aspects including vegetation type, logging history and fire history. However, general assumptions about habitat quality can be made.

Firstly, most areas scheduled for logging in East Gippsland comprises good owl habitat (for at least one owl species). This is because logging is targeted towards tall forests on flat terrain and in areas with high rainfall (often Damp and Wet Forest). Usually such forests comprise amongst the highest quality owl habitat, especially for Sooty Owls (see the concentration of owl records in relation to the proposed logging coupes in Appendix 6).

Much can be inferred about the quality of owl habitat within proposed coupes purely by understanding the harvesting technique proposed. Within mixed species forest (not Alpine Ash *Eucalyptus delegatensis,* Mountain Ash *Eucalyptus regnans* or Silvertop Ash *Eucalyptus sieberi* dominated), the seed-tree method or clear-fell harvesting is usually undertaken within multi-age or mature forest that has not previously been heavily logged. Such forest would typically support good structural diversity and support numerous hollow-bearing trees, therefore comprising good quality owl habitat. However, I consider most forest comprising Silvertop Ash as low quality owl habitat, and this species is often targeted by harvesting in drier and lowland forest types. Harvesting by thinning (from above or below), indicates previous disturbance via logging and suggests uniform age, structure and species composition, relatively young timber, and would usually comprise low quality habitat (unless Common Ringtail Possums are abundant in the area). With the 'Schedule of Coupes' providing information on the harvesting techniques for 35 sites, 31 of those are scheduled to be harvested via the seed-tree method and four sites by thinnings method, this suggests that the vast majority of the sites (the seed-tree harvest sites) comprises good quality owl habitat, especially for Sooty Owls and Powerful Owls.

The geographical location of proposed coupes also provided some indication of owl habitat quality (see Appendix 6), especially when considering the vegetation in those areas. Although I have not displayed a vegetation map for East Gippsland, the proposed logging coupes are primarily within Damp and Wet Forest types and areas with high rainfall.

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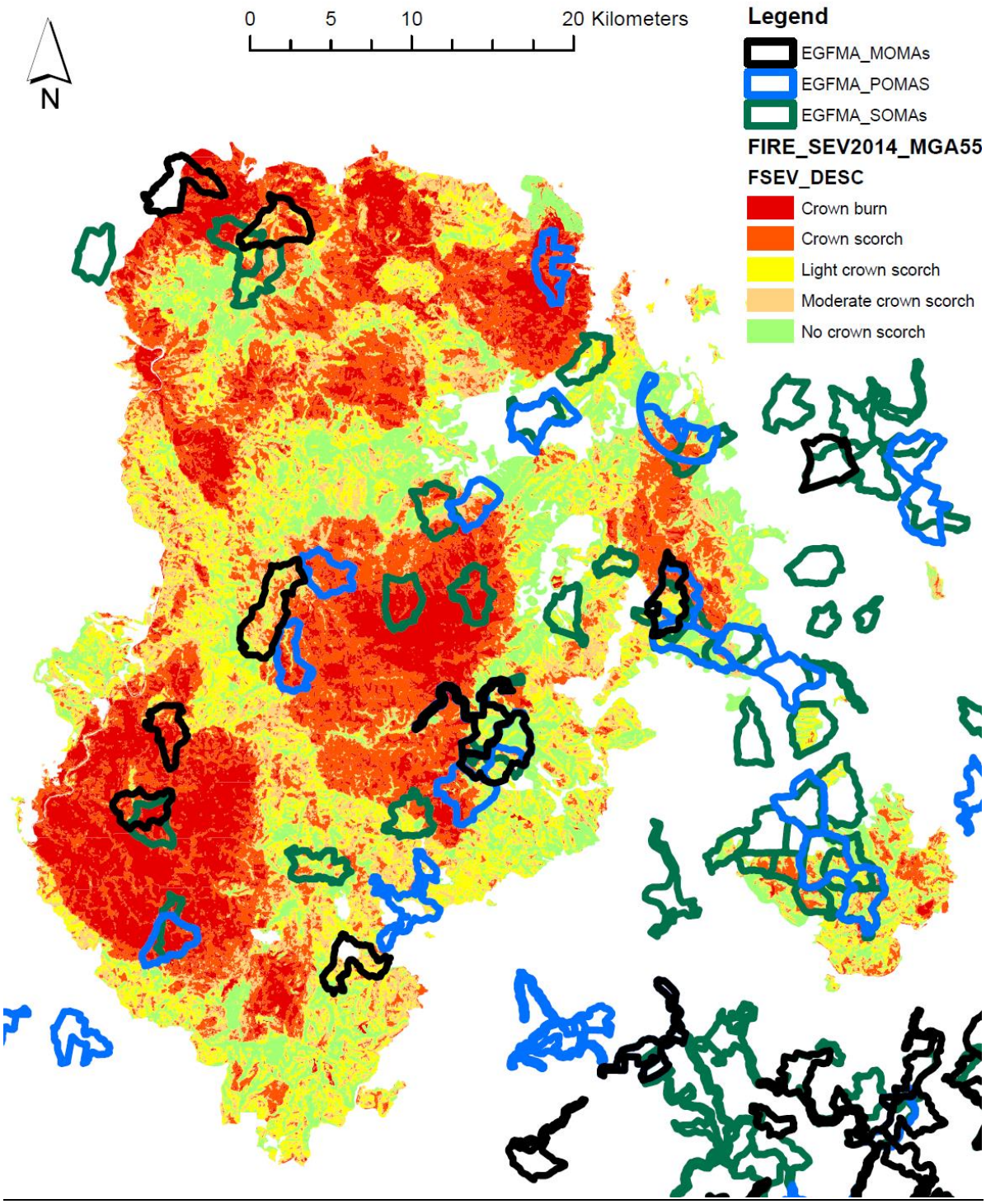
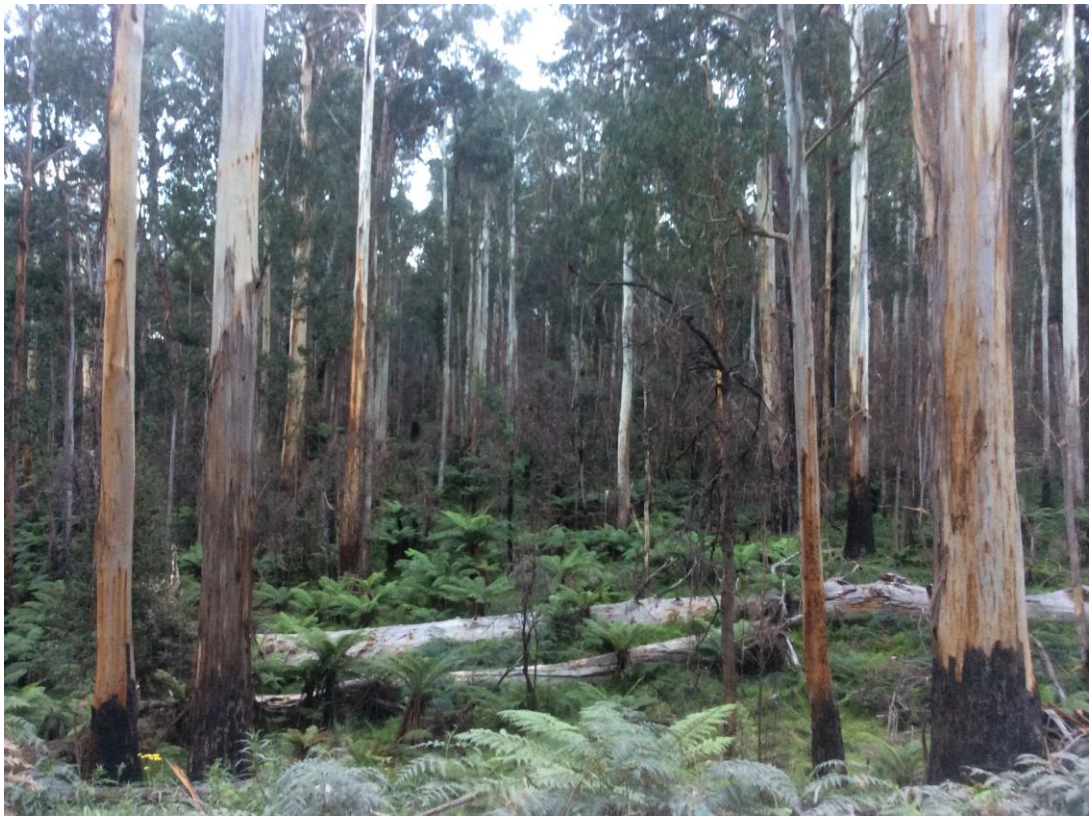
<u>Appendix 1.</u> Map of fire severity with the boundary of OMAs shown. Many OMAs are overlapping.



<u>Appendix 2.</u> Images of forest with differing burn severity. All images 14 months post fire.

Images of burnt forest with 'No Crown Scorch' and/or Light Crown Scorch, showing consumption of understorey vegetation and the mortality of most mid-storey vegetation. Note fallen large eucalypt in the bottom image.



Forest burnt by Moderate Crown Scorch'. Note the proliferation of epicormic growth and consumption of most midstorey and understorey vegetation.

Forest burnt by 'Crown Scorch'. Note all eucalypts have epicormic growth and consumption of virtually all understorey and midstorey vegetation.

Forest burnt by 'Crown Burn', showing dead trees and dead upper branches of surviving eucalypts. Note that in image at bottom of page, the consumption of Gallery/Warm Temperate Rainforest along creek.

Appendix 3. The percentage of forest within each POMA affected following the Orbost Fire Complex.

	Crown Burn	Crown Scorch	Moderate Crown Scorch	Light Crown Scorch	No Crown Scorch	Unburnt	Total size (Ha)
POMA_0032	0.4	4.2	17.4	16.9	8.4	52.7	733.2
POMA_0033	23.7	43.5	10.5	13.3	9.0	0	734.6
POMA_0034	0.8	14.9	8.8	27.0	48.5	0	621.4
POMA_0035	38.3	53.8	4.7	1.6	1.6	0	575.7
POMA_0036	26.6	69.0	4.2	0.1	0	0	560.6
POMA_0037	6.2	34.9	29.3	7.7	7.3	14.7	521.7
POMA_0038	79.8	20.2	0	0	0	0	502.3
POMA_0047	6.9	39.4	18.8	24.9	9.9	0.1	692.2
POMA_0048	0.8	9.5	16.7	30.3	42.7	0.1	765.3
POMA_0049	0	5.3	13.4	4.9	22.2	54.3	687.9
POMA_0050	0	0	0	0	0.9	99.1	624.2
POMA_0051	0	0	0	0.2	0.5	99.3	736.5
POMA_0053	1.7	26.1	14.1	16.5	18.3	23.3	797.4
POMA_0054	0.4	19.5	23.4	32.3	24.4	0	679.3
POMA_0128	5.9	20.8	19.0	29.3	25.0	0	673.3
POMA_2012_0011	0	0	0.1	2.8	8.4	88.7	728.8
POMA_2012_0012	77.1	22.8	0	0	0	0	596.1
POMA_2012_0022	3.7	35.9	18.2	12.6	29.2	0.5	900.4

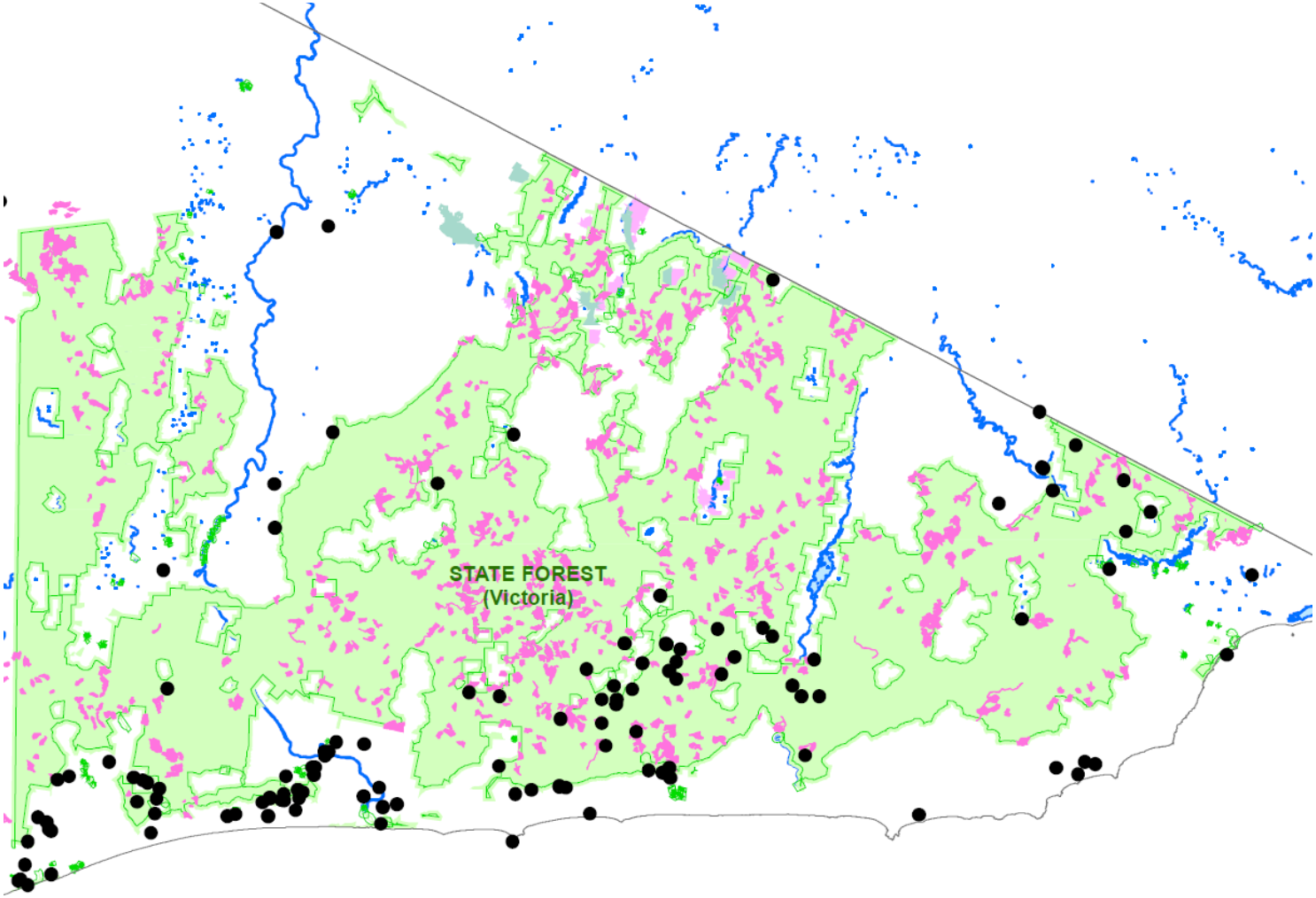
Appendix 4. The percentage of forest within each MOMA affected following the Orbost Fire Complex.

	Crown Burn	Crown Scorch	Moderate Crown Scorch	Light Crown Scorch	No Crown Scorch	Unburnt	Total size (ha)
MOMA_0002	17.2	41.7	26.1	14.4	0.7	0	816.5
MOMA_0003	17.9	16.4	2.0	0	0	63.7	785.3
MOMA_0004	1.4	38.5	34.0	18.9	7.2	0	1103.7
MOMA_0005	53.8	36.1	5.5	3.9	0.7	0	523.8
MOMA_0014	60.4	36.1	2.5	1.0	0.1	0	583.2
MOMA_0048	0.3	12.9	16.5	33.0	37.2	0	935.3
MOMA_0049	5.1	35.3	23.1	27.3	9.0	0.1	673.3
MOMA_0092	5.5	21.5	19.0	28.7	25.3	0	668.2
MOMA_2012_0005	0.3	9.6	29.5	24.5	9.7	26.3	631.3

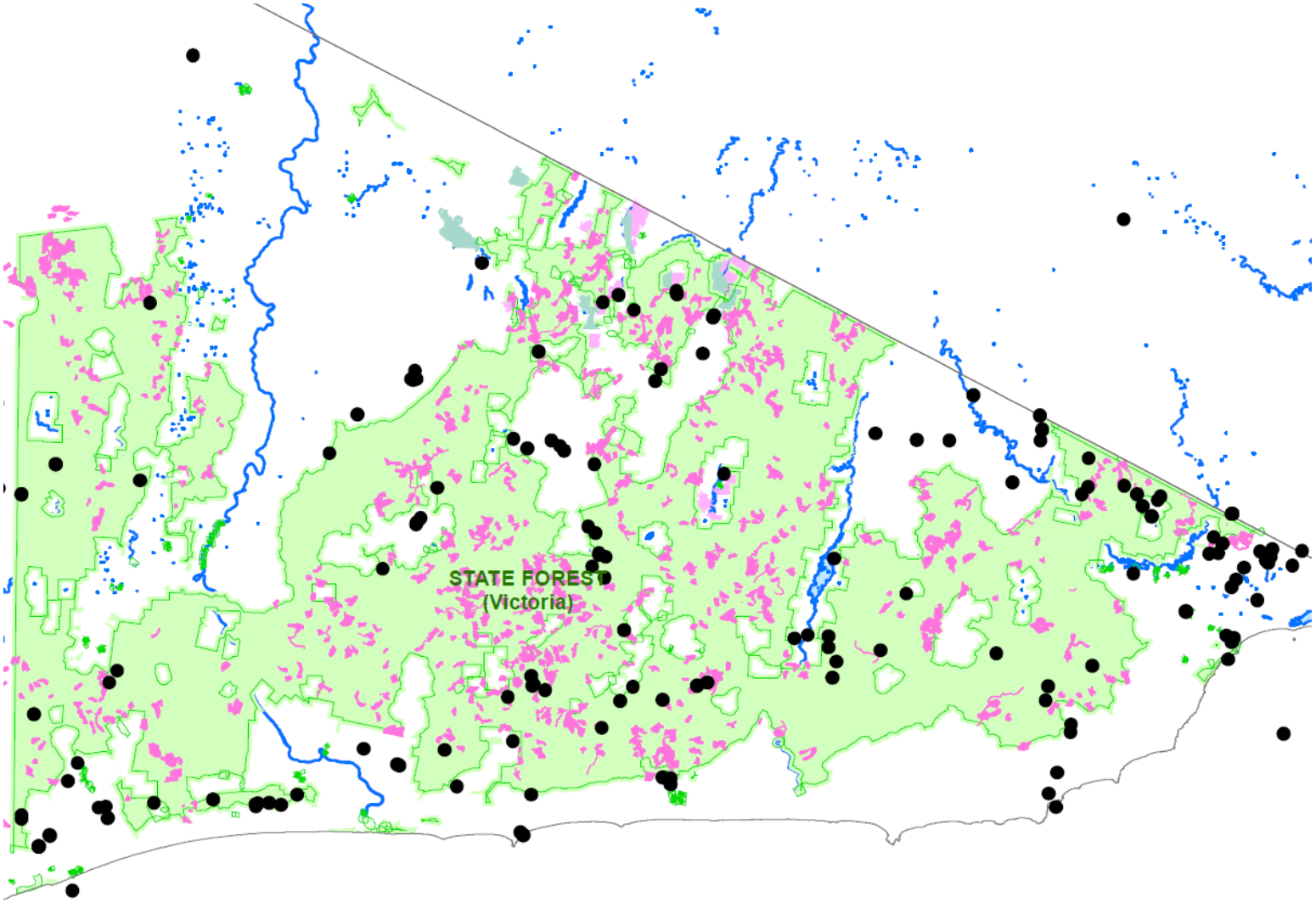
Appendix 5. The percentage of forest within each SOMA affected following the Orbost Fire Complex.

	Crown Burn	Crown Scorch	Moderate Crown Scorch	Light Crown Scorch	No Crown Scorch	Unburnt	Total size (ha)
SOMA_0004	0	33.7	29.5	16.8	16.0	4.0	575.4
SOMA_0005	0	2.7	34.4	30.5	13.9	18.6	560.5
SOMA_0117	0	0.3	20.5	23.6	31.4	24.2	642.3
SOMA_0118	34.9	2.4	23.2	11.3	12.2	15.9	567.7
SOMA_0119	0.1	0.2	18.1	14.0	31.3	36.3	638.2
SOMA_0120	79.8	0	0.2	2.8	12.4	4.8	812.5
SOMA_0121	96.1	0	0.1	0.3	0.8	2.7	589.2
SOMA_0123	99.4	0	0	0	0	0.5	502.9
SOMA_0124	36.0	0	2.8	4.5	36.7	20.0	626.3
SOMA_0126	31.7	0.3	11.2	19.1	11.0	26.8	593.4
SOMA_0128	0.5	1.3	11.8	13.7	35.1	37.6	543.7
SOMA_0129	2.3	0.1	16.4	26.9	35.9	18.3	629.7
SOMA_0136	12.2	4.2	39.2	14.0	10.6	19.7	567.7
SOMA_0138	22.8	1.0	13.6	14.2	35.8	12.6	507.3
SOMA_0139	98.5	0	0	0.1	0.1	1.3	524.6
SOMA_0140	0	10.1	44.4	24.6	9.5	11.4	597.7
SOMA_0141	0	80.5	19.3	0.1	0	0	508.7
SOMA_0142	0	80.8	19.2	0	0	0	523.6
SOMA_0143	38.2	0	4.7	15.5	22.6	19.0	684.6
SOMA_0144	0	4.4	17.5	17.9	32.6	27.6	592.0
SOMA_0145	4.9	0	4.8	13.0	30.6	46.6	578.4
SOMA_0149	0	12.9	30.3	17.8	28.8	10.1	512.5
SOMA_0150	0	1.5	20.8	20.8	28.6	28.3	520.5
SOMA_0151	0	80.3	19.5	0.2	0	0	568.9
SOMA_0152	0	79.6	19.9	0.4	0.2	0	521.3
SOMA_2012_0002	31.9	0	16.6	10.9	17.4	23.3	533.4
SOMA_2012_0023	0.5	6.0	52.5	16.6	14.1	10.3	606.2

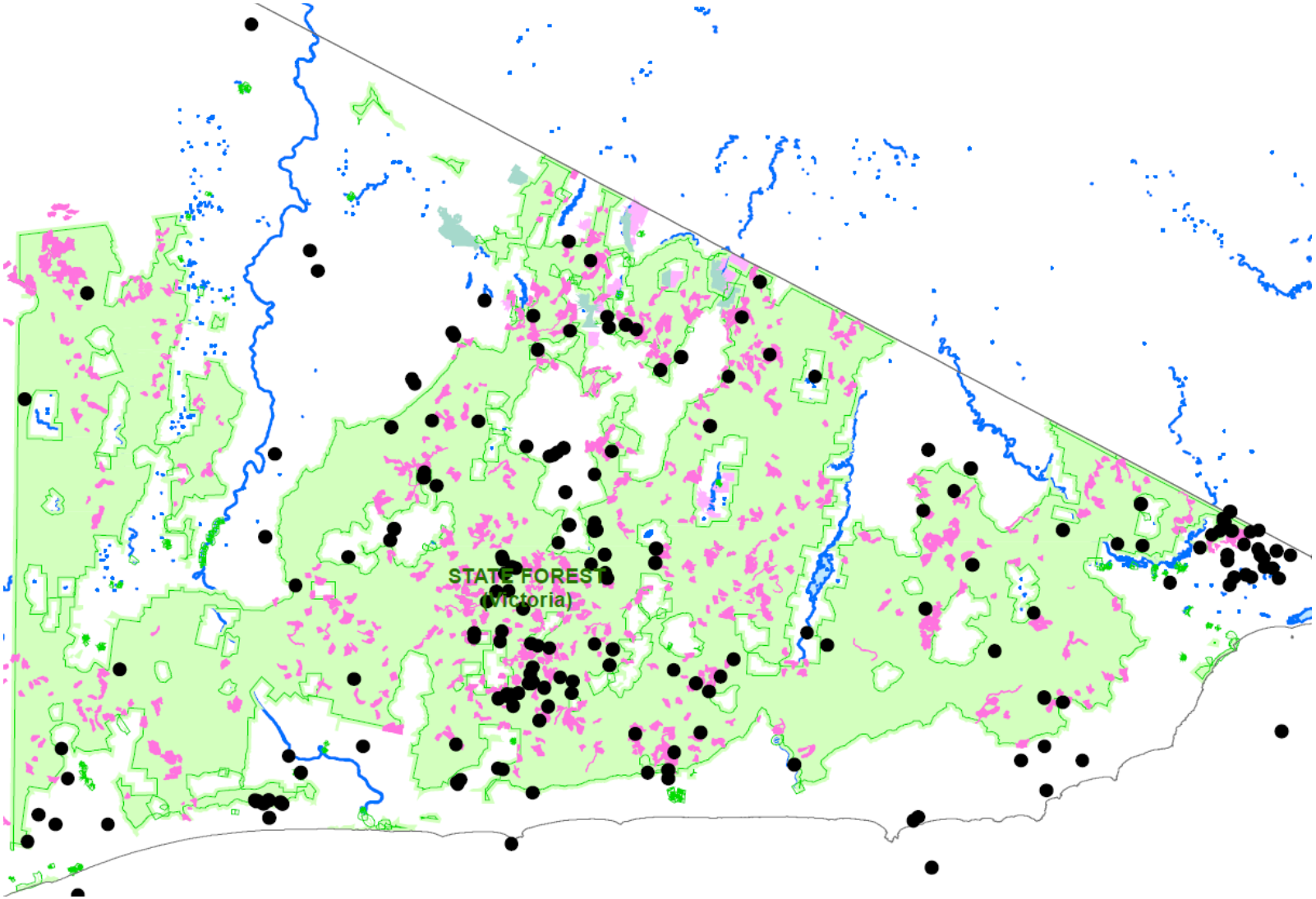
Appendix 6. Records of owls from the Victorian Biodiversity Database (2010) in East Gippsland with relation to proposed logging coupes from the Timber Release Plan (2013-2016). Owl records = black circles, State Forest = green, Logging coupes = pink.



Masked Owl records – note that most records are within coastal and low elevation forest types (mainly the drier forest types).



Powerful Owl records – note that records are widely distributed throughout East Gippsland across various habitat types.



Sooty Owl records – note the concentration of records within the central region of East Gippsland that represents the core area of Damp and Wet forests, where there is also a high concentration of logging coupes proposed (also the region with the highest concentration of logging historically).