IN THE SUPREME COURT OF VICTORIA
AT MELBOURNE
COMMON LAW DIVISION
VALUATION, COMPENSATION AND PLANNING LIST

S CI 2020 00373

BETWEEN

WOTCH INC

Plaintiff

and

VICFORESTS

Defendant

SECOND EXPERT REPORT OF DR ANDREW SMITH AND LETTERS OF INSTRUCTION

Date of document:	23 August 2021	
Filed on behalf of:	Plaintiff	
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Contents:

1. Second Expert Report of Dr Andrew Smith dated 23 August 2021;
2. Digital folder containing:
    a. Letter from Environmental Justice Australia to Dr Smith dated 30 June 2021 with enclosures:
        0. Expert Witness Code of Conduct;
        1. Index to Coupe Documents 30 6 2021
        1.1 Volume 1.1: VicForests coupe documents;
        1.2 Volume 1.2: WOTCH survey results and coupe photographs with maps;
        1.3 Volume 1.3: Destroyed or damaged hollow-bearing tree observations;
        2. Volume 2: Pleadings, articles, reports, policies and affidavits;
        3. Volume 3: Maps.
    b. Email from Environmental Justice Australia dated 4 July 2021 with enclosures:
        1.1 Supplement to Volumes 1.2 and 1.3;
        1.2 Volume 1.2 (replacement files);
        1.3 Volume 1.3 (replacement files);
    c. Email from Environmental Justice Australia dated 7 July 2021 with attachment:
        1. Exhibit “MFR-4”: True copy of Post-harvest spreadsheet;

d. Letter from Environmental Justice Australia to Dr Smith dated 20 July 2021 with enclosures:
    1. Seventh Affidavit of Blake Nisbet dated 4 July 2021, with maps; and
    2. Volume 3.1: VicForests' Maps.
e. Email from Environmental Justice Australia to Dr Smith dated 3 August 2021 with attachments:
    1. Eighth Affidavit of James Gunn dated 27 May 2021;
    2. Affidavit of Bruce McTavish dated 20 August 2020;
    3. Affidavit of Anne Geary dated 4 August 2020; and
f. Email from Environmental Justice Australia to Dr Smith dated 16 August 2021.

LOGGING AND WILDFIRE IMPACTS ON THE GREATER GLIDER (*Petauroides volans*) Second Report.

A Report to the Supreme Court of Victoria

Proceeding S ECI 2020 00373

By Dr. Andrew P. Smith.

23 August 2021

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Qualification and Experience

Qualifications

a) Ph. D Monash University 1981, for studies on the ecology of Leadbeater's Possum and the Sugar Glider.
b) B.Sc. (Hons1) Sydney University 1975, majoring in entomology, zoology and botany.

Experience General

1. Over 44 years experience in ecology of possums and gliders and forest planning and management in the states of Victoria, New South Wales and Queensland.

a) Completion of a Ph.D on the diet and ecology of Leadbeater's Possum and other species of possums and gliders in the Central Highlands of Victoria (1977-80);
b) sixteen years as a lecturer, then Associate Professor and Sub-Dean in the Faculty of Natural Resources at the University of New England conducting and supervising postgraduate research of various aspects of forest fauna ecology and management in timber production forests (1980-96);
c) twenty seven years as a Director and Principal of Austeco Environmental Consultants, preparing policy documents, management plans, ecological surveys and environmental impact statements for a wide range of forestry operations.

Experience Greater Glider

2. Devised and evaluated the stag-watching method for survey of arboreal marsupials including the Greater Glider in the Victorian Central Highlands (Smith 1980, Smith et al. 1989). Carried out the first regional scale arboreal mammal survey in the Victorian Highlands (Smith et al 1985). Pioneered methods for wildlife survey, habitat modelling and mapping using Geographic Information Systems (GIS) (Smith et al 1989, 2002, Ferrier and Smith 1990, Smith 1997) for biodiversity conservation and management in Australia and Madagascar. Author or co-author of many studies and reports on the effects of timber harvesting on arboreal mammals including Greater Gliders (Dunning and Smith 1986, Smith and Lindenmayer 1988, 92, Smith et al. 1993, 94, 95, 2002, Andrews et al 1994, Eyre and Smith 1997). First person to identify the threat to possums and gliders from tree hollow loss in timber production forests and to model relationships between arboreal mammal abundance and the number of tree hollows in forests (Smith 1982, Smith et al 1985, Smith and Lindenmayer 1988). Expert advisor to Government Departments on standards for protecting tree hollows in wood production forests in NSW, Queensland and Victoria (Smith et al 1985, Smith 1991, 93, Lamb et al. 1998).

Experience in Forest Policy and Ecologically Sustainable Forest Planning and Management.

3. Commissioned by NSW Government to develop guidelines for regulation and implementation of ecologically sustainable forestry operations on private lands throughout the state of New South Wales (Smith 2001). First to devise a wide range of ecologically sustainable forest management "standards", commonly referred to as "conservation protocols", that have since been widely adopted and expanded to provide a foundation for sustainable forestry and implementation of Regional Forest Agreements. These include standards for protection of hollow dependent wildlife (habitat trees), maintaining forest

structure, pre-logging surveys and protecting sensitive and poorly known threatened species and ecological communities (Smith et al. 1992, 1993, 1994, 1995, Andrews et al 1994). Adviser to the NSW Department of Environment and Planning and the Department of Natural Resources of Queensland on prescriptions for tree hollow (old growth) protection in state forests of NSW (Smith 1993) and Qld. (Lamb et al. 1998). Proposed the original forest zoning and old growth forest protection system subsequently modified and used to maintain Leadbeater's Possum in timber production forests in the Victorian Highlands (Smith et. al. 1985). Appointed to the panel of inquiry into wood chipping (value added utilization) in East Gippsland (Gruen et al. 1989) by the Victorian Minister for Planning and Environment. Appointed to a panel of inquiry into gap and cluster clear felling silviculture in NSW (Attiwill et al. 1996) by the NSW Minister for Land and Water Conservation. Co-convenor of a national Sustainable Forestry Conference (UNE February 1993). Reviewed forestry practices and conservation protocols in the Eden Management area for the CRA/RFA process (CSIRO et al 1997). Prepared sustainable forest management guidelines for private native forestry and timber harvesting on protected lands for the NSW Government Department of Land and Water Conservation (Smith 2001). Appointed to an expert panel to provide "*expert advice regarding approaches to identification and mapping of koala occurrence and habitat in areas of NSW subject to Crown and or Private Native Forestry*." for the NSW Environment Protection Authority in 2015. Commissioned by the NSW Environment Protection Authority to provide an analysis of what constitutes (ecological) best practice forestry operations in burnt forest after the 2019/20 wildfires and independent, expert advice and recommendations informing the ongoing development of best practice forest management in NSW forests (Smith 2020). Details of qualifications and experience are provided in a summary CV attached to this report (Attachment 1).

Expert Witness Code of Conduct

4. I, Andrew Peter Smith of 35 Albany Lane Currumbin, Queensland have read, complied with and agree to be bound by the Expert Witness Code of Conduct Rule 44.01. The opinions expressed in this report are based wholly or substantially on my specialized knowledge arising from my study, research, investigation and experience in Greater Glider ecology and forest conservation and management. I declare that I have made all the inquiries which I believe are desirable and appropriate (save for any matters identified explicitly in the report), and that no matters of significance which I regard as relevant have, to my knowledge, been withheld from the Court.

Brief.

5. This report was prepared in response to a brief supplied by Danya Jacobs of Environmental Justice Australia dated 30 June 2021 and 20 July 2021. The brief requested my opinion and response to specific questions relating to the impact of wildfire and timber harvesting on populations of the Greater Glider (*Petauroides volans*) in forest coupes in the Victorian Central Highlands and beyond the Central Highlands to the extent that such coupes contain or are likely to contain Greater Glides or their habitat.

Facts and Assumptions

6. I based my assessment of the impacts of timber harvesting and fire on Greater Gliders in the specified coupes on the following:
    a) My prior experience and observations of timber harvesting operations at numerous coupes in the Central Highlands, Alpine Area and East Gippsland regions of Victoria. These included regional surveys of logged Ash forests during the periods 1977-1980 and 1983-84 for the purpose of formulating forest management policies and recommendations for protection and management of Leadbeater's Possum (Smith 1980, 1982 and Smith et al 1985), inspection of logging operations and proposed experimental silvicultural trials in Victorian Ash and Mixed Species forests for the Minister for Planning and Environment in 1989 (Gruen et al 1989), inspection of harvesting impacts on Greater Gliders and/or Yellow-bellied Gliders at seven coupes in East Gippsland in 2010 and 2016 (Smith 2010, 2016), and inspection and measurement of timber harvesting impacts on Greater Glider habitat at 58 coupes in the Victorian Central Highlands in 2018 (Smith 2019).
    b) My published scientific research papers, reports and unpublished data on the effects of timber harvesting on Greater Gliders and other possums and gliders at a wide range of locations including the Victorian Central Highlands, East Gippsland, a range of Northeast NSW State Forests and the New England Tablelands (Smith et al 1985, Smith et al 1987, 1992, 1994, 1995, Smith 1982, 2010, 2019, Andrews et al 1994, Dunning and Smith 1986, Lindenmayer et al 1990).
    c) My critical review of the scientific literature and scientific studies of others on the effects of timber harvesting and fire on arboreal mammals. My experience in use of this knowledge combined with my own to formulate policies and recommendations for achieving ecologically sustainable forest management at the request of various state Government timber management Agencies including VicForests (Smith 1985), Minister for Planning and Environment Vic. (Gruen et al 1989), Forestry Commission of NSW (Smith et al. 1992,94,95), NSW Department of Planning (Smith 1993), Queensland Department of Natural Resources-Forest Resources (Lamb et al 1998), NSW Department of Conservation and Land Management (Smith 2001/10), and RACAC NSW (CSIRO et al 1997) and EPA NSW (2020). My most recent experience involved a review of timber harvesting impacts in NSW state forests affected by extreme wildfires in 2019/20 at the request of the Environment Protection Authority of NSW (Smith 2020), in which I recommended changes to current silvicultural practices and adoption of new minimum standards for corridors, oldgrowth protection, diameter limited harvesting and protection of fire refuges, amongst others, to sustain sensitive species including the Greater Glider.
    d) Examination of site and aerial photos of logging disturbance in "**the Coupes"** and examination of coupe plans and maps of forest type, fire and logging history and other environmental variables on and in the vicinity of these coupes provided as evidence in these proceedings.

Response to Questions Part A. Species description, conservation status, threats and bushfire impacts.

7. **Question 1 Please describe the species Greater Glider, its characteristics and distribution within Australia.** The Greater Glider (*Petauroides volans*) is the largest (650-1800 gram) gliding marsupial. It is a member of the nocturnal and arboreal leaf eating Ringtail Possum family (Pseudocheiridae). It feeds on leaves, buds and flowers of eucalyptus trees at night and sleeps in hollows in large old living and dead trees during the day (McKay 2008). It is found in the tall wet and more productive eucalyptus forests of coastal eastern Australia from central Victoria to the base of Cape York. Prior to European settlement and up until about the 1990's the Greater Glider was considered to be widespread and common. Despite its former abundance it remains poorly know to the general public, largely because it is nocturnal, difficult to observe in the canopy of tall trees, and does not, or rarely comes to the ground.
8. **Survey and Observation**. The Greater Glider can be observed while walking or slow driving along a road or track at night and searching the foliage of the upper canopy with a strong spotlight. Greater Gliders are easily detected when they look towards the observer and the spotlight beam is reflected from the tapetum at the rear of their eyes causing a bright "eyeshine". Counts of Glider sightings per km of transect provide and index of abundance. In Victoria and southern regions with a long twilight period Greater Gliders can also be observed silhouetted against the sky as they leave their tree hollows at dusk. A survey method, referred to as "stagwatching" (Smith 1980, Smith et al 1989), involves stationing observers beneath all known or potential nest trees within a fixed 3-hectare plot and instructing them to looking upwards and count all emerging Gliders for an hour after sunset.
9. **Social Organization** Greater Gliders are predominantly solitary and each individual may occupy many different nest trees (Habitat Trees or trees with suitable hollows) within its home range which are about 1-3 hectares in size in Victoria (Henry 1985). Nest trees may be changed frequently. *P. v. armillatus* has been reported to use up to 18 den trees within its home ranges (Kehl and Boorsboom 1984, Comport et al 1996, Smith et al 2007). Frequent nest tree changes may be necessary for temperature control, avoidance of parasites, rotation of feeding areas and to reduce predation by owls and Quolls.
10. **Predation.** Greater Gliders, especially subadults, are an important food resource for Powerful Owls, Sooty Owls and Spotted Tail Quolls (Belcher et al 2007, Bilney 2009, Higgins 1999). Powerful Owls may consume approximately 80-250 large mammal prey like Greater Gliders every year within their home ranges which are about 300-350 hectares (Higgins 1999). If Powerful Owls fed solely on Greater Gliders they would deplete Glider populations faster than they can reproduce in habitats with a density of one Greater Glider per hectare. There have been reported instances of sudden and catastrophic collapse in Glider numbers in some locations which have been attributed to excessive owl predation (Kavanagh 1988). The mechanisms that prevent excessive predation of Greater Gliders by owls currently remain unknown. As a precautionary measure it could be considered appropriate to avoid timber harvesting practices which expose Greater Gliders to increased risk of predation, such as clearfelling and other forms of intensive silviculture which increase the spacing between trees and leave Habitat Trees exposed and visible above the forest canopy.
11. **Question 1 a Where in Victoria and Australia the Greater Glider is found.** Until relatively recently the Greater Glider was considered to comprise two subspecies, *P. v. volans* distributed from Victoria

to about the Tropic of Capricorn and *P. v. minor* north of the Tropic of Capricorn. The northern subspecies is smaller (650-1100) and slightly different in colouration (dusky brown above) and form with larger more prominent ears (McKay 2008). In 2015 Jackson and Groves raised the subspecies *P v. minor* to species status and split the subspecies *P. v. volans* into two species, *P. armillatus* for populations in Central Queensland and *P. volans* for southern populations in Victoria, New South Wales and South East Queensland (Figure 1). This classification was not initially widely accepted due to lack of supporting evidence. In 2020 McGregor et al. measured genetic variation in a small sample of Greater Gliders and identified three distinct genetic groups one in northern Queensland, one in central Queensland and one in Victoria and NSW. This genetic grouping is an indication that these three populations were isolated and fragmented within the recent past most likely in response to climate change during recent ice age(s). They found evidence of hyrbidization between the two northern groups and found the highest genetic diversity amongst the southern group. They concluded that the three distinct populations of the Greater Glider are genetically but not reproductively isolated. Whether or not they are treated as separate species depends on how species are defined. For the purpose of conservation and management it is appropriate for these three groups to be treated separately, effectively as distinct species, because they are likely to have different genetic adaptations to the different climates and habitats. In this report the name “Greater Glider” or “Glider” refers to the southern sub-species *P. v. volans* also known as the species *P. volans* (Southern Greater Glider) unless otherwise specified.

12. **Distribution** The distribution of the Southern Greater Glider in Australia and Victoria is shown in Figures 1,2 and 3.

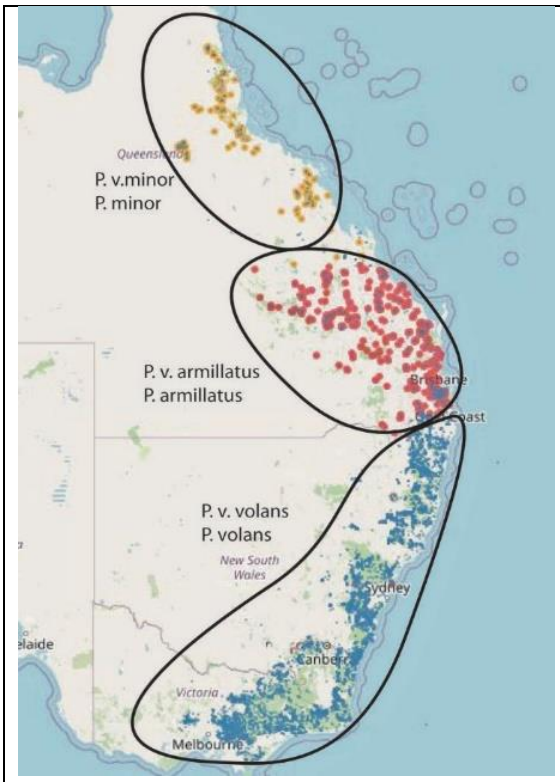


Figure 1. Distribution of the records of *Petauroides volans* from the Atlas of Living Australia in eastern Australia within the 3 regions recognized by McGregor et al (2020) to comprise genetically distinct populations.

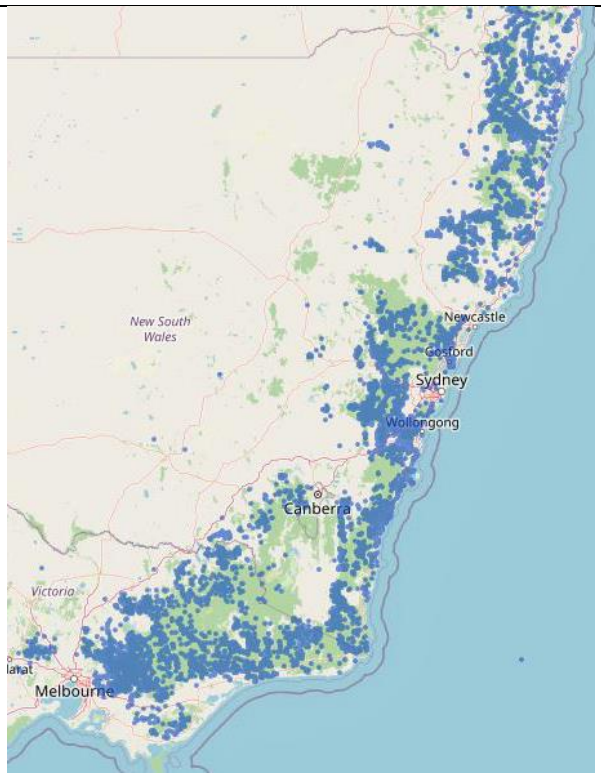


Figure 2 Distribution of the records of the Southern Greater Glider *Petauroides volans volans* from the Atlas of Living Australia.

13. **Question 1 b The type and range of habitat and hollow-bearing trees in which Greater Glider lives in Victoria, and Australia, the characteristics of habitat critical to the survival of Greater Glider, individuals' home-range.** Within its broader geographic range (encompassing the dots shown in Figure 2) the Greater Glider is patchily distributed within the forest and highly variable in density, from less than 0.1 to more than 2.5 animals/ha. Greater Gliders may be absent from around 50% of the forest in any one region due to past fires, timber harvesting and droughts, especially on the hotter and drier western (inland) margins of its known range and some low elevation coastal forests. In the Eden region of NSW, Greater Gliders were absent from 48% of state forest coupes surveyed during logging operations. They were scarce or absent from areas of low soil fertility, low productivity, and with a low tree basal area that had been intensively burnt by fire within the past 40 years (Braithwaite (1983). Similar patterns may be expected in East Gippsland in Victoria. Gliders are likely to be scarce in low elevation coastal dry forests on infertile soils and abundant in cooler, wetter higher elevation forests on more productive soils and in areas subject to less frequent fire. In the high elevation Central Highlands of Victoria Gliders are especially abundant in forests on the ecotone between tall, wet Montane Ash forests and drier Stringybark Forests (also known as Mixed Species Forests) at mid to high elevations (Figure 3) which have not previously been intensively logged since the 1970's. Gliders have been recorded in 96% of previously unlogged (since the 1970s) forest coupes recently surveyed in this region (Smith 2019).
14. **Habitat Requirements** There have been many scientific studies of the Greater Glider so its habitat requirements are relatively well known and may be summarized as follows (updated from Smith 2020 para 7):
    a) Forest Type: tall more productive wet sclerophyll eucalyptus forests at moderate to high elevations, including those dominated Mountain Ash, Shining Gum, Alpine Ash and a variety of high-quality dry sclerophyll or Mixed Species types in Victoria at elevations above 300 m and sometimes lower on the east coast (see Figure 3).
    b) Tree Hollows (Habitat Trees): abundant (0.5 - 12/ha) large diameter living or dead trees with large hollows (> 10 cm entrance diameter and 30 cm deep) suitable for nesting (Smith et al 1985, Smith and Lindemayer 1988) are essential and the single most important habitat requirement of the Greater Glider. Trees first develop hollows at about 120 years of age and continue to develop more hollows over hundreds of years (Ambrose 1982). Trees with hollows are called Habitat Trees (HT). A Habitat Tree is any tree with a hollow that is used by Gliders. Habitat Trees can include young mature trees with sound stems and hollows only in lateral branches as well as old senescent trees with multiple branch hollows and hollow stems. VicForests Habitat Tree Resource and Inventory guideline (2019) defines Habitat Trees (that VicForests is obliged to identify, retain and protect under existing regulatory controls in Victoria), as "***Live, large hollow bearing trees (e.g. pre 1900 trees* in ash forests); in mixed species forests these trees are senescing (Mature to Over Mature) trees (typically with low market value***)". This VicForests definition is based on commercial rather than ecological criteria and appears designed to allow harvesting of Habitat Trees for woodchip and timber products, especially in Mixed species forests where habitat trees are abundant (7-9/ha Smith 2019). In my opinion this definition is overly restrictive and will lead to the destruction of Glider habitat and the habitat of other hollow-dependent species. My use of the

term Habitat Tree in this report refers to any tree with hollows potentially suitable for Gliders. This generally includes but is not limited to Habitat Trees in categories 1-3 inclusive, including dead trees, as described by VicForests 2019.

c) Forest Age structure: uneven aged and old growth (UA OG) forest with a high basal area of large tree stems (> 25 /ha) in the mature size class (40 - 80 cm diameter at breast height (dbh)) and a scarcity of dense young regrowth in the subcanopy space, to provide a high biomass of foliage leaf for eating and an ideal open structure suitable for movement by gliding (Smith 2019a).

a) Cool Climate: low maximum, mean monthly temperatures that do not exceed about 20 degrees C for long periods and moderate to high rainfall (>about 400 mm /annum) typically found at higher elevations (Smith 2019).

b) Long Unburnt Forest: Mixed Species Forest (also known as dry sclerophyll forests and foothill forests) protected from severe (type 1 or 2) or frequent wildfire in the past 10-25 years, and areas of Ash Forest (also known as wet sclerophyll forest and Montane Ash) protected from intense wildfire for 40 – 120 or more years (depending on intensity of past fire) (Smith et al 1985, Smith et al 1994, Andrews et al 1994, MacLean et al 2018, Smith unpublished).

c) Unlogged Forest (since 1960/70): structurally mature, uneven aged or old growth forests with no recent (since 1960-80) history of high intensity logging (clear-felling) or timber harvesting that has removed more than about 33-66% of the large tree stem basal area in wet sclerophyll forests or about 15-60% of the large tree basal area in dry sclerophyll forests (Dunning and Smith 1985, Howarth 1989, Kavanagh 2000, Eyre 2006).

d) Low Predation Risk: forests and habitat trees with a good canopy cover to reduce the risk of predation by owls as gliders emerge from their hollows at night and while they feed in the upper canopy.

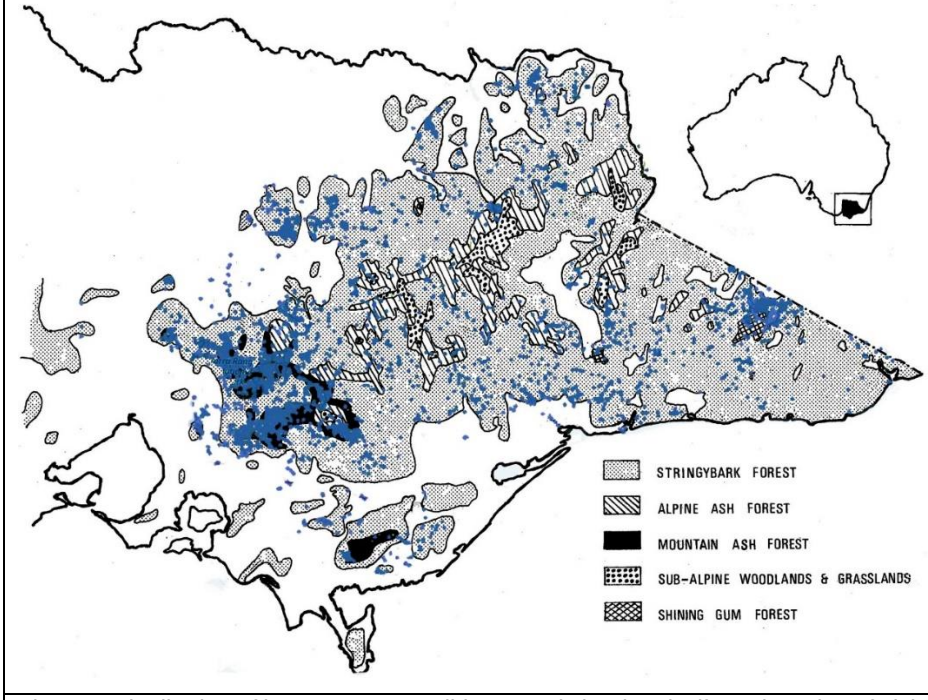
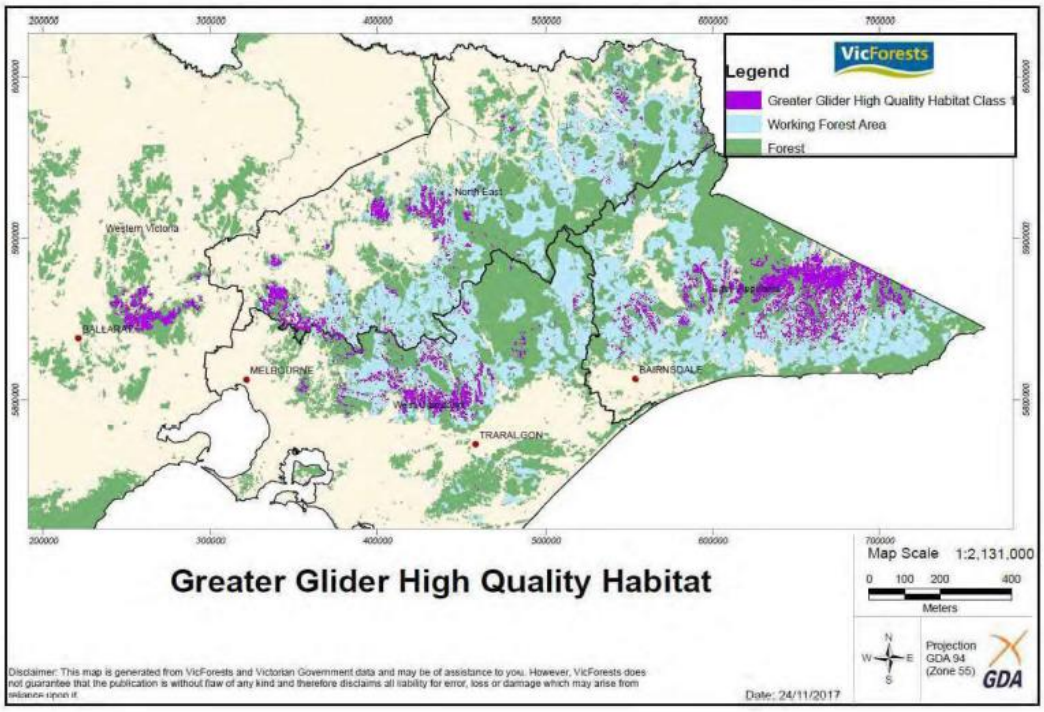


Figure 3 Distribution of known Greater Glider records in Victoria (from the Atlas of Living Australia) showing concentration in wet (Montane Ash) forest types and wet dry ecotone forests of the Central Highlands and far East Gippsland (Base map from Smith et al 1985).

15. **Question 1a The characteristics of coupes in Victoria that are likely to contain Greater Glider or its habitat.** Forest with habitat characteristics most suited to Greater Gliders (as described above) are distributed throughout the landscape in patches of varying size, shape, and degree of isolation from one another depending on past fire, logging, drought, and topographic position. Suitable habitat is most likely to be that found **in all coupes** at moderate to high elevations (> 300m) containing forest that has not been intensively logged (since 1960) especially in moist gullies and on sheltered (southern) aspects.
16. **Greater Glider Models.** Models and maps (eg. Lumsden 2013 Figure 4) which predict the distribution of Greater Gliders in Victoria are currently inaccurate and unreliable for management use at the scale of a logging coupe. There are no maps that show the distribution of key habitat characteristics essential for Greater Gliders including the number of trees with hollows (habitat trees), the basal area of large trees, and the occurrence of fire refuges. At present it is only possible to be certain whether Greater Gliders or their habitat occur on timber harvesting coupes by undertaking ground surveys targeting this species, especially in wet forest types. A recent survey of Greater Glider habitat in 58 coupes the Victorian Central Highlands (Smith 2019) found no correlation between the predictions of Greater Glider Models that VicForests rely on for planning and the occurrence of Greater Gliders. Greater Glider Habitat Class 1 (HDM 1) habitat was mapped as occurring (at more than 5% of forest area) on only 12 out of the 58 (21%) of logging coupes sampled but Greater Gliders detected on all but two of these 58 (97%) of these coupes by pre-logging surveys. Importantly a negative correlation was found between the percentage of coupe area predicted by the model to be in HDM class 1 habitat and the actual number of Greater Glider records on each coupe. Similarly in this study (see Appendix 1) no significant or near significant correlation was found between the abundance of Greater Glider records on coupes and the predictions of Habitat Models relied on by VicForests. Whenever these models are used by VicForests for coupe planning without undertaking ground surveys they can be expected to miss about 80% of coupes with Gliders.
17. The lack of accuracy and unreliability of models is important because VicForests appear to impose environmental protection measures (that reduce harvesting intensity and timber yields) only in forests where maps show high quality modelled glider habitat to be present, and fails to apply them when high quality modelled habitat is absent, unless ground surveys have shown high densities of Gliders to be present. This system provides an incentive for VicForests to avoid undertaking adequate pre-logging Glider surveys. In my review of logging coupe plans for this report (Appendix 1) I identified many Coupe Plans (Turkey Feet, Monster, Bauble, Groves Manna, Brumby) which found no Gliders to be present based on desk top assessments and model predictions, but surveys by other organizations (notably Wotch) found Gliders to be abundant. Reliance on models to minimize the application of costly mitigation measures (in terms of reduced timber yield) is inconsistent with the Precautionary Principle. ***In my opinion the correct Precautionary approach to dealing with the unreliability of models is to assume that*** "***Gliders are present in abundance on all coupes unless this is proven to be otherwise by comprehensive and adequate ground surveys***.

Figure 4 Examples of habitat models (a) Vic Forest GG Conservation Strategy 2019, b) Victoria's bushfire emergency report Aug 2020) used to predict high quality Glider habitat in Victoria. There is no close agreement between either of these models or between the predictions of models and actual glider occurrence.

9. Appendix One: Modelled High Quality Greater Glider Habitat Class 1 Map



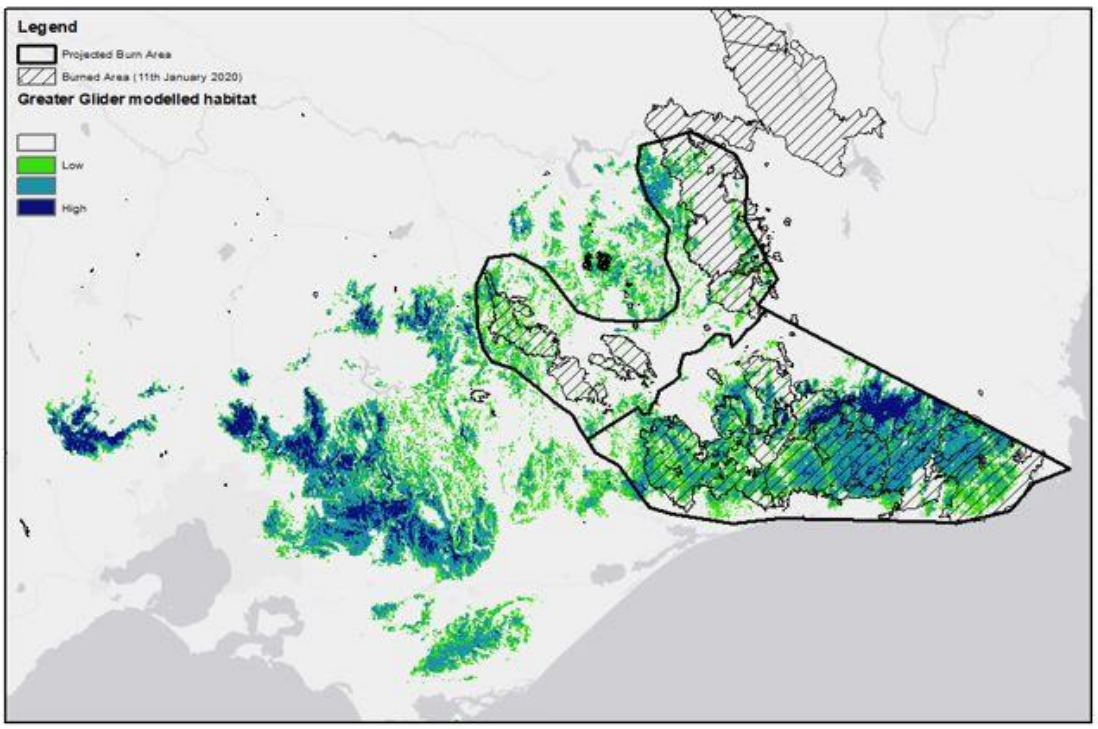


Figure 14: Modelled habitat distribution for Greater Glider in eastern Victoria. Darker colours indicate areas of relatively higher habitat suitability compared to lighter colours. This model could help guide on-ground survey and assessment to understand post-fire recovery of the species.

18. **Important Habitat** Even if Glider models were reliable, I fail to see the reasoning and justification for limiting Glider habitat protection measures to just a few habitat patches with exceptionally high Glider density, especially as these habitats may change over time after logging, fire and drought**.** Important populations and habitat are not simply those with the highest density. In the extensively logged and burnt Victorian forests important habitat at a local scale is more likely to include large remnant patches (50-100 ha) of unlogged glider habitat within extensively clear-felled forest, or large patches of unburnt (or lightly burnt) habitat surrounded by more intensively burnt forest. At regional scales important habitats are those that provide corridors and links, especially within fire refuge areas, including wet forests, gullies, drainage lines and sheltered aspects. At regional scales important habitats also include those with a natural uneven-aged or old growth structure with senescent trees with hollows in the upper canopy and abundant mature trees in the stand. In Victoria these structurally rare and important habitats include:
    a) All wet forests (including Mountain Ash, Shining Gum and Alpine Ash) that have not been intensively logged since the 1980's with at least 0.5 or more living large senescent trees with hollows per hectare.
    b) All dry (Stringybark or Mixed Species) forests above 300 m elevation in Victoria that have not previously (since 1970) been subject to high intensity logging or clearfelling, because most of these forests are resistant to fire and have a naturally "uneven-aged" or "old growth" structure with an abundance of mature and older trees with hollows (Lutze et al 1999, 2004).
    c) All mixed wet and dry (ecotone) forests that have not previously (since 1970) been subject to high intensity logging or clearfelling because most of these have an uneven aged old growth (UA OG) structure with a mix of trees of different age and an abundance of older trees with hollows.
    d) All remaining uniform aged mature, unlogged, wet forests (including Mountain Ash, Shining Gum Alpine Ash and Mountain Gum) in Victoria that regenerated after wildfires in 1939, irrespective of hollow numbers, because this forest will provide future hollows in the shortest possible time (40+ years) offering the best possibility for re-balancing forest structure and restoring the predominance of uneven-aged and old growth age classes which are now critically rare.
    e) All forests in potential fire refuges (gullies, drainage lines lower, lower slopes and sheltered aspect) with large living old trees in the overstorey(> 0.5/ha) that were not killed by intensive fires in 2003, 2009, or 2019/20, because of their importance in maintaining source populations and corridors to assist recovery of Greater Glider populations where they have been eliminated by intensive logging and fire.

19. **Question 1 c The reproductive cycles, fertility and fecundity of the Greater Glider**. The Greater Glider has low fecundity and low to moderate capacity for population growth. Females can reproduce in their second year and give birth to a single young between March and May, and maximum longevity is about 10-15 years (McKay 2008). Henry (1985) found that some females failed to give birth, some failed to raise young to independence and only 50% of female Greater Gliders in his study area (in Mixed Species, Messmate, Grey Gum, Peppermint forests) in Central Victoria successfully raised

young in one year. Annual fertility is likely to be about 0.2 to 0.4 young per adult per year giving a capacity for population doubling about every three years. Gliders in habitats affected by drought or with low available foliage nitrogen levels may not be able to obtain enough protein in their diet to reproduce.

20. **Question 1 d**. **Do the presently available location records accurately reflect all sites at which it is likely to be present**? No, Greater Gliders may be absent from many sites where they have previously been recorded, especially if these sites have since been logged or intensively burnt. Greater Gliders are also likely to be present in many sites where they have not yet been surveyed due to inaccessibility, lack of funding or lack of necessity. Greater Gliders are also likely to be present undetected in many sites that have been surveyed because survey plots were too small, or survey techniques were inadequate.

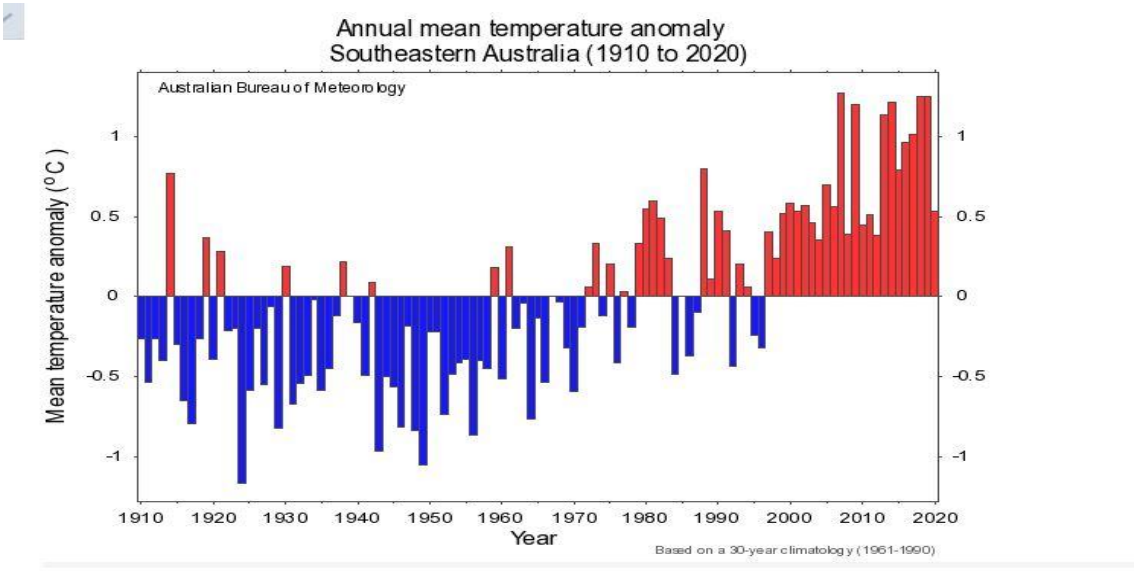
21. **Question 1e: the species' population trend, and reasons for this trend, and 1f: whether the extent and quality of habitat is stable, increasing or declining and the reason for this.** I have read the Threatened Species Scientific Committee (TSSC) Consultation Document on Listing Eligibility and Conservation Actions for *Petauroides volans* (Greater Glider (southern) under Criterion 1 Population size reduction and the 2016 TSCC Conservation Advice on the Greater Glider which together summarize the published and unpublished information on recent Glider population trends. These reports document evidence of significant and substantial declines in distribution and abundance of the Greater Glider in different regions of Victoria and NSW over recent decades. I generally accept most of the evidence of decline reported in these reviews, but I note that some of the reported trends are based on unpublished survey reports using methodologies that I have not had an opportunity to critically review. The degree of decline and reason for decline of Glider populations is likely to vary considerably in different regions of Victoria. In my opinion the causes of recent Glider population decline in Victoria in order of importance are timber harvesting, drought and warming (lengthy periods of abnormally warm and dry weather) and wildfire. The relative importance of timber harvesting, wildfire and drought on population decline in Victoria differs between regions and forest types as discussed further below.
22. **Drought and warming**. The Greater Glider is not physiologically well adapted to prolonged hot dry weather because it requires more energy and water for evaporative cooling at temperatures above 20 C (Rubsamen et al 1984). Gliders are unable to maintain water balance on a diet of Eucalyptus leaves (53% water) alone and must drink free water in order to stay alive (Foley et al 1990). Free water obtained from dew or rainwater on the surface of leaves, or in pools in hollow branches, may become scarce or absent during droughts and prolonged hot periods causing reproductive failure, death and population decline, especially in marginal habitats on the extremes of the species geographic range.

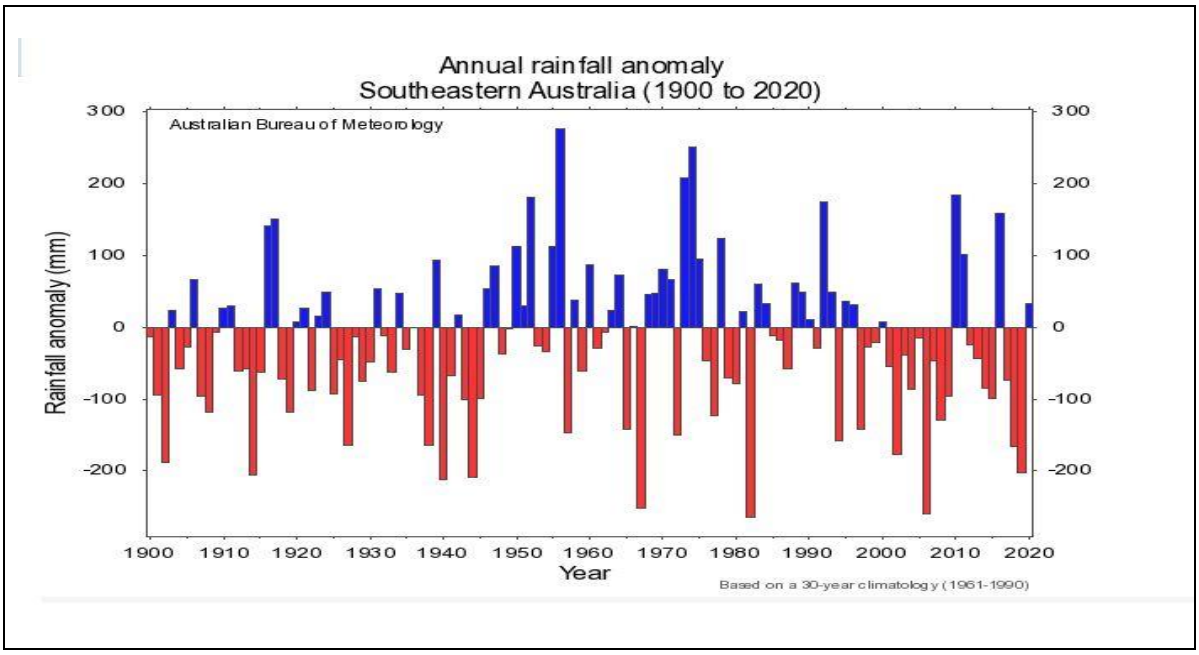
23. Records from the Bureau of Meteorology show that it has been abnormally dry and hot in southeast Australia over the past 20 years (Figure 5). In my opinion this period of prolonged dry weather provides a likely explanation for recent declines in average Glider density throughout their range and contractions in Glider distribution on the margins of their preferred habitat at lower coastal elevations and in the drier forests of the western slopes. Howarth (1992) reported that Glider abundance in an unlogged control sites within a 249 ha. experimental logging coupe in tall, wet high site quality forests

in northern NSW increased more than threefold (from 0.3/ha to 1.3/ha) between 1985 and 1992, after cessation of a the 1980's drought. Similar declines are likely to have occurred in the past 20 years throughout the species range.

24. In my opinion reported Glider declines in the Blue Mountains, Booderee National Park and the emerald district of Queensland can be attributed primarily to drought and warming. Declines of Gliders in the Blue Mountains of NSW (Smith and Smith 2017) can be attributed to drought because the magnitude of decline decreased with increasing elevation and wetness. Gliders were absent from forest below 200m elevation and 75% less abundant in forests below 500 m. In the Emerald district of southeast Queensland Woinarski et al (2006) monitored fauna changes at 24 survey sites and reported a decline in Glider frequency of occurrence from 29% of sites to 13%, and a decline in mean abundance from 5.3 to 0.6 Glider per site between 1973-76 and 2001-02. During the same period koalas declined from 21% of sites to 4% and abundance declined from abundance of 1.2 to 0.3. This region occurs on the western edge of the known range of *P.volans armillatus* in Queensland and is dominated by low productivity non-eucalypt and eucalypt woodlands which are not normally considered habitat for Greater Gliders. Marginal habitat is particularly vulnerable to the effects of drought, which is likely to be the principal cause of these declines. Weather conditions were much wetter in the initial survey (average 895 mm annual rainfall) than during the follow up survey in 2001-02 (293 mm).

Figure 5 Bureau of Meteorology records showing temperature and rainfall variation I the past 100 years.





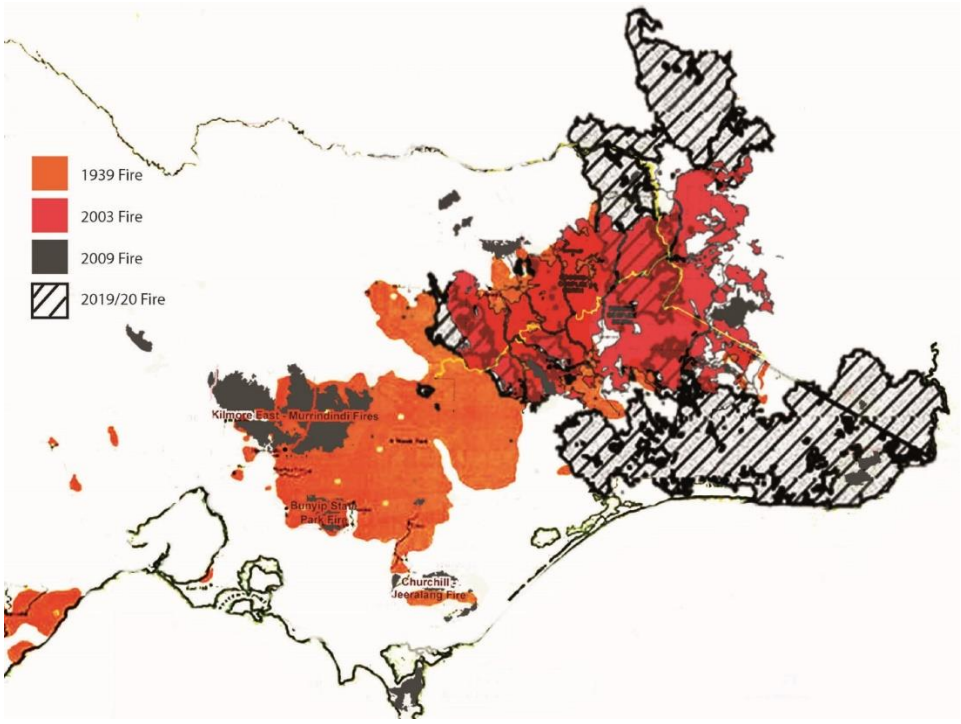
25. It is possible that drought has caused a general reduction in average glider density across its geographic range in Victoria since 2000 but I am not aware of any conclusive evidence to support this and there is some evidence to the contrary. Recent surveys of Gliders in the Strathbogie Ranges report no reduction in Glider density compared to 1983 (Nelson et al 2018), but 1983 was also a drought period.

26. **Wildfire.** The forests of Victoria are subject to extensive wildfire at reasonably regular intervals, especially after long periods of abnormally hot and dry weather. The distribution of some of the most severe and extensive forest fires are overlayed in Figure 6 (adapted from figures in www.ffm.vic.gov.au/history-and-incidents/past-bushfires). Wildfires burned approximately 1.5 million hectares of forests in North east Victoria and East Gippsland in 2019/20, about 0.43 million hectares of Ash and Mixed Species Forest in the Central Highlands in 2009, 1.3 million hectares of Alpine Ash and other forests in North East Victoria in 2003, and 1.5-2.0 million hectares of Montane Ash and Mixed Species Forests across all forests except East Gippsland in 1939. Additional extensive forest fires also occurred in Gippsland in 2006/7 and many smaller fires occurred in intervening years.

27. It has been estimated that fire burns about 20% of the Montane forests in the Victorian Central Highlands every 20 years (VEAC 2017), but not all of the forest within the fire envelope is affected by fire. Wildfires are patchy in their intensity, scorching the canopy and killing the trees in some areas, burning the understory in others and leaving some patches unburnt. The 1983 Warburton fires in the Victorian Central Highlands burnt only 24% of Ash forests with sufficient intensity to kill all the canopy trees (Smith and Lindenmayer 1992). Monitoring of 108 sites in Montane Ash Forests after wildfires in 2009 found that 13 sites (12%) experienced intense fire, 32 sites (30%) experienced moderate fire and 63 sites (58%) no fire (Lindenmayer et al 2013). Fire frequency and extent may be higher elsewhere and in drier forest types. In NSW 3% of parks and reserves were burnt by wildfire on every year on

average between 1976 and 2011 (OEH 2012). After the 2019/20 wildfires 23% of forest within the fire envelope was fully affected, 36% partially affected, 27% unburnt, 8% little changed and 6% not assessed in NSW (NSW Department of Planning Industry and Environment: NSW Fire and environment 2019-20 Summary).

Figure 6 Occurrence of major bushfires in Victoria since 1939.



28. **Impact of Fire on Gliders** The limited available data suggests that Greater Gliders are killed in intensively burnt forest, reduced in moderately to lightly burnt forest and unaffected in unburnt forest and forest with a burnt understory but unscorched canopy. Preliminary results of post fire fauna surveys after the 2019/20 wildfire in Victoria (see Table 4, P54 in VicForests 2019/20 Bushfire VicForests' Precautionary Principle Application and Adaptive Management, evidence in these proceedings) indicate that Greater Gliders are absent from the most severely burnt areas (Fire severity 1), present in highest numbers in unburnt and lightly burnt forests (severity classes 4 and 5) and present in low numbers or frequencies in moderately burnt forests (severity classes 2 and 3) immediately after fires. In this study Greater Gliders were recorded in several coupes within patches of forest mapped as having been burnt at category 2 intensity (Appendix 1) about 10 years after the 2009 fires. Lindenmayer et al (2013) reported only a minor impact of the 2009 wildfire on Gliders in monitored Ash forests of the Central Highlands but meaningful interpretation of this data is difficult because plot size was small, monitoring was intermittent, sites were protected from logging, and results were presented as a smoothed model without showing the spread of actual data.

29. **Time to Recovery After Fires** Assuming that Glider population decline is approximately proportional to fire intensity, a typical hot fire (that intensively burns 25% of the forests, moderately to lightly burns 50%, and leaves 25% unburnt) will reduce Glider abundance by about 50% and the proportion of forest occupied by gliders by about 25% within the fire envelope. The time taken for the Glider population to recover after fire will vary with: a) fire intensity, b) the proportion of overstorey trees which recover by resprouting relative to the proportion that are killed and recover from seedlings, c) the size and extent of unburnt or lightly burnt "fire refuges" in which Gliders survived the fire, d) distance to unburnt or lightly burn refuges, e) the ratio of unburnt of lightly burnt refuge habitat to severely burnt habitat within the surrounding region (eg 2km) and f) the effects of any post fire timber harvesting on fire refuges and recovering Glider habitat. Glider population recovery will generally be most rapid (5-10 years) in unlogged dry forests in which all or most of the larger trees recover by re-sprouting, and slowest (120+ years) in wet sclerophyll forests in which most of the overstorey trees are killed and recover by seeding. Recovery will be more rapid where unburnt refuges are close to, and dispersed throughout, intensively burnt areas.

30. **Fire Refuges** Glider populations are presumed to recover from fire by expanding from nearby unburnt or lightly burnt fire refuges. Natural and long term fire refuges typically occur in moist gullies, riparian zones and protected (cooler, wetter) southern aspects (Robinson et al 2013, Berry et al. 2015). The location of important long term fire refuges is indicated by the occurrence of individual large living trees and stands of uneven-aged, mature and old growth forest, which typically occur in wetter, sheltered gullies drainage lines and southern slopes. These areas can easily be mapped by aerial photo interpretation and ground truthing. Protection of these refuges from timber harvesting for 10-40 years (dry forest) and 10-120+ years (wet forest) after fire is the key to ensuring Glider population recovery after intense fire (Smith 2020). There are currently no maps suitable for use in planning timber harvesting and retention which show the distribution of long term fire refuges. Short term fire refuges (10-20 year) within fire envelopes is provided by patches of unburnt or lightly burnt forest (severity 3-4) within close proximity (within the same coupe or within 2 km) to more severely burnt (severity 1 and 2) forest. The distribution of these forests is available on fire history maps for the 2009 fire and for the 2019/20 fires (but note that the order of fire severity is different and reversed in these two regions). In this report category 1 fires are the most severe. There is scope to use these maps to identify short term fire "unburnt fire refuges" based on distance and area statistics, for example short term fire refuges requiring 15 years protection from logging could be defined as "***all unburnt or lightly burnt areas of forest in areas in which the percentage of forest burnt in the top 2 severity classes exceeds 50% within a 2 km radius***". I am not aware of any maps or attempts to model and map "unburnt fire refuges" within either the 2009 or 2019/20 fire envelopes.

31. **Effects of Fire in Dry Sclerophyll Forests on Gliders**. Dry Sclerophyll Forests, which make up the majority of forest area in Victoria (see figure 3), are generally dominated by tree species which are not killed by fire but resprout from buds under bark on branches and trunks or from the root base. These forests regrow their foliage and recover much of their structure within about 5-20 years. Seedlings and young trees are shade tolerant and regenerate continuously in the understory or in forest openings in

the absence of fire. For this reason dry sclerophyll forests are typically uneven aged with a mixture of stems of all sizes and ages including young trees, mature trees and old growth trees with hollows (Lutze et al. 1999,2004). In a study of 58 logging coupes in the Central Highlands Smith (2019) found large old trees with hollows and an uneven-aged or old growth structure with abundant mature trees to be present in 100% of plots located in dry forests and 100% of forests located in ecotones between wet and dry forests***. In general, the frequency of intense wildfire is sufficiently low (about 0.75% of the forest each year), and the recovery of Glider populations is sufficiently rapid that wildfire alone cannot generally be considered either a significant threat to Gliders in dry sclerophyll forests and ecotone wet and dry sclerophyll forests in the absence of logging.***

32. **Effects of Fire in Wet Sclerophyll Forests on Gliders a) uniform aged forest**. Wet sclerophyll Forests, like Mountain Ash, are dominated by tree species which are usually killed by intense fire and regenerate from seedlings in uniform stands beneath the dead or partially killed forest canopy. Forests that are severely burnt regenerate as uniform even aged stands with emergent standing dead fire killed trees ("stags") in the overstorey. These stands increase in average tree size, height, stand basal area and dominance by large old trees with hollows with time since fire. They reach a mature stage in about 80 years after fire and senescent stage about 120+ years after fire when trunk and branch hollows first develop. Senescent stages may last for hundreds of years in the absence of fire and sometimes give way to stands dominated by cool temperate rainforest as large old trees collapse. Gliders are expected to be absent from these uniform aged forests until they are older than 120 years of age, unless some scattered living or dead trees with hollows are present in the overstorey (> 0.5/ha.), in which case Glider populations may begin to recover after about 40 years and remain while tree hollows are present.

33. **Loss of Dead Habitat Trees from Uniform Aged Wet Forest** Uniform aged regrowth Montane Ash forests that develop after intense fire and have only dead fire killed trees ("stags") with hollows in the overstorey will only suitable for Gliders for a short period about 40-70 years after fire because dead Montane Ash trees decay and fall rapidly, a rate of about 2.5% per annum, (Smith 1982), and are now scarce of absent in uniform aged mature Ash forests killed in the 1939 wildfire. Smith (2019) found dead trees to be present in 53% of coupes at an average density of 1.6/ha in 1939 regrowth forests in the Central Highlands, but all of these dead trees had highly decayed forms likely to be unsuitable for use by Gliders. Once dead trees with hollows have collapsed in these forests they do not re-appear until the forest reaches an age of more than 120 years, when stem and branch cavities first begin to form (Ambrose 1982). In summary, the suitability of uniform aged regrowth Ash forests for Gliders is bimodal with a small peak in mature forests at 40-60 years after intense wildfire and another peak in old growth at 120 + years after fire.

34. **Effects of Fire in Wet Sclerophyll Forests on Gliders a) uneven- aged forest**. Wet (Ash) Forests that are only partially burnt develop into uneven-aged stands with two or more age classes of trees, including an understory of younger post fire seedlings and emergent layer(s) of larger older living trees in the canopy. Glider abundance in these forests may decline after wildfire but can be expected to

recover after about 40 years and reach peak densities about 80 years after fire in stands with a 20% or higher basal area of large living trees with hollows per hectare (A. Smith unpublished).

35. **Natural Extent of Uneven Aged Old growth Wet Sclerophyll Forest Suitable for Gliders**. If 5% of Montane Ash forest is killed by wildlife every 20 years then overall forest structure should tend towards a predominantly (>70%) old growth forest structure over time, where old growth is forest with mature and living senescent trees with hollows in the upper canopy (Smith 2019). Old growth is likely to have been the predominant structural type in Ash Forests of the Central Highlands prior to European settlement (Smith 2019). In the absence of timber harvesting and under normal fire regimes it is my opinion that about 70% of the wet (Montane Ash) forests in Victoria would have has a suitable structure to support Greater Gliders at any one time. Today, after more than 80 years of logging since the1939 fires, less than 10% of the Ash forest in the Victorian Central Highlands has an age structure suitable for Gliders (see forest older than 1926 in Figure 7), and much of this is in small patches and remnants in which glider populations are at risk of extinction from isolation.

36. **Natural Extent of Old Growth Dry Sclerophyll Forests** Uneven aged old growth is the predominant natural structure in dry sclerophyll forests and ecotonal wet and dry forests because the large old stringybark trees in theses forest are not usually killed but resprout after fire. Consequently, all Mixed Species forests in Victoria that have not been intensively logged and retain an uneven-aged structure can be considered “old growth” within the context of the 1997 JANIS report which guided the definition of old growth for use in Regional Forest Agreements throughout Australia (Smith 2019, Mortimer 2021). Consequently, Greater Gliders are likely to have occurred throughout 90% or more of all mid to high elevation Mixed Species forests in Victoria prior to European settlement, and they remain abundant in these forests in areas that have not been intensively logged since the 1960-70’s. A recent assessment found Greater Gliders to be present in 97% of unlogged coupes dominated by Mixed Species and ecotonal forests in the Central Highlands (Smith 2019). In this study Gliders were also found to be present in 100% of coupes dominated by unlogged (since the 1970’s) dry sclerophyll and ecotone wet and dry forests (see Appendix 1).

37. **Summary of Fire impacts** Wildfire initially reduces Glider populations by about 50% within the fire envelope but the population recovers relatively rapidly (<20 years) in dry sclerophyll forest and ecotonal forests and more slowly (40-120 years) in wet sclerophyll forest. Wildfire may reduce the local density of Gliders in burnt patches but does not reduce the broad geographic range (distribution) of Gliders over the long term because glider populations can survive mild fires in tree hollows and recover over time by expanding outwards from unburnt or lightly burnt patches and fire refuges. ***On their own, wildfires do not appear to represent a threat to Greater Glider habitat, but they can become a potentially serious and catastrophic threat to Gliders in conjunction with timber harvesting, especially in Victoria where excessive clear-felling of the little remaining unburnt mature (1939) and older wet forest and high elevation ecotone (mixed wet and dry) forest has occurred at a such a high rate and over such extensive areas that insufficient old growth forest may remain to provide a buffer against future fires.***

38. **Impacts of Timber Harvesting on Gliders** The immediate impact of intensive (100% tree basal area removal) clear fell logging on 1038 adult and immature Gliders and 319 pouch young was measured by Tyndale Biscoe and Smith (1969). They found that most gliders survived the initial felling but lost weight rapidly and died in situ within a week. Gliders displaced by logging were found in uncharacteristically low trees or wandering clumsily along the ground where they were easy prey for foxes, cats, dogs, quolls, and owls. Glider remains were found in the nests of diurnal wedge tailed eagles (Aquilla audax) which do not normally prey on gliders. The only Gliders which survived logging were those on the edge of the harvest area whose home ranges remained partially intact. There has been no comparable study of glider survival in partially logged forest that removes only a portion of tree basal area, but surveys of partially logged forests have found glider density to be reduced in approximate proportion to tree basal area removal above a threshold of about 28-40% below which all animals disappear (see subsequent paragraphs for details).

39. **Impacts of Timber Harvesting and Fire**. Low intensity timber harvesting such as that which occurred in much of NSW, Qld and Victoria prior to the 1960's can be considered to mimic the effects of wildfire and has a minimal long term impact on Gliders. Historical selective timber harvesting typically removed only merchantable stems and retained a large proportion (66%) of the stand basal area including the large old trees with hollows (Smith 2010). In NSW Gliders remain widespread and moderately abundant in forests subject to past low intensity timber harvesting (Smith et al 1994,95. McLean et al 2018). In contrast, modern (post 1960/70) timber harvesting practices in Victoria, Southern NSW and parts of northern NSW typically clear fell all standing trees except those retained to provide habitat or seed trees, and schedule these stands for re-harvest on rotations too short (<60 years) for Glider habitat to recover. These practices have a similar impact to land clearing. They permanently eliminate Gliders from felled patches and leave Glider populations in retained patches that are small, isolated, fragmented and at high risk of local extinction. Most if not all Glider populations in these remnants are likely to be too small and isolated to sustain viable Glider populations for the mid to long term (see para 48 cumulative impacts).

40. **Impact of Timber Harvesting on Gliders in Dry Sclerophyll Forests.** The impact of timber harvesting on gliders in dry sclerophyll forests varies with the intensity of harvesting. Prior to the 1990's in northern NSW and the 1960's in southeast Australia and Victoria dry sclerophyll forests were generally only lightly logged by selective removal of large merchantable stems. This generally maintained and uneven aged structure suitable for gliders. A survey of 77 forest sites in the Grafton and Casino districts of northern NSW in 1994 found an uneven-aged structure at 87% of sites, and Gliders present at 51% of sites. Gliders were absent or less abundant at low elevations, in recently burnt areas (within 10 years), low productivity sites < 30m height, and in sites that had been "culled" to remove large dead and defective trees with hollows.

41. After the 1960s timber harvesting intensified in southeast Australia from light selective logging to clear felling to supply pulpwood markets and this is now the dominant form of harvesting in both wet and dry sclerophyll forests. Clear felling and intensive logging has no natural ecological equivalent in dry

sclerophyll forests which do not generally regenerate in uniform aged stands. This form of intensive silviculture cannot be considered “ecologically sustainable” because it converts structurally complex, mature and uneven forest stands (which satisfy the Janis (1997) definition of old growth (Mortimer J 2020)) into unnatural uniform aged stands of young regrowth more like agricultural crops or plantations, which are re-harvested on short rotations of insufficient duration to sustain species like the Greater Glider that depend on old growth.

42. **Impact of Timber Harvesting on Gliders in Wet (Ash) Forests on Gliders.** Prior to the 1960’s Logging operations in Montane Ash forests of the Victorian Highlands focused on salvage logging of damaged trees after fires in 1939 and earlier (1911, 1926) and subsequently on the harvest of sound large old living trees in unburnt mature, uneven-aged and old growth forests that survived these fires. Harvesting was of moderate to high intensity leaving only scattered defective large living trees in the overstory. By 1984 approximately only about 8000 ha of old growth ash remained in timber production zones, and approximately 80% of production Ash forests were less than 60 years of age (Forests Commission of Victoria 1984). A survey of Greater Gliders at 29 sites stratified across Mountain Ash forests of different age in the Central Highlands at this time found Gliders to be scarce or absent in regrowth forests burnt in the 1939 fires and logged prior to 1970. Gliders were only abundant (63% of sites) in unlogged 53-133 year old mature and uneven aged forest that regenerated after fires in 1850, 1911, 1926 and which were not or were only lightly burnt in 1939 (A. Smith unpublished, Smith et al 1985).

43. After about 1970 old growth sources of Ash were largely exhausted in the Victorian Highlands and harvesting practices shifted from low intensity large tree selection to high intensity clear felling of advanced regrowth (1939) and mature forests (191,1926) on short rotations for woodchip. Clearfelling and related forms of intensive harvesting eliminate Gliders from logged forest by removing habitat trees over the short and long term and by converting previously mature and uneven-aged forest structure to uniform regrowth harvested on cycles too short to reach maturity (Smith 2010, 2016, 2017). By 2017, the total area of mature, uneven-aged and old growth Ash Forest in the Victorian Central Highlands suitable for Gliders had been reduced to about 10 % (Figure 7 VEAC 2017).

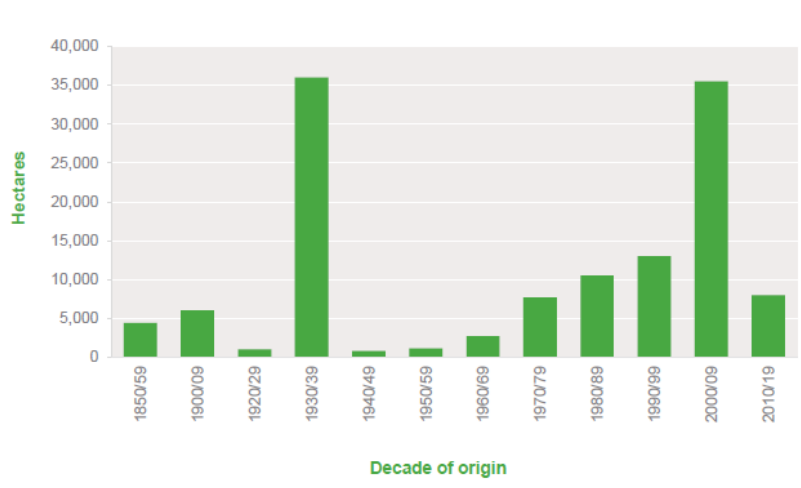


Figure 7 Showing the proportion of Ash forests by decade of origin in Victorian highlands (from VEAC 2017). Only classes older than 1939 are likely to be suitable for Gliders

44. **Impacts of Forward Supply Commitments on Greater Gliders** Greater Gliders are still moderately abundant in limited remaining areas of unlogged dry sclerophyll (Mixed Species) forests of the Central Highlands on the ecotone or interface with Mountain Ash (Smith 2019) but much of this high value Glider habitat is at risk of future clear-felling to satisfy forward supply agreements. In recent decades harvesting rates and supply commitments in Ash and Mixed species forests in the Victoria have overcommitted supply to such an extent that all remaining available 1939 regrowth Ash and much of the remaining uneven-aged Mixed Species forest is at risk of being clear-felled to meet forward legislated supply agreements until 2030 (VEAC 2017). Graphs showing changes in past (since 2004) and future (to 2027/30) harvesting rates and supply commitments in Ash and Mixed Species forests (after VEAC 2017 Figures 3.6, 3.7) are reproduced in figure 8. These graphs show a steady decline in harvesting rates followed by a plateau in pulp log supply commitment from 2024-2030 which cannot be sustained in Ash forests because the sawlog supply will be exhausted under current clear-felling regimes. VEAC 2017 has stated that "*in 15-20 years there will be a wood supply bottleneck as the available 1939 mountain and alpine ash regrowth (i.e. not in reserves, protected areas, or other forest practices code exclusions) that dominates the timber supply from the Central Highlands is exhausted and new regrowth from the 2000s is not yet commercially viable.* In its summary VEAC concludes that "*decline in ash sawlog supply indicates that additional alternative sources of pulp, such as thinnings, will be required to meet the current commitments of 265,000 m3 year-1 of ash pulplogs until 2030 arising from the legislated supply agreement to Australian Paper*." Overharvesting has been so severe that it is now risking a shutdown of Victoria's native forest timber industry. VEAC (2017) has stated that "*If a large proportion of the 1939 regrowth is lost to bushfires in the next two decades, it could potentially spell the end of Victoria's native forest industry*". Thus, we are in a situation in which the once common Greater Glider is now threatened, and our forestry industry is at risk of closure due to inadequate forward forest management planning. This practice is clearly inconsistent with the three main objectives of Victorian Regional Forest Agreements (RFAs): (*to identify a comprehensive, adequate and representative reserve system and provide for the conservation of those areas; to provide for the ecologically sustainable management and use of forests in each RFA region; and to provide for the long-term stability of forests and forest industries, VEAC 2017*).

45. **Overall Impact of Timber Harvesting on Gliders**. Timber harvesting after the 1939 and 2009 fires in Victoria has shifted forest structure from one dominated by mature, uneven-aged and old growth to one dominated by uniform aged young regrowth (with few or no living emergent trees) on a massive scale. This has reduced the extent of Glider habitat in Montane Ash forests of the Central Highlands from about 75% at the time of European settlement to around 10% or less today. A similar or greater magnitude of decline in Glider habitat can be expected to occur, or may already have substantially occurred, in the dry sclerophyll or Mixed Species forests and ecotonal wet and dry forest throughout Victoria wherever ecologically unsustainable, clearfell timber harvesting practices are used.

Figure 8 Forward harvesting commitments in Ash and Mixed Species forests (after VEAC 2017)

46. **Relative Impacts of Fire and Logging** The effects of timber harvesting on biodiversity can be broadly likened to the effects of fire but there are some important differences listed below that make timber harvesting effects more severe:
    - Timber harvesting is not naturally constrained like fire to leave undisturbed fire refuges over large parts of each compartment or landscape but is more likely to remove natural fire refuges because they generally support old growth or larger, older trees.
    - Timber harvesting is much more intense in all its forms than the effects of fire especially in its permanent removal of medium sized and large trees, and old trees with hollows.

- Intensive harvesting is cumulative and more extensive over time than fire disturbance in natural forests and maintains a much higher proportion of the forest in early regrowth stages rather than late mature and old growth stages.
- Timber harvesting does not retain the degree of connectedness (natural corridors and links) found in burnt forests.

47. Greater Glider Population Trends in Victoria There have been a number of Gliders Surveys in different parts of Victoria which give an indication of Glider population trends.

i. Between 1982 and 1984 surveys of arboreal mammals along 197 four hour walk spotlight transects in northeast Victoria (Bennett et al 1991) found Greater Gliders to be virtually absent from dry forests below 300, moderately abundant (62% of sites) in higher elevation Dry Peppermint dominated forests, abundant (82% of sites) in Wet Peppermint Forests and scarce in high elevation Alpine Ash forests (24% of sites).

ii. In 1983 Smith et al (1985) undertook a survey of arboreal mammals by spotlighting at a range of locations throughout the high elevation Alpine Ash forests of Central and north east Victoria (see Alpine Ash forest in figure 3). This is a region where Greater Glider records are now few and modelled Glider abundance is predicted to be low. Gliders were detected on 50% of transects at a rate of or 0.71/km or 0.68/hour and a density of 0.14/ha., across all areas or 0.26 gliders per hectare in transects with Gliders. A survey of forest structure and habitat suitability for arboreal mammals at 44 sites along the transect route showed that most forests were structurally suitable (mature or uneven aged with abundant large stems) for Greater Gliders but had low densities of habitat trees due to past logging and fire. Habitat trees were scarce (< 1/ hectare) or absent on 40% of sites and averaged only 2.2 per hectare across all survey sites. It can be concluded from this survey that the density of Greater Gliders in Alpine Ash dominated forests of Central Victoria has been unusually low since the 1980's due to historical logging practices which failed to adequately protect and recruit habitat trees during logging operations.

iii. In 1983-84 arboreal mammals were surveyed at 32 three-hectare sites in the higher elevation (> 300m) Ash and Messmate dominated forests of the Central Highlands by stagwatching (Smith et al 1985, Smith et al 1989 and A. Smith unpublished). Greater Gliders were detected at 32% of sites overall and in 63% of sites with an old growth (mature, uneven-aged or senescent) structure. Gliders were absent from uniform aged forests regenerating after intensive fire in 1939 or subsequent intensive logging.

iv. In 1987-89 a further 120 sites in the Central Highlands surveyed by Lindenmayer et al (1990) using the same methodology as Smith et al 1985 (and incorporating the data of Smith et al 1985) reported a similar occupancy by Greater Gliders of 30%.

v. In 1989 Milledge et al (1991) surveyed greater gliders by spotlighting at 130 sites across a regrowth to old growth gradient, and Greater Gliders were detected at 37% of sites.

vi. Lindenmayer and Sato (2018) monitored Greater Gliders at 156 one ha. sites by stagwatching in Ash forests of the Central Highlands from 1996 -2015 and reported a decline in the proportion of occupied sites from around 60% in 1996 to around 10% after 2009. The findings of this study are difficult to interpret, however, because of small plot size (1 ha., less than the average home range

area of a single Glider) and the protection of survey sites from logging. Glider population trends in these plots is primarily related to the loss of dead habitat trees from regrowth forests regenerating after 1939 fires and may not be reflective of the situation across all Ash Forest.

vii. Lumsden et al (2013) surveyed Greater Gliders at 200 random sites in the Central Highlands and detected them at 32 (16%) of sites. Because these surveys were based on short transects (100m the data may underestimate the actual frequency of occurrence of Gliders within the landscape.

viii. In 2019 DELWP detected Gliders at 19% of sites in eastern Victoria and 41% of sites in central and north eastern Victoria and recorded lower glider densities than expected where they were present (0.42 – 1.86 per transect km). Surveys from 107 sites in East Gippsland, comprising 49 sites with previous records of Greater Glider (southern) and 58 randomly stratified sites, found a decline in Greater Glider (southern) occupancy rate of about 50 percent compared to about 20 years ago (DEWLP unpublished, in Department of Agriculture, Water and the Environment Consultation on species listing eligibility and conservation actions Petauroides volans (Greater Glider southern) June 2021).

ix. In 2018 a survey of Gliders in the Strathbogie Ranges reported above average Glider densities and found no declines in Glider abundance over the past 34 years (Nelson et al 2018).

The results of Glider surveys in Victoria point to significant Glider range and density declines in the logged wet forests of the Central Highlands, the Alpine Areas and in the dry forests of east Gippsland in the order of 50-85% since European settlement with most of this decline occurring in the last 25 years. In my opinion these declines are consistent with and point conclusively to the cumulative impact of intensive timber harvesting (clear falling) as the primary cause of Glider decline in Victoria.

48. **Cumulative Impacts: fragmentation and Isolation.** The magnitude of timber harvesting impacts on Glider populations can be much greater than simply the area of forest clear felled*.* Remnant Glider populations in retained patches of unlogged forest in SPZs, streamside protection strips and unlogged (scheduled) coupes are at risk declining to extinction once they become isolated by harvesting in surrounding areas. Current timber harvesting is creating a patchwork of hundreds or thousands of habitat patches variously isolated by roads, areas of unsuitable vegetation (swamps and low scrubs) and stands of dense regrowth (post logging) with few or no habitat trees. The Cottonwood Coupes (Arena and Teeter Totter, Appendix 1) provide an example of a harvesting region in which cumulative harvesting of adjacent coupes over time has left retained patches of habitat fragmented and largely isolated. Glider surveys in the Central Highlands in 2001 found that remnant patches of old growth and uneven-aged forest left after the 1939 fire needed to be greater than 60 hectares in size in order to have an 80% chance of supporting Gliders (Incoll et al 2001). There is some empirical data for Squirrel Gliders (*Petaurus norfolcensis*) in fragmented dry sclerophyll forests in NSW (Smith 2002) which predicts that glider populations left isolated by timber harvesting will need to be quite large, > 115 individuals or 250 hectares of habitat, in order to survive for the duration of just a single harvesting rotation (40 -60 years). Squirrel Gliders occur at similar densities to Greater Gliders and are more mobile so the effects of fragmentation on Greater Gliders are likely to be more severe. There are no empirical data for Gliders predicting minimum habitat patch and populations sizes needed to survive many hundreds of years. But there is some evidence from mammal survival and extinction on offshore

islands isolated by past sea level rises, that isolated populations would need to be in the 1000's to avoid extinction. In my opinion current harvesting systems in Victoria have not taken this risk into account. They do not allow for adequate levels of corridor connection between remnants and do not retain sufficient areas of fire refuge and other protected habitat patches (of 120+ hectares in size) at regular intervals (every 4 km) across the harvested landscape to be certain of Glider survival.

Figure 9a Map 13M showing isolated trees and isolated small remnant patches of unlogged forest (visible as tall uneven patches with shadows) left after clear felling in the area surrounding Arena and Teeter Totter coupes.

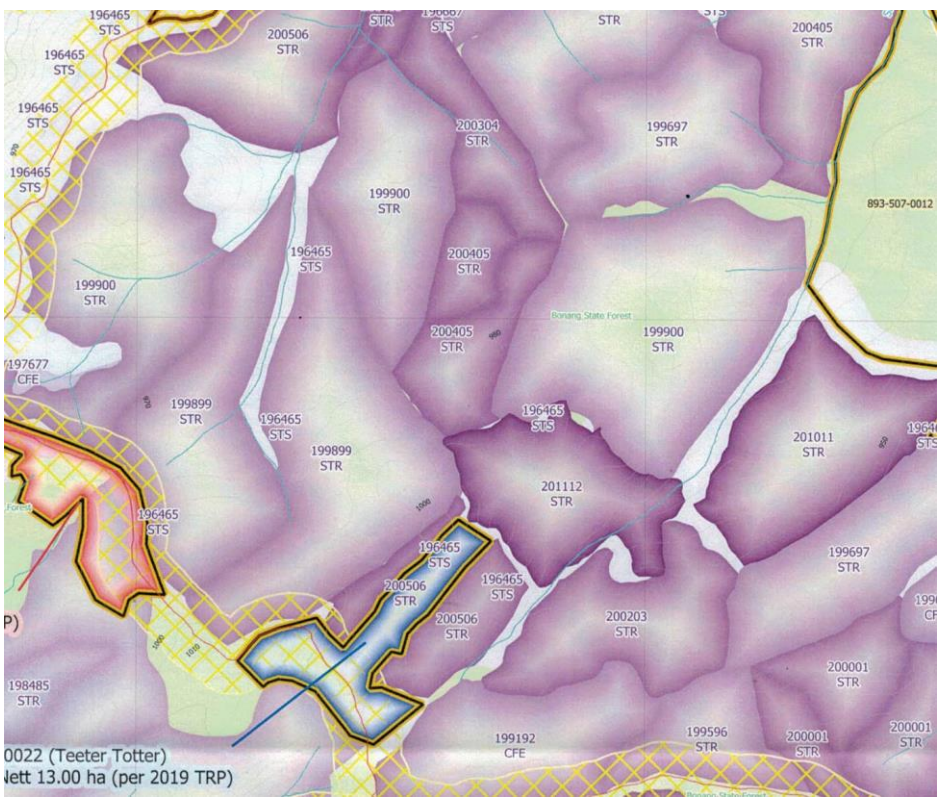


Figure 9 b Map 13 b showing the small isolated patches of forest (white and green areas) left after cumulative clear felling of adjacent coupes. The coupe in the upper right and the two outlined coupes in the lower left (Arena and Teeter Totter) have yet to be harvested.

49. **Question 1 h) The conservation status of the species, having regard to the 2016 Conservation Advice and the May 2021 Consultation Document on Listing Eligibility and Conservation Actions, please address whether you consider the species now meets eligibility for Endangered.** I have read the TSSC justification for concluding that the Greater Glider is "eligible for listing as Endangered under A2abc and possibly A3bc**"** and I support this conclusion based on the evidence presented above. In my opinion the extent of Glider habitat decline in the high elevation Mixed Species and Montane Ash forests of the Central Highlands, which supports the greatest concentration of Glider records and the bulk of the Victorian Glider population, is likely to have exceeded 75 % since European settlement with the great bulk of this decline having occurred in the past 25 years as a result of the cumulative impacts of intensive clear felling exacerbated by fire and drought.

50. Question 3 Please review paragraphs [6]-[33] of your first report, which address:

(a) the distribution, habitat, threats to, and recovery of the Greater Glider;

(b) impacts of timber harvesting on Greater Glider,

(c) effects of the 2019/2020 Bushfires on Greater Glider and its habitat, and changes to relative importance of populations in the Central Highlands and in unburnt parts of the North-East, Gippsland and East Gippsland areas,

(d) important populations of Greater Glider,

(e) actions in the 2016 conservation advice,

Do you wish to supplement or add to those answers in light of any of the further assumptions in Annexure A, the new documents or maps enclosed with this letter, or any other recent information or material since your first report?

Para 7, see new additional habitat specifications in this report.

Para 9. Threat from land clearing is not significant in Victoria but has not ceased and will continue to be a threat into the future in Queensland (P.v.armillatus) where many small fragmented populations are isolated (Ferguson et al 2018).

Para 11 Second last sentence refers to remaining area of Senescent Ash Forest.

Para 18/21/22 the term old growth is intended to include uneven-aged and senescent structural classes.

Para 26 Timber harvesting impacts are also more severe in Victoria than other states because harvesting is more intense in Victoria and clear felling is not used in most of northern NSW and Qld.

Para 29/30. I also consider a main effect of the 2009 and 2019/20 wildfires to have been the contraction of Glider populations in the most intensively burnt areas to "fire refuges" which will require protection from timber harvesting for periods of at least 5-20 years to provide source areas for recolonization of burnt habitats as they recover after fire.

51. **Question 4 Please review the Kavanagh 2000 publication. Do you agree with the statement in the Conservation Advice 2016 (enclosed with our first letter item 6, p3), and the new 2021 draft (p20), that Greater Glider populations can be maintained if 40% of the basal area is left, said to be sourced from that publication?** No, I do not agree with this statement as it appears to be interpreted and is currently applied by VicForests. There are different ways of retaining 40% of the tree

basal area. It can be retained by leaving 40% of the coupe area unlogged, an approach that I refer to in this report as **CAR40 (40% coupe area retention**) and what VicForest calls **Retention System 1 or 2 with higher levels of aggregated retention**". It can also be achieved be leaving 40% of trees in all size classes dispersed evenly across the coupe. This would be equivalent to moderate intensity clear felling or high intensity selection logging or what VicForests calls **Variable Retention System 2 with higher levels of dispersed retention.** Both of these approaches may be successful in retaining Gliders within logging coupes but only under strict circumstances (see next para), and both are close to minimum limits below which Glider density in coupes is likely to decline to zero, which means that the 40% retention target is not guaranteed and is only likely to be successful part of the time and then only under special conditions, none of which are currently met by VicForests.

52. **Impact of Vicforests 40% Retention Harvesting**. **Please explain your answer, including addressing: (a) your observations of VicForests' harvesting (whether by site inspection or photographs) in the following logged coupes each of which is stated in VicForests' coupe plan to retain 40% basal area - Sample Coupes: The Acheron Coupes, Loch Valley East Coupe 'Myrrh', Loch Valley West coupe 'Turkey Feet' (incomplete, under injunction), Mount Klondyke coupe 'Sun Downies', Spraggs coupe 'Jokes'; and if you wish and time permits, the following Further Coupes: Big River North coupe 'Lemon Lime' (incomplete, currently active), Big River South coupes 'Barcelona', Icy Creek coupe 'Hole', Mount Delusion coupe Groves Manna, Mount Despair coupes 'Shetland Carriage', Mount Klondyke coupe 'Propellor' (incomplete, under injunction), Neerim East coupe 'Walkindapark', Nunniong coupe 'Windy Road'.** VicForests 40% aggregated retention harvesting will only be effective in retaining Gliders populations on coupes under special circumstances including the following:
    a) the retained area is suitable Glider habitat;
    b) the retained area is not isolated and fragmented but is linked by retained wide (> 100m) forest corridors (not longer than 2km) to large patches of nearby reserved Glider habitat or National Parks (> 120 ha);
    c) the retained area is protected from burning and destruction during post logging burns;
    d) the retained unlogged area is permanently protected in SPZs and is not available for harvesting in subsequent years or rotations. VicForests current Conservation Strategy **appears to d**efine retained habitat as **"any intact forest unlikely to be harvested within the next 20 years, including Code mandated buffers and any permanently reserved areas**", which means that none of these retained areas are permanent and none can be considered to have any long term habitat value.

    At present none of these criteria appear to be required or applied by VicForests in coupes that are the subject of these proceedings (see Appendix 1 for further details). There is no evidence that coupes have been or will be adequately surveyed and mapped prior to harvest to identify and protect the best areas of Glider habitat, there is evidence from aerial photographs that retained habitat patches are sometimes left in small isolated and fragmented patches of no long term value, there is evidence that retained patches are burnt, there is no proposal to map and permanently

protect retained patches, and there are no plans to link retained patches with a network of protected wildlife corridors, large habitat patches and viable conservation reserves (See Appendix 1 for further descriptions and assessments of Glider habitat on each coupe and impacts of timber harvesting). The use of aggregated retention by VicForests in preference to dispersed retention makes it convenient and easy for retained patches to be harvested at a later date. Dispersed retention does not facilitate late harvesting of retained patches because this would cause too much damaged to regenerating forest between dispersed retained trees.

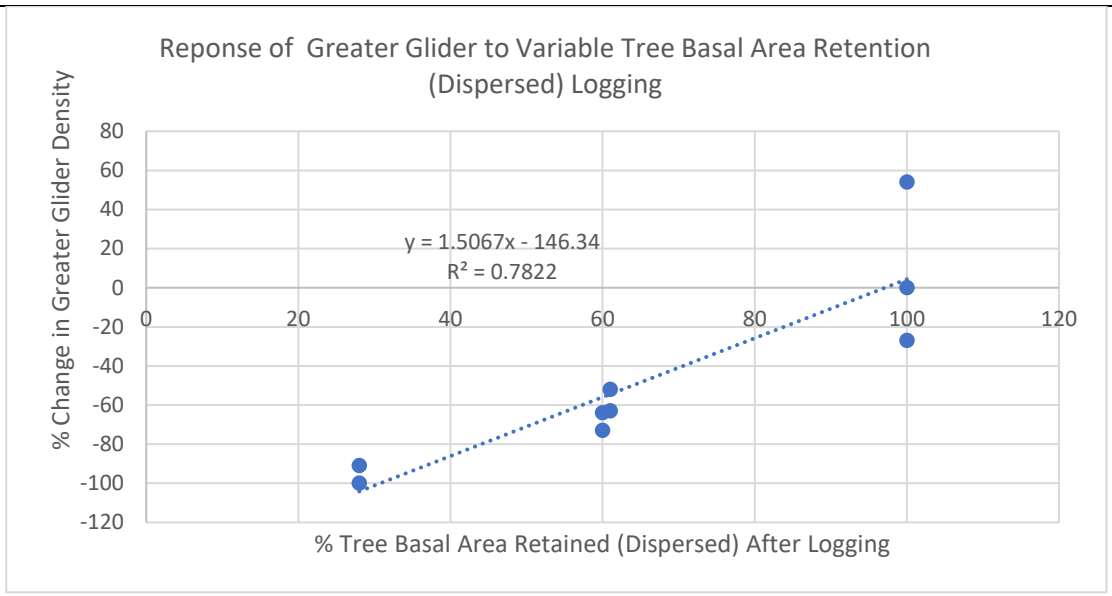
53. **Impacts of 50% Dispersed Retention Harvesting**. Kavanagh (2000) measured Glider density before (1988) and after (1989,1990) selection harvesting of variable intensity in four replicate coupes subject to 3 logging treatments (control, nominal 50% retention, and normal integrated logging for pulp and sawlog). All the study coupes were in different locations and supported habitat of different quality. Four of the 12 experimental sites did not have any Gliders and numbers in the other coupes varied more than threefold (from 3.5 to 9/km of transect). Glider numbers on one of the two control sites more than doubled between 1988 and 1989 a change which can be accounted for by cessation of the 1980's drought. In a similar before/after logging study in northern NSW Glider density in experimental logging control sites was also found to more than double after cessation of the 1980's drought (Howarth 1992). Kavanagh did not correct for the increase in Glider density on control sites in his analysis which resulted in an underestimation of logging impacts. The combined effects of site variation and absence of glider from two controls and four treatment sites, meant that the study lacked sufficient replication for statistical analysis, so its main conclusion (that there was no significant difference between logged and unlogged treatments) can be considered invalid. This limitation is acknowledged by Kavanagh who noted that the study lacked sufficient power for avoiding a Type 2 error (falsely finding no difference when one may exist).
54. **Question 4 (b) the statement in the 2021 Conservation Advice that "Subpopulations in south-east NSW had not recovered 8 years after logging in sites retaining 62%, 52% and 21% of the original tree basal area (Kavanagh & Webb 1998)" (p20).** The study of Kavanagh and Webb (1998) examined the effects of **50% aggregated retention harvesting** on Gliders in an area of high site quality forest in southern NSW. The experimental design included one control, two experimental coupes and a normal logging coupe with retained habitat trees and streamside strips on about 15% of the coupe area. One experimental coupe had large retained patches and corridors over about 50% of the area and the other had a chequerboard of clear felled and unlogged half hectare patches. **All coupes were surrounded by a matrix of unlogged forest**. Because this was a high-quality forest (dominated by large sound trees) logged for sawlog and pulpwood, harvesting was similar to, but less intensive than, current clear felling in Victoria. Survey transects on each coupe were located partly in clear felled areas and partly in retained unlogged patches of forest. **After harvesting no Gliders were observed in any areas of logged forest**. All observed Gliders were found in retained patches or corridors of unlogged forest. In the first year after logging Greater Glider numbers declined in approximate proportion to the relative area of forest clear felled, but the small number (4) of treatments (before after surveys) was insufficient for statistical analysis. In later years Glider numbers declined to zero in all treatments including the control. This decline did not affect other arboreal mammal species

and was attributed to increased predation of Greater Gliders by owls. This demonstrates the vulnerability of Gliders to predation after logging and drought. Below average rainfall and higher than average temperatures in the mid to late 1980's (see Figure 5) could have prevented females from obtaining sufficient water and protein for reproduction, leading to gradual population decline in this area over a number of years as adults taken by owls were not replaced by new offspring.

55. Based on the observed pattern of decline in the first season after logging, before the period of severe owl predation, Kavanagh concluded that Glider abundance declined in approximate proportion to the area of forest logged. Kavanagh qualified this conclusion by noting this "proportional decline", and the persistence of gliders in a logging treatment areas with as little as 21% retained habitat, only occurred in this study because retained forest was surrounded by and immediately adjacent to large areas of unlogged forest. Kavanagh noted that no Gliders were seen in areas of logged forest and that all Gliders displaced by logging appear to have died except those with home ranges including unlogged forest on the perimeter of the logged area, consistent with the previous findings and conclusions of Tyndale Biscoe and Smith (1969). If the study plots of Kavanagh (2000) had been surrounded by logged forest, or if the retention had been dispersed rather than aggregated into large patches connected to adjoining habitat, it is likely that Glider decline would not have been proportional but more rapid or precipitous at low retention levels (<40%). Kavanagh (2000) concluded from the results of both his studies that ***a "threshold may exist within the range of 21%-39% retention of tree basal area below which the numbers of greater Glider suffer a marked decline***. This hypothesis was tested and supported by similar concurrent experimental studies in Northern NSW by Dunning and Smith (1986) and (Howarth 1992).

56. **Impact of Selection and Dispersed Retention Harvesting** A study by Dunning and Smith (1986) and (Howarth 1992) examined the effects of selection harvesting at three different nominal intensities, (66% canopy retention, 33% canopy retention and normal logging (15%) canopy retention) in a 250 hectare patch of forest near Mt. Boss north of Wauchope in northern NSW. Gliders surveys were carried out on multiple occasions in each treatment area in the year before and year after harvesting. A follow up survey was undertaken in the same area about 7 years after harvesting by Howarth (1992). The study was carried out in very high site quality (55m site height) high altitude (1100m) old growth wet forest dominated by exceptionally large and valuable old trees. Normal logging removed high quality sawlogs and retaining unmerchantable species and small and defective trees. Regeneration was natural, after soil disturbance, and no dead or senescent trees were felled for safety, fire prevention or other reasons, in marked contrast to current practice in Victoria. Harvesting was of unusually high intensity for selection logging due to the predominance of very large (>150 cm dbh) sound trees. The forest surrounding the experimental coupes had mostly all be previously harvested, so survival of gliders in retained trees was not greatly influenced by the presence of adjoining unlogged forest as it was in the studies of Kavanagh and Webb (1998), although Howarth noted that some Gliders in the 33% retention area were gliding in from a small patch of adjacent unlogged forest providing some boost to numbers in this area. These studies found a highly significant correlation between the percentage basal area of trees removed and change in Glider density (see Figure 10). The form of this relationship

is not directly proportional but shows that Glider abundance declines to zero once the percentage of retained trees falls below 31% of unlogged basal area or when the number of large, retained trees (> 75 cm dbh) falls below 8/ha. This study demonstrates that Gliders will not survive where just scattered trees (large habitat trees (4/ha) and large recruitment trees (4/ha)) are left after harvesting.



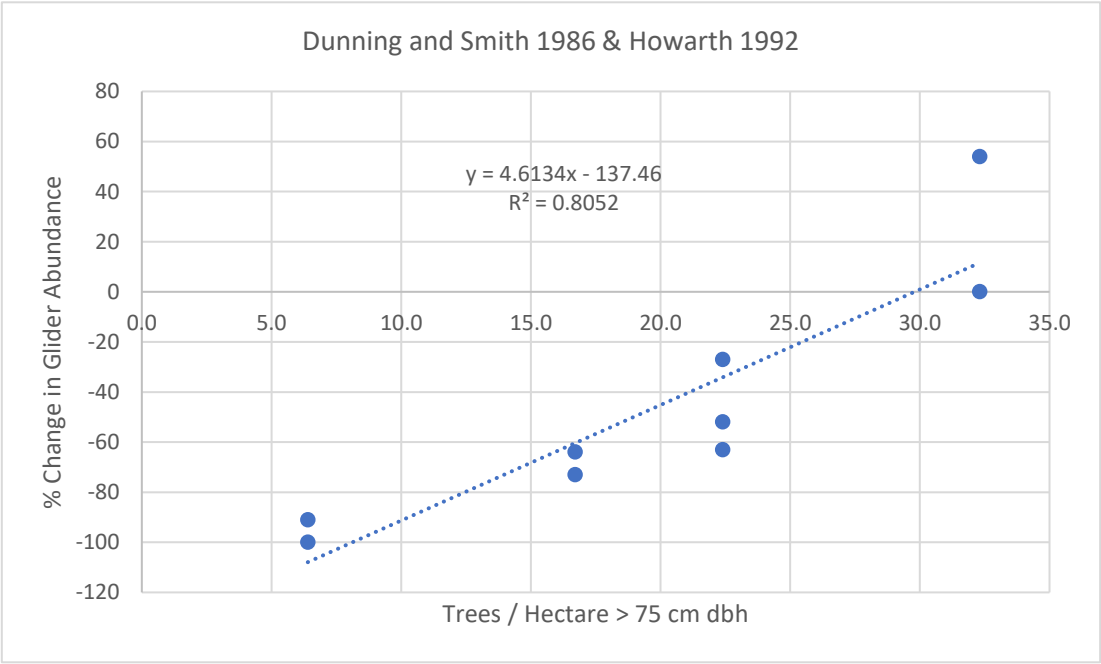


Figure 10 Showing relationships between % tree basal area retained and the number of large trees (>5cm dbh)/hectare remaining after dispersed selection timber harvesting and % change in Greater Glider abundance on 5 experimental logging sites at Mt. Boss in northern NSW before, soon after (1-2 years), and 7 years after logging (from Dunning and Smith 1986, Howarth 1992).

57. **Minimum Percentage Tree Basal Area Retention Thresholds for Gliders in Logged Forest**.
The absence of Gliders from more open logged forests with a reduced tree basal area less than 31% can be explained by increased spacing between retained trees to a level which impairs Glider movement, reduces food supply, and causes excessive exposure to predators. ***In my opinion the 40% aggregated retention target for maintaining gliders in logged coupes used by VicForests can be considered too low and too close to the zone at which Glider abundance crosses a threshold and declines to zero, to be an adequate Precautionary Target for retention harvesting. In my opinion this target should be increased to 60% dispersed retention harvesting.*** At the 60% level Glider population reduction would average 56% across the timber harvesting estate but there would be no range reduction or risk of habitat isolation and fragmentation. ***Consideration could be given to adopting a 50% aggregated retention target but only once the essential landscape scale corridor and reserve planning requirements specified in para 52 (above) have been put into place.*** The retention limits recommended above are based on studies in highly productive moderate to high elevation wet forests that carry above average Glider densities. Much higher retention thresholds (up to 85% dispersed retention) are required in low productivity dry forests in Queensland to maintain the forest structure preferred by Gliders (Eyre 2006, Eyre et al 2010), **and much higher thresholds (75% basal area retention) will be required in the lower elevation, drier and less productive forests of Victoria including much of East Gippsland**. Low site quality forests are shorter and have fewer trees and a lower basal area of trees at maturity than more productive forests, which means that fewer trees are available to harvest before forest structure becomes compromised for Gliders.

58. **Part B. Impacts of logging in the coupes and effectiveness of VicForests' adaptive measures, as implemented, in avoiding risk of serious or irreversible damage to the Greater Glider** Questions **5-8** My answer to these questions is provided in Appendix 1 which provides a general response to impacts of timber harvesting on scheduled and logged coupes and specific response for individual coupes.

59. **Question 9/10 Are any, or all, of the measures in Annexure A Part B proportionate to the threat to Greater Glider? Having regard to Annexure A at [21]-[22], do any of the measures in Annexure A Part B constitute adaptive management that is effective to address the threats from timber harvesting to the Greater Glider, avoid serious or irreversible damage to the Greater Glider, and to arrest and reverse its decline?** In my opinion, with the possible exception of selection harvesting, none of the silvicultural systems in use or proposed by VicForests will prevent the decline and gradual loss of Glider populations from logged coupes for the reasons outlined in para 23-25 of my initial report and previous sections of this report (paras 38-45, 51-58). The only substantive changes in practice since my recent previous reports (Smith 2010,2016,2019,2020) are proposals to increase levels of "**aggregated retention**" in some harvesting operations to 40% of coupe area in some compartments. But for reasons previously outlined in Paras 52-58 above I do not consider the implementation of this policy to have any merit as currently practiced. Some key problems and limitations with VicForests silvicultural proposals included the following:

a) Pre-logging surveys for Gliders and Glider Habitat are not mandatory for all coupes.
b) Forests with average and higher densities of gliders are routinely clear felled.
c) Survey, mapping and protection of all large old Habitat Trees with hollows is not mandatory.
d) VicForests Habitat Tree typing system appears to be designed to focus protection only senescent trees of little or no commercial value and to allow harvesting of mature and more sound Habitat Trees (Type 2 living and Type 3) that have commercial value for wood production.
e) Habitat trees are frequently killed and burnt in regeneration operations.
f) Exemptions that allow large old trees with hollows to be felled if they are unsafe can potentially be applied to all habitat trees, consequently this exemption needs to be removed, if trees are unsafe they need to be left unlogged, protected and avoided.
g) Habitat trees greater than 2.5 m dbh are so rare that they are no more than museum pieces, and policies to protect them have no meaningful quantitative impact, this policy needs to cover all remaining living trees with hollows in Ash Forests irrespective of diameter, and all trees > 80 cm dbh in mixed species forests in order to effectively protect habitat trees.
h) Retained forest left in patches may be burnt, killed, or logged in subsequent years and rotations.
i) Retained patches are all too small and isolated to have any long-term value for Gliders.
j) Retained forest patches are not linked by protected and mandatory wildlife corridors such unlogged buffer adjoining roads, retained unlogged buffers between coupes, streamside strips and wide corridors and fire refuges along all drainage lines.
k) Existing corridors may be too disjunct, narrow, distant (> 2km) from large (>100 ha) reserves or lack suitable habitat to be effective for Gliders.
l) Corridor planning in logged forests is minimal and ad hoc and cannot be considered “precautionary”.
m) There are no substantive targets or plans to inject uneven aged and old growth stand characteristics back into Montane Ash forests, if there were it would start with protection of all remaining living individual Ash trees over 1m dbh., and limitation of further harvesting in all 1939 Ash regrowth to selection harvesting.
n) There are no plans to cease ecologically unsustainable post logging burning and clear-felling practices (including variable retention 1 and 2 harvesting) in dry or mixed species forests and ecotone forests.
o) The introduction of ecologically sustainable low intensity harvesting that reduces wood supply in wet and dry forests is being prevented by over commitment of wood supply to industry.
p) The 40% retention target for habitat on some coupes with Greater Gliders is too low, it is predicted to cause an excessive (average 86%) reduction in Glider abundance and is close to the minimum threshold below which no Gliders are able to permanently survive and reproduce.

60. **Question 11. Having regard to the Sample Coupes (and as you may wish to consider, some or all of the Further Coupes), and the quality of habitat in those coupes, is the TRP prioritisation and coupe scheduling process in part 7.2.3 of VF PP Report (Aug 2020) an adaptive management measure that is effectively addressing the threats from timber harvesting to the**

Greater Glider, avoiding serious or irreversible damage to the Greater Glider, and arresting and reversing its decline? I have read the paragraph referred to above and in my opinion the TRP Prioritisation Process is **not** an adaptive management measure that is effectively addressing the threats from timber harvesting to the Greater Glider, avoiding serious or irreversible damage to the Greater Glider, and arresting and reversing its decline. I say this because:

a) the mapping and modelling of Glider habitat on which the process relies is inaccurate and unreliable (See para 17 Greater Glider Models),

b) the process itself (prioritizing coupes for harvesting) simply delays Glider habitat destruction in some coupes and not others and does not alter the long-term outcome which will be one of Glider population decline under current silvicultural systems,

c) the process of Post Bushfire Adaptive Management as described in the above report are superficial and do little or nothing to retain Gliders within logged coupes, allow adequate time for Gliders to recover from fire in areas affected by fire severity 1-3 burns or to protect Gliders from ongoing decline in logged forest.

The measures proposed are not those needed to protect and maintain Gilder populations. Salvage logging is permitted in fire severity 2 and 3 wet (Ash) forests despite that fact that these forests are known to support Gliders populations within a decade after fire. Salvage logging is also permitted in dry and ecotone (Mixed Species) Forests affected by fire severity class 1 and 2 despite the fact that trees in these forests are generally not killed by fire and may recover to be suitable for Gliders with 10-20 years after fire.

61. **Question 12 Please review [36]-[56] of your first report addressing: (a) whether 40% basal area retention is likely to be effective to avoid serious or irreversible damage to Greater Glider, and its distinction from the ordinary retention of about 25% of a coupe, (b) the level of protection provided by VicForests then adaptive measures. Do you wish to supplement or add to those answers in light of your field inspections, any of the further assumptions in Annexure A, the new documents or maps enclosed with this letter, or any other recent information or material since your first report?** In relation to my first report (para 36 -37) I have the following additional comments to make. When I first read the description of VicForests proposed 40% retention measure (*Retain at least 40% of the basal area of eucalypts across each timber harvesting coupe, prioritising live, hollow bearing trees)* I incorrectly interpreted this description to mean that retention harvesting would result in retention of 40% of the basal area of the trees "***dispersed across the entirety of the logged area***". The description of Variable retention (VR) system logging in VicForests Harvesting and Regeneration Systems Aug 2019 report (p16, see below) provides a photo of logged forest with what appears to be about 20-30% canopy retention retained across the harvest area and has wording which states that dispersed retention will retain about 20+ trees per hectare. I incorrectly assumed that the special 40% retention measure that is proposed to apply to high density glider habitat would be an "enhanced" version of Variable Retention 2 (VR 2) system harvesting that would retain a minimum 40% of forest cover and around 40+ trees per hectare across the logged area. I now realize, since I have examined the aerial and site photographs of coupes (e.g. Myrrh, Jokes, Shetland Carriage, Walkindapark, Hole) reportedly harvested under 40% retention (see Jokes figure 12) that this is not

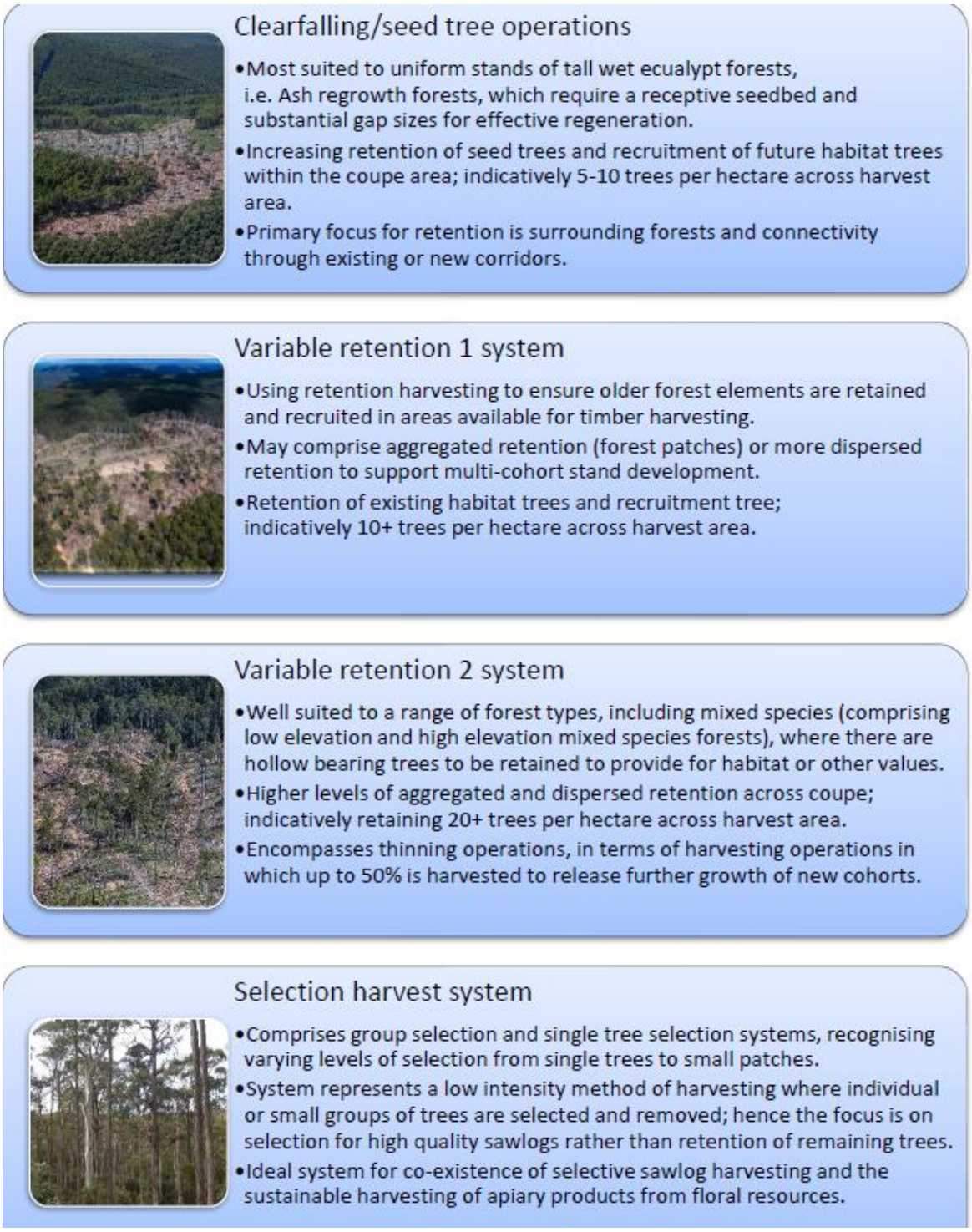
correct and that 40% retention as practiced by VicForests simply refers to normal clear felling that leaves up to 40 % of the coupe area unlogged including areas that would normally have been retained as streamside corridors, rocky areas or other unloggable areas plus some retained (and often subsequently burnt) habitat trees. There is no evidence in any of the logged coupes of “dispersed” retention across the logged area beyond what would normally be required for habitat tree and seed tree retention. This type of logging will eliminate Gliders from the logged forest which is too sparse and open for them to survive. It may retain some Gliders in retained forest patches in the immediate short depending on patch size, isolation, habitat suitability, and occurrence of owl predators, but it will almost certainly eliminate Gliders over the long term (> 40 years) once the adjacent coupes have been logged and retained patches become isolated (see Appendix 1).

	**Jokes** coupe (HSF-97 DJI 0169) logged with 40% retention in isolated patches and strips. The scattering of retained trees in isolated patches reduces the effectiveness of the 40% retention threshold to levels at which glider density is likely to decline to zero after clearfelling of adjoinng coupes.

62. **Question 12 cont.** I have updated my assessment of mapping data for logging coupes mentioned in Para 38 or my initial report and provided this updated description in Appendix 1 of this report. Some of the coupes listed in para 38 may have some wet as well as dry mature and old growth forest. With respect to Paragraph 39 I wish to add that aggregated retention of 40% of each coupe is not likely to retain Gliders in the long term unless the criteria listed below are met (from this report):
    a) the retained area is the best Glider habitat;
    b) the retained area is not isolated and fragmented but is linked by retained wide (> 100m) forest corridors (not longer than 2km) to large patches of reserved Glider habitat or National Parks (> 120 ha);
    c) the retained area is protected from burning and destruction during post logging burns;
    d) the retained unlogged area is permanently protected in SPZs and is not available for harvesting in subsequent years or rotations.

e) The retained area is not so open and exposed or with a large edge to areas ratio so as to risk increased owl predation. At present none of the preceding criteria appear to be required or applied by VicForests (see Appendix 1 for further details).

Figure 11 Summary of Vic Forests silvicultural or harvesting methods from VicForests (Aug 2019)



63. **Question 12 cont.** In respect to para 41 of my initial report I would add that in my opinion there is sufficient uncertainty about the effectiveness of VicForests SPZs, 40% retention harvesting and other retention systems that no further logging should be conducted in East Gippsland until such time as a dedicated landscape scale wildlife corridor and fire refuge system (which includes dispersed small conservation reserves (> 100 ha in size) at regular intervals) has been designed, mapped and protected to connect all retained unlogged forest within the timber production estate with nearby National Parks.

64. **Question 12 cont.** In respect of para 52 of my first report, having now examined aerial photographs of logged forests in the areas surrounding and including the coupes investigated in this study (Appendix 1) I am so alarmed by the low apparent density of habitat trees in most logged forests and unlogged wet forests that it is my opinion that all large trees (> 80 cm dbh) with hollows in Mixed Species Forests should be protected in all VicForests, and that all large trees (> 1m dbh) with hollows in wet (Montane Ash) forests should be protected by a 200m diameter unlogged buffer linked to a corridor network.
65. **Question 12 cont.** In respect of para 53 and 54 of my initial report I would also like to add that the study of Kavanagh and Webb (1998) also found that it took Gliders up to six years to disappear from logged coupes.

66. **Question 12 cont.** In respect of Para 55 in my first report I wish to add that before and post logging pictures of **Barcelona** show that this coupe supported large senescent gum species indicating that it had an uneven-aged old growth structure especially valuable for Greater Gliders that warrants protection from timber harvesting because of its structural rarity. The HCV map for Barcelona shows an exceptional density of habitat trees in the logged area (6.3/ha) of prime conservation importance for Gliders and Leadbeater's Possum. VicForests mapping shows this coupe to be dominated by dry mixed species and 1939 or younger regrowth forests. This mapping inaccuracy clearly demonstrates why ground survey is essential. The HCV plan describes vegetation as High Elevation Mountain Mixed Species, Mountain Grey Gum *(Eucalyptus cypelocarpa),* Messmate *(Eucalyptus obliqua),* Narrow Leaf Peppermint *(Eucalyptus Radiata)* with a scattering of Manna Gum (Eucalyptus viminalis) and Mountain Ash (Eucalyptus regnans). This list of tree species includes several that are known preferred food tree species of the Greater Glider. Glider records were abundant on the site. The HCV plan states that "within the coupe's gross area 6 Greater Gliders *(Petauroides* volans) were observed during DELWP pre-harvest surveys. In response to these observations 64% of the gross coupe area will be retained." This is to align with the Greater Glider 2019 Action Statement which requires VicForests to ***'Retain at least 40% of the basal area of eucalypts across each timber harvesting coupe, prioritising live, hollow bearing trees, wherever*** **a** ***density of Greater Gliders equal to or greater than five individuals per spotlight kilometre (or equivalent measure)*** **is** ***identified. The HCV plan also states that "Habitat and recruitment trees will be retained at a minimum density of 9 trees per ha. Type 1, 2 and 3 habitat trees have been marked and will be retained where safe to do so. For each type 1 habitat tree retained 2 additional trees (preferable type 2 or 3) will be retained for recruitment for hollows. Suppressed regrowth and younger trees that are unmerchantable due to size will be retained where possible for future recruitment. One Retention strip between***

the VF Reserve and Harvest boundary will be retained during harvest {0.27Ha) to provide connectivity for native fauna*. "* Examination of the HCV plan shows that the 64% exclusion area was not deducted from the net harvestable area but was included in areas previously set aside for Leadbeater's possum protection which may be unsuitable habitat for Gliders. Leadbeater's possum prefers different forest structure to the Greater Glider and the records of the Glider are mapped as occurring outside the Leadbeater's Possum SPZ and predominantly within the remaining area that was virtually all clear felled. In practice there was potentially little or no retention of Glider habitat on this coupe. Post logging site photographs and coupe plans of Barcelona show that normal clear felling has been undertaken outside the Leadbeater's possum SPZ. Habitat trees have been left singly instead of being left in small clumps. There is no evidence of 9 habitat trees per hectare. There are substantial gaps without habitat trees where habitat trees have not been recruited and there is no evidence that slash has been pushed away from retained habitat trees to protect them from post log burns.

67. **Please review the detection maps at series A and consider differences (if any) in the number and location of detections made by WOTCH versus FPSP in the Sample Coupes (and as you may wish to consider, some or all of the Further Coupes). Please assume that VicForests' coupe planning places less weight on detections made by WOTCH compared to those made by FPSP. Do you consider that approach has a sound basis? Is that approach likely to affect the severity of any damage to the Greater Glider from logging (if any)? If so, please explain why.** I have reviewed the occurrence of Glider records on coupes and I note that Gliders were survey/detected on about 84% of coupes by Wotch, 65% of coupes by FPSP and only 5% of coupes had Atlas records. Gliders were detected on all but one coupe by at least one method. There was a small but not statistically significant positive association between the number of gliders recorded by Wotch and the number recorded by FPSP on coupes with records from both. Abundant gliders were recorded by Wotch on some coupes with no FPSP records. I have no reason to believe that any less reliability should be placed on surveys by Wotch than by FPSP. The mean number of records (>50m apart) per coupe by Wotch (6.1) was comparable to that reported by FPSP (5.3). Gaps in FPSP records indicate that some high quality Glider habitats and populations would have been lost in the absence of surveys by Wotch, Such problems would not arise if effective standardized pre-logging surveys of all the forest in logging coupes was **mandatory before coupe planning and harvesting**. In order to comply with the Precautionary Principle it is my opinion that Gliders should be assumed present in all unlogged mixed species forests and in all wet forests with more than 0.5 large living habitat tree per hectare unless comprehensive surveys have shown otherwise.

68. **Question 14. Would your answers to questions [9]-[12] differ for other coupes unburnt by the 2019 2020 fires which: (a) contain detections of Greater Glider; (b) are likely to contain Greater Gliders; (c) contain Greater Glider habitat; (d) are likely to contain Greater Glider habitat?.** Yes, if these coupes were located in potential "unburnt fire refuges", important for ensuring Glider recovery over the next 10-15 years in regions or patches of forests with a high proportion or total area of severely burnt forest. No, for coupes outside the 2019/20 fire envelope. In the latter areas it remains my opinion that the only ecologically sustainable and certain option for maintaining Gliders in logged coupes is the harvesting of all dry (Mixed Species) and Ecotone (wet and dry) forest (> 300m elevation) in Victoria

by low intensity selection harvesting that maintains an uneven-aged structure by retaining at least 60% of the basal area of all large trees (>40 cm dbh) dispersed across the coupe (referred to in this report as **LTBAR60** harvesting). It also remains my opinion that clear fell harvesting and Variable Retention harvesting are only ecologically appropriate in about 25% of high elevation wet Montane Ash Forests, and then only in areas with an established permanent network of protected wildlife corridors, fire refuges, and roadside and coupe boundary buffers linked to large conservation reserves (within 2km). In the remaining 75% of wet forests and in wet forests without adequate corridor reserve networks it remains my opinion that the only ecologically sustainable harvesting method that will sustain Gliders into the future is low intensity selection harvesting that converts uniform 1939 regrowth to an uneven-aged structure.

Part C. VicForests' precautionary principle and post-harvest monitoring work – is it a careful evaluation of management options? Is it a proper assessment of the risk weighted consequences of various options.

69. **Question 16 Do these precautionary principle reports, risk assessment and adaptive measures appendices, and the process to prepare them (to the extent the process is identified in these documents or otherwise in the affidavit material), demonstrate or constitute: A careful evaluation of management options to wherever practical avoid serious or irreversible damage? b) A proper assessment of risk-weighted consequences of various options?** I have reviewed the VF Precautionary Principle Adaptive Management Proposals and VF Adaptive Measures and provided a summary of conclusions in Tables 2 and 3 below. In general, I find the adaptive measures so minimal, constrained, ill applied or temporary as to offer little or no improvement on past practice for the reasons given in Tables 2 and 3 below and explained in earlier paragraphs and reports. In my opinion these measures and proposals will not halt the current ongoing decline in Glider abundance caused by cumulative intensive and ecologically inappropriate timber harvesting in Victoria.

	Table 2. Review of VF PP report Aug 2020	
	VicForests Proposed Adaptive Management Response	**Review comments**
1	The risk assessment found that there is a very small area of high-quality habitat (in most cases <1%) that will be impacted by timber harvesting over the next 10 years, and this is prior to any further adaptive management measures being implemented. Given this small footprint, VicForests is confident that the risk of serious or irreversible damage to biodiversity from timber harvesting in the post-fire landscape can be mitigated by implementing VicForests' package of integrated precautionary measures	The fact that only 1% of habitat area will be impacted in the next 10 years (if true which it may not be as this figure is derived from unreliable models) is irrelevant. While this area may be small, its cumulative impact is potentially large, especially in areas that have already been substantially logged (such as Murindindi, Oakes and Cottonwood coupes, see Appendix 1). The Greater Glider is declining as a result of the cumulative impact of timber harvesting over the past 25 + years. In my opinion this decline will continue at the same or higher rate over the next 10-60 years and will not be mitigated in any meaningful way by Vicforests adaptive measures.
2	• Enhance habitat connectivity and retention throughout timber harvesting areas by increasing variable retention levels in harvesting operations through shifting from the predominant use of clearfall harvesting systems, to a broader suite of silvicultural practices including	Variable retention harvesting as proposed by VicForests does not increase "habitat connectivity" in any meaningful way for Gliders. It decreases connectivity. VicForest's use of selection harvesting in the 64 coupes examined in this study is minimal, rather than extensive.

	selective and dispersed harvesting that support age and structural diversity	VicForests use of disperse harvesting in the 64 coupes examined in this study is minimal. VicForests has failed to demonstrate any serious intention to maintain natural age and structural diversity within logged stands either in theory or practice.
3	• strengthen measures to protect High Conservation Values (HCVs), through planning and operational systems focussed on identifying, retaining and protecting HCVs	Current approaches to identification of high conservation value habitats are so simplistic, inadequate and lacking in scope that they are not certain to halt or prevent regional GG decline. HCV areas should (but do not) also include fire refuges, old growth (as defined in this study and not by VicForests) corridors, dispersed large habitat patches, and networks of permanent conservation reserves.
4	• minimise the use and intensity of controlled burns for regeneration and shift to a broader suite of regeneration treatments that reduce risks of damage to retained trees	This would be beneficial if it were true, but despite being aware of the problem for at least 45 years VicForests appears to be doing nothing effective at an operational level to mitigate the problem and is making it worse by allowing habitat trees declared “unsafe” or “fire hazards” to be felled and removed (instead of leaving and avoiding them).
5	• progress a more formalised landscape approach to biodiversity management, to be completed by the end of 2020.	I have not seen any landscape scale conservation plan for GG, this would be a good idea but would take years and would need to be undertaken by an independent organization.

Table 3 VF Adaptive Measures Summary and Review comments Greater Glider

	Adaptive Measure	Review Comment
1	Retain at least 40% of the basal area of eucalypts across each timber harvesting coupe, prioritising live, hollow bearing trees, wherever a density of Greater Gliders equal to or greater than five individuals per spotlight kilometre	40% is too low, it is very close to the lower limit at which Gliders typically disappear completely from logged areas, current data (see figure 10) predict that 40% retention will cause 78% Glider decline, I recommend increase the retention target to 60% which will cause about 56% glider decline. Retained trees are aggregated and not dispersed across the entire logged area. Need to be dispersed and additional to existing aggregated retention. Retention in many coupes is not additional to existing unlogged retention areas (eg streamside strips) (see Barcelona coupe). Increased retention only in forest with high GG density will **not** halt Glider population decline throughout its range. Needs to be correctly applied in all habitats with GG. 40% retention areas are not permanent but may be harvested in future years. Need to make all retained aggregated habitat permanently protected.
2	Suitable habitat and linkages protected through VicForests Harvest and Retention systems. Retention design is developed to minimize the distance between retained patches within harvested areas. Stream protections also ensure connectivity of suitable habitat at a landscape scale	VicForests does not have an adequate dedicated planned and mapped corridor reserve and habitat linkage system in place to maintain viable populations of GG in retained patches. Stream protections, roadside protections, boundary protections may or may not be left, are typically too long and narrow, are isolated by clearing, roads and gaps of unsuitable habitat, and are ad hoc in implementation.
3	Retain undisturbed habitat patches containing hollow-bearing trees and a variety of feed tree species within the harvestable area; Protect patches from harvesting and regeneration activities	Habitat trees are seldom protected in patches or clumps. Clear felling is not compatible with the retention of a variety of trees species, but this is achievable with selection harvesting. Apply selection harvesting to all dry and mixed wet and dry forests with GG. Clear-felled areas are almost always burnt which commonly kills and destroys habitat trees and retained patches in wet and ecotone forests. Undertake all regeneration in dry and mixed wet and dry forest by soil disturbance and planting only.

4	Application of high retention levels (40%) of hollow-bearing trees and recruitment trees in timber harvesting areas ensures that suitable habitat is protected to allow the species to persist. Protection of forest components based on overlap with modelled and known distribution ensures that suitable habitat is protected, regardless of species detections. Preliminary Preliminary results from post-harvest monitoring surveys have found the species to persist in retained habitat within harvested areas.	All of these statements in my opinion are either false or misleading. 40% basal area retention rate is not guaranteed to sustain gliders as currently practiced. Glider habitat models have been proven inaccurate, unreliable and the restrictive manner in which they are used is likely to miss around 80% or more of Glider occurrences on coupes. The decline in Glider abundance in retained forest patches is expected to occur gradually over the next 60 years, depending on the pattern and cumulative extent or harvesting in surrounding coupes. Observations that GG persist in retained habitat within harvested areas immediately after harvesting are meaningless and may be misleading unless monitoring has been continued for 10-60 and more years.
5	Greater Glider is one of the top-10 detected threatened species in the post-fire environment. Landscape- and coupe-based reservation of highest quality habitat ensures individuals are afforded protection based on habitat suitability, regardless of detection. A species detection triggers **significant additional retention** at the coupe-level. Additional landscape protection of high quality habitat is prescribed in Bendoc due to this being an important area for Greater Glider	There is no evidence of Gliders in high intensity (category 1) burn areas. Landscape and coupe based reservation is not permanent, and is not based on habitat suitability (regardless of detection) because it relies on habitat models which are unreliable. Habitat retention is not always "additional" (see Barcelona coupe) but includes areas already retained for other purposes (eg filter strips). Landscape level planning appears to be non-existent.

70. **Question 16 Adequacy of VicForests Prelogging Surveys and Reliance of Habitat Models. VicForests states that it relies on DELWP s Forest Protection survey Program (FPSP) detections of Greater Gliders and its own surveys.** Gunn (may 2020, paras 18-) states that The FPSP aims to survey 80% of coupes planned for harvest each year,but it is not clear to me if this target is aspirational or achieved. Mr. Gunn states that DELWP relies on " *Habitat Distribution Models (HDM.. to prioritise what species will be surveyed. If the HDM or other modelling does not indicate that the coupe contains suitable habitat for a particular species, DELWP may conduct less extensive or fewer targeted surveys for that species*." As found for coupes in this and previous studies (Smith 2019) the predictions of HDM's for the Greater Glider in the Central Highlands are mostly unreliable and bear no relationship to the actual distribution of Greater Gliders in the forest or in logging coupes. I note that Mr Gunn (para 25) recognizes these limitations, in para 25 he states " *These spatial layers can assist coupe planning, but are too crude a tool for assessing actual habitat distribution in a particular coupe. As such VicForests relies on its Habitat and Hollow Bearing Tree surveys in combination with targeted species surveys*" But if surveys are only carried in areas identified by the HDMs as being high quality habitat, as indicated by Mr Gunn in para 23 (" *The HDM area for each species as set out for each coupe, represents the high quality habitat area and is the top 20% by area based on rank score within the HDM of each species"*) the majority of actual Greater Glider occurrences within coupes may be missed. Mr Gunn states (para 26) that the VicForests approach to forests that have not been subject of pre-logging actual surveys is to identify "*coupes that overlap with species high quality habitat but have not had a targeted species survey at this stage. In order to appropriately manage these species, planning will either assume species presence and protect habitat as prescribed (eg. 40% pre-harvest basal area retention for Gliders), or a targeted species survey will occur*." In my opinion this approach

is not consistent with the Precautionary Principle and in order to become so, targeted surveys for Greater Gliders must be extended to all logging coupes, irrespective of HDM predictions.

71. **Question 17 Do you agree with the conclusion referred to by Dr Cardoso 4 Aug 2020 at [12] that: (a) the measures VicForests was implementing were sufficient and VicForests did not need to do more? (b) "the retention by VicForests in the landscape of large hollow-bearing trees beyond the regulatory requirements and the recruitment of trees which might grow to become large hollow-bearing trees (effectively the "next generation"), all of which were retained or recruited in patches or corridors which provided landscape connectivity, would provide good protection for species such as the Greater Glider".** No, I have read the affidavits of Dr. Cardoso and in my opinion her confidence in the adaptive measures proposed by VicForests is not justified by either theory or practice. There is no evidence of consistent or planned protection of permanent corridors to link retained patches of Glider habitat in logged coupes with reserves of sufficient size to maintain viable Glider populations for the duration of logging cycles. Dr. Cardoso has placed undue weight and almost total reliance on the protection of habitat trees as the solution to protecting Gliders. This approach fails to recognize or acknowledge that clear felled forest does not reach a structure suitable for Gliders until about 60-80 years after logging. If the forest is harvested on short rotations, as is the pattern in Victoria, the forests will be re-harvested before they are structurally suitable for Gliders **and the retained habitat trees will be of little or no use to Gliders**. The key to protection of Gliders does not lie with retention of habitat trees scattered across clear felled forest, it lies with a) retention of forest structure and habitat trees dispersed across the coupe by low intensity selection harvesting, or b) by retention of high quality habitat on > 50% of coupe area and the connection of this retained habitat to nearby viable Glider reserves (>120 ha) that include fire refuge areas, or preferably c) both of the preceding.

72. **Question 18 Do you agree with the OCR's concern in its Oct 2020 letter that VicForests' September 2020 risk assessment 'has a critical gap in not considering the cumulative impact of timber harvesting', particularly in East Gippsland (WEP-3 and WEP-4, Paul 7 May 21)? Does the later draft version dated March 2021 address this issue?** Yes. See Table 2 Row 1 and elsewhere in this report (para 48 Cumulative impacts).

73. **Question 19 Having regard to Mr Ryan's affidavit and data regarding post-harvest monitoring, Part 8 of VF PP Report (Aug 2020) titled "Monitoring and evaluation", and your observations of harvesting in VicForests' coupes and its plans for harvesting, do you consider it likely that VicForests' adaptive measures are "proving effective and the populations [of Greater Glider and Sooty Owl] are maintained" as stated in Mr Ryan's affidavit and Mr Gunn's Second. Affidavit at [8]? Please explain your answer. Please also address whether the monitoring indicates that Greater Glider population decline is being arrested and reversed by the adaptive measures**. **Question 20 What pre and post-harvest monitoring would be required, and for what duration, in order to effectively measure whether Greater Glider populations are maintained on logged coupes, and whether population decline is being arrested and reversed?** I have responded previously to monitoring issues in my first report. Adding to this, it is my opinion that monitoring of

Gliders on post logging coupes is only meaningful within the context of the surrounding landscape. Immediate declines (with 12 months) can be expected in small isolated patches (less than one home range area) isolated in logged coupes, much slower declines 50+ years can be expected in large retained patches (20- 80ha.) shared across several adjoining coupes, and no decline can be expected in retained areas that are part of very large adjacent unlogged forest or National Park. In order to have any interpretive meaning monitoring must be carried out over a broad landscape areas and long periods of time (10-60+ years) that sample cumulative impacts of harvesting and fire over successive harvesting rotations. This is not the approach described by Mr Ryan (May 21) who states that "*The results show that in the vast majority of coupe surveyed to date where they were preharvest detections of the Greater Glider there are also post-harvest detections, including on repeat surveys, some up to two years later*." Mr Ryan appears to be assuming that if Gliders are present 2 years after logging then logging will have no long-term impact. This argument is simplistic and misleading because it fails to take into account the longer term effects of fragmentation and isolation. In my opinion it would be more appropriate under the Precautionary Principle to assume that these surviving glider populations will not be viable in the long term unless they are proven to reside in retained habitat that is permanently protected and of sufficient size and connectedness to remain viable for at least 120 years.

Part D. The effect of modelling and projected harvesting to 2030 on the damage to Greater Glider from harvesting

74. **Question 21 Do the post-fire Greater Glider HDM and top 20% HDM, or the Integrated top 20% priority species modelled habitat, contribute to planning harvesting post-fire in a manner that avoids serious or irreversible damage to Greater Glider wherever practical, in the manner OCR recommends or otherwise? Are there any limitations to the use of these models?** As previously stated in this report (para 17 Greater Glider Models) both this and previous studies (Smith 2019) found ***no statistical correlation between Glider occurrence or density in 64 coupes and the predictions of Glider habitat models***. In this study no correlation was found between the density of Glider records in coupes and the ranking of coupes as modelled by the Greater Glider Post-fire Habitat Distribution Model, or between the density of Glider records on coupes and the proportion of each coupe mapped as Top 20% Highest Value Habitat for Priority Species Modelled Post Fire. It can be concluded that neither of these models have any practical use, merit or relevance to planning and management of Greater Glider conservation at the coupe scale in Victoria **and should be disregarded** for conservation and management this species.

75. **Question 22 Do the post-fire Greater Glider HDM or Integrated top 20% priority species modelled habitat (IBVM), or any portion of either model, reliably identify: (a) current available habitat for Greater Glider (b) current high quality habitat, habitat critical to the survival of, or important post-fire refuge areas for, Greater Glider? (c) habitat occupied and in use by important populations of Greater Glider? If not, is it more likely the models over or understate those areas**? No to all questions. It is clear from the large number of Gliders reported in coupes that

were not mapped as top GGHDM or IBVM top 20 in this and previous studies (Smith 2019) that reliance on these models will greatly underestimate the occurrence of good quality GG habitat.

76. **Questions 25/26 Do you agree with the OCR's May 2020 recommendations** See response in table below.

A	postpone harvesting in East Gippsland;	Yes, for 15 years in dry and ecotone wet/dry forests areas burnt to severity 1 and 2.
B	postpone harvesting from the integrated top 20% habitat for priority species (IBVM, blue);	No with respect to GG, does not correlate with glider density or occurrence.
C	where possible, avoid harvesting in the top 20% modelled habitat of the Greater Glider (among other priority species), and if harvesting such areas apply 40% retention where 3 or more Greater Gliders are found within a spotlight kilometre?	No. unless modified to include all modelled habitat of GG (low -high) not just top 20%. Increase retention to 50% and specify that it is to be additional to existing aggregated retention for other purposes and should be dispersed retention across the logged coupe achieved by selection harvesting with no regeneration burns.
D	limit harvesting within the East Gippsland FMA fire footprint to areas subject to the highest intensity fires (fire severity classes 1 and 2) and that have been surveyed pre-harvesting to demonstrate that very low biodiversity value remains; (p8)	No for all dry Mixed Species forests which are adapted to fire and need time to resprout. Yes, for severity class 1 burnt areas in Ash forest.
E	postpone harvesting in modelled habitat for Greater Glider outside the fire footprint in the East Gippsland FMA, unless VicForests can demonstrate nil or negligible impact on species of concern (p8),	No, postpone harvesting permanently in all areas of potential fire refuge, including all wet forest mapped as pre 1939 in age, and all forest in remaining unlogged drainage line corridors, gullies and sheltered aspects with > 0.5 senescent trees /ha.
F	ensure that those coupes with greater than 50 per cent of their area containing high value habitat (assume this is top 20% modelled habitat) for Greater Glider will not be harvested, via TRP prioritisation (p8).	Only has merit if such areas are > 100 hectares in size and are linked by unlogged corridors to regional conservation reserves.

77. **Question 27 Part 5 of VicForests' PP Report (Aug 2020), pp 8-12, includes five "corrected assumptions" responding to "underlying assumptions" in the DELWP Biodiversity Analyses that informed the OCR's precautionary principle advice. Please carefully review that Mr McTavish's affidavit at [8]-[25] and [47]-[50] and Ms Geary's affidavit at [11] in respect of these, and answer the following:**

a	Is there a reasonable basis for the DELWP Biodiversity Analyses to include analysis of the total area available for timber harvesting (both in hectares and as mapped), rather than the total area VicForests projects will be harvested by 2030 (which is in hectares but not yet mapped), in identifying measures to minimise the risk of harm to species of concern from timber harvesting? Do you agree that "risk is inflated" by that approach?	Yes to the first no to the second. Glider decline is gradual and cumulative with a lagged response of about 60+ years which is the product of past logging, current logging and future logging. It is the responsibility of DELWP to assess this cumulative impact by taking into account future as well as past disturbance.
b	Based on your observations of harvesting in the logged coupes in the Annex, do you agree with VicForests' "corrected assumption" 2 and 3 that VicForests' retention harvesting can "enhance	No, in my opinion these claims are misleading or false. In my opinion Gliders will gradually decline and disappear from the

	habitat", "retains and protects substantially more trees in most coupes", than clearfelling, "maintains core patches and connectivity of habitat within coupes", or that its silvicultural systems result in a much higher retention of hollow-bearing trees and therefore provide a critical level of habitat for Gliders (Geary at [11](b)])?	logged areas and most of the unlogged (retained) areas in all coupes over time (see Appendix 1) due to predominance of high intensity harvesting, burning and lack of adequate landscape scale corridor and reserve planning.
c	Based on your observations of harvesting in the logged Coupes, do you agree with VicForests' feedback that OCR's assessment was flawed on the basis that it failed to take into account what VicForests describes as "the benefits of VicForests' additional adaptive management measures, such as pre-harvest surveys for species of concern and habit [sic] of those species and post-harvest species to ensure that the areas meant to be retained were retained and that the animals were present after logging"	No, I do not support VicForest assessment. Current adaptive measures do not prevent the short term loss of gliders from the net logged area and do not prevent their long term loss from retained areas. Doing a survey after logging does not ensure that habitat was retained or that animals will remain in retained habitat long term
d	On the basis of the detections made by WOTCH compared to those made by FPSP on the Maps, the VicForests habitat tree maps in the HCV maps for Coupes enclosed, and your field inspections, do the range of pre-harvest surveys described at "corrected assumption 5", result in (a) reliable identification of all Greater Gliders and hollow-bearing trees, and (b) effective protection of the values identified during those surveys?	There can be no reliable identification of habitat trees and gliders on coupes without comprehensive on-site survey and mapping

78. **Response to Mr. McTavish's** At para 48 Mr McTavish makes the following statement. "*Despite a large percentage of forest harvested in the previous five supply years coming from IBV top 20% habitat, the areas where the was harvested remained in the IBVM top 20% habitat and were not classified as lower quality habitat following harvesting. This shows that timber harvesting does not necessarily result in serious or irreversible damage of the quality of the habitat*." And in reference to the south Marysville area " *Despite this history of harvesting activity and bushfire the area was still identified as within the IBVM top 20%. This indicated that neither harvesting nor recent fire events caused severe or irreversible damage to the environmen*t." In my opinion these statements demonstrate the serious lack of understanding, misinterpretation and erroneous conclusions that can arise from use and reliance on models rather than actual field survey data. The inclusion of severely burnt and logged forest in areaa mapped as IBVM top 20% does not in any way prove or indicate that harvesting and fire do not cause severe and irreversible damage to the environment and should not be used as justification for avoiding the implementation of effective environmental policy. The apparent inconsistency highlighted by Mr. McTavish is most likely an artefact of the inadequacy of models, application of the model at an inappropriately fine scale, or misinterpretation of the limitations and intent of the model which is primarily designed to identify landscape potential to support top 20 habitat (based on climate, topography soil type and other variables) rather than its temporary presence or absence at any one time which is more dependent on localized fire and logging.

Part E. Awaiting, and applying the Precautionary Principle consistent with, the State & Commonwealth bushfire biodiversity responses

79. **Question 28. What is the degree of difference in terms of the severity of any impact on, or risk to, Greater Glider from timber harvesting after the bushfires, between: (a) Adopting the OCR May 2020 and Oct 2020 Precautionary Measures referred to at Annexure A Part E [57(b)] and [58(d)] above; versus (b) Pursuing harvesting adopting VicForests' measures at Annexure A**

Part paragraph [23]-[36], including in coupes on the TRP containing detections of Greater Glider which are located in the top 20% integrated highest value modelled habitat for priority species (blue), and within the top 20% modelled habitat for Greater Glider, but applying 40% basal retention as assumed at [36]? In my opinion none of these measures is particularly effective in protection Gliders and preventing their decline in production forests. Comments of the limitations and merits of the approaches are given in the table below and previous paragraphs.

OCR Precautionary Measures include advice in May 2020 to: i. continue postponement of any harvesting in the East Gippsland FMA (component 1), subject to review by OCR in Nov 2020; ii. postpone logging the integrated top 20% highest value modelled habitat for the basket of 34 priority bushfire-affected species (blue, and depicted in Mapsseries K) (component 2); iii. where possible, avoid logging the top 20% modelled habitat for each individual species of the 34 priority bushfire-affected species (pink). If logging occurs in these areas, survey and apply 40% basal retention where 3 or more Greater Gliders are found within a spotlight kilometre (component 3).	Only has merit if key refuges areas are mapped and retained for more than 10 years. "Where possible" this wording leaves the door open for uncertainty and the absence of precaution. 40% retention is an improvement if permanent and carried out in a way that best protects GG habitat but as currently practiced will have little short term benefit and little or no long term benefit.
i. Greater Glider remains a priority species and requires additional precautionary approach. Post bushfire reconnaissance not complete. Greater Gliders are highly fire sensitive and only seem to be being recorded in lightly burnt sites. Assessments to date suggest food source and hollow availability depleted in East Gippsland due to fires and not as adaptable as Yellow-bellied Glider, which has a more variable diet. Insufficient fieldwork has been conducted to assess full impact (p16); ii. assessment of the status of species since the 2019/20 bushfires has been hampered by limitations on the ability to safely work within the burnt forests and by COVID-19 (p7); iii. OCR considers that VicForests' additional mitigation for greater glider (please assume this refers to the measures at [35] above), its silvicultural systems, and quantifying and projecting the likely location of timber harvesting over the next 10 years, complies with the precautionary principle, other than relating to cumulative impacts in East Gippsland, TRP prioritisation and pre-harvest surveys. (Ltr OCR to VF 6 Oct 2020, p4); iv. harvesting within the East Gippsland FMA fire footprint should be limited to areas subject to the highest intensity fires (fire severity classes 1 and 2) and surveyed pre-harvesting to demonstrate that very low biodiversity value remains (p8); v. harvesting should be postponed in modelled habitat for Greater Glider outside the fire footprint in the East Gippsland FMA, unless VicForests can demonstrate nil or negligible impact on species of concern (p8); vi. TRP prioritisation should ensure that those coupes with greater than 50 per cent of their area containing high value habitat (assume this is top 20% modelled habitat) for Greater Glider will not be harvested (p8).	True. I have no experience of safety issues in severely burnt forest Limiting harvesting to Cat 1 and 2 burnt areas is not appropriate in dry forests that may recover naturally within a decade, but it is reasonable to prioritize these areas over unburnt areas after the next decade. Models are unreliable, protection of Gliders based on a few high density patches is a flawed approach that could hasten the species extinction.
FPSP *pre-harvest detections* of Greater Glider, or its own pre-harvest surveys for Greater Glider, *Additional habitat tree identification and retention policy: The policy includes that where Type 1 and Type 2 habitat trees are present, they must be retained, unless there are safety issues with retention (for example, the tree might fall over and there are risks it might hurt someone), and that the habitat tree surveys inform the silviculture system selected.* *Habitat tree surveys are to be conducted if practicable* *Coupe Operations Maps and High Conservation Value Plans* *post-harvest monitoring* *post-harvest aerial surveys* *evaluate the impact of new purportedly cooler and slower burning techniques* *The 40% Basal area retention pattern and design referred to in the conservation strategy is determined during coupe planning. The retention pattern may either be dispersed or aggregated, with arrangement of retained basal area governed by the characteristics of the forest stand and the habitat needs of threatened species which may inhabit a particular coupe. That is, the retention pattern may be aggregated in particular areas of a coupe to enhance the habitat connectivity for species within the coupe after harvesting is completed.*	Pre-harvest Glider and habitat surveys to specified standards are essential but meaningless if habitat is not better protected wherever Gliders are found. Coupe planning and HCV planning is currently highly variable (ad hoc) and inadequate suggesting a lack of consistent and effective guidelines, I have seen no evidence of a shift to non-burning regeneration techniques. 40% retention is too low and can be located in areas that minimize loss of wood volume rather than protecting the best habitat. Retention is not permanent.

80. **VicForests GG Conservation Strategy 2019.** Further review comments on VicForests GG Conservation Strategy 2019 are summarized in the below. The strategy Defines retained habitat as

“any intact forest unlikely to be harvested within the next 20 years, including Code mandated buffers and any permanently reserved areas”. This is not sufficient length of time for effective mitigation of Glider habitat loss.

Conservation Measures	Review Comments
Coupe-level detection based retention *VicForests must 'Retain at least 40% of the basal area of eucalypts across each timber harvesting coupe, prioritising live, hollow bearing trees, wherever* a *density of Greater Gliders equal to or greater than five individuals per spotlight kilometre (or equivalent measure) is identified* *Harvest and Regeneration systems will identify prior to harvest live, large, hollow-bearing trees (Type 1) and additional Type 2 and 3 trees as feed trees and recruitment trees. The 40% Basal Area retention pattern and design will be determined during coupe planning. Pre-harvest basal area is based on the average across gross coupe area and the retention requirement is also based on this area. Retention pattern may be either dispersed or aggregated, with arrangement of retained basal area governed by the characteristics of the forest stand.* *As a a guide, a distance of less than 75m should be used when considering the provision to provide habitat connectivity needed for the Glider to make optimal use of the hollow-bearing trees and retained habitat features. This distance is based on the known home range and estimated gliding distance capability of the species (up to 1 00m).*	This policy only retains GG habitat in areas of above average glider density, and then only if surveys are conducted properly and in the correct weather conditions. This policy could miss about 80% of all GG habitat. The 40% coupe retention is not based on selection of the best GG habitat, it is based on existing retention patterns for other uses which may not include GG habitat. 40% retention is at the lower limit of Glider tolerance and could fail to retain Gliders. Retaining habitat trees is no use in clear-felled habitats harvested on short rotations (< 60 years). This distance between retained trees is unreasonably excessive and too wide for gliders to span, the trees are not tall enough and the glide angle (31-40) is too steep to achieve this. In my opinion gliders are unlikely to regularly glide between trees more than 25-35 m apart, also, Gliders do not survive and reside permanently in forests with such sparse tree cover. 40% retention areas are not permanent. VicForests Conservation Strategy **d**efines retained habitat as **“any intact forest unlikely to be harvested within the next 20 years, including Code mandated buffers and any permanently reserved areas**”. Consequently, none of these retained areas can be considered to have any long term conservation value.
Existing Hollow-Bearing Tree Protection *The Code of Practice for Timber Production (the Code) requires VicForests to provide for the continuity and replacement of old hollow-bearing trees.* *To ensure that habitat tree population dynamics are maintained on coupes and at broader scales, VicForests has defined three categories of habitat trees based on current and future provision of hollows.*	VicForests has implemented a policy of describing and mapping habitat trees then felling or burning many of them in subsequent operational procedures. VicForests definition of habitat trees is inconsistent and does not accomplish retention or protection.
Variable Retention Harvesting *As the density of Type 1 habitat trees increases, the retention of other hollow bearing trees (HBT's) and recruitment trees (Type 2 and 3) increases, which results in the implementation of a less intensive harvesting. ie Variable retention 2 or Selection harvest system. This approach allows habitat features to be identified and protected regardless of Greater Glider detections.*	There is minimal evidence of dispersed or selection harvesting in the 64 coupes despite the predominance of dry and ecotonal forests with abundant tree hollows and high glider densities. In order to achieve this low intensity (LTBAR60) selection harvesting must be made mandatory in all forests with more than 0.5 category 1 habitat trees per hectare. Barcelona is an example of a coupe with 6 habitat trees (type 1-3 inclusive) per hectare (indicating that it was rare old growth forest) that was clear felled

81. **Question 29 Do the results of the State or Commonwealth Bushfire Biodiversity responses to date include monitoring, research or advice about the Greater Glider which is relevant to the manner in which timber harvesting should be managed, including where it should be conducted, in order to: (a) avoid serious or irreversible damage to that species wherever practical, or (b) arrest and reverse the decline of the Greater Glider, and assist its recovery, following the 2019/2020 bushfires?** I have reviewed the **“**Rapid analysis of impacts of the 2019-20 fires on animal species, and prioritisation of species for management response March 20” report which aims to “maximise the chances for long term recovery of native species and communities”, which is relevant to the Greater Glider. The report correctly recognizes that the glider is a poor disperser at particular risk from extensive hot fire. The “Management interventions for 119 priority animal species” report recommends some general actions to protect the Glider including the following: a) avoid clearing

those results in population fragmentation for the species; b) adapt forestry prescriptions to prevent habitat patches becoming too small to support viable populations, and 3) avoid salvage logging in burnt parts of its range. These actions are largely consistent with my advice and conclusions except that I would consider harvesting in Ash forest burnt by severity 1 fire to be available for salvage harvesting.

82. **Question 30 Are the actions foreshadowed in the State or Commonwealth Bushfire Biodiversity responses (see above, and further detail at p26-36 of the State Aug Report and p28-30 of the Commonwealth Rapid Analysis response) likely to include monitoring, research or advice about the Greater Glider which is relevant to the manner in which timber harvesting should be managed, including where it should be conducted, in order to: (a) avoid serious or irreversible damage to that species wherever practical, or (b) arrest and reverse the decline of the Greater Glider, and assist its recovery, following the 2019/2020 bushfires?** I note that the Rapid evaluation report states that "The specific interventions required for each species are best informed by species experts". I agree with this, and as an expert on this species I have provided in this report (especially in Appendix 1) additional recommendations for comprehensive action over and above those previously identified. Long term Research monitoring and adaptive management feedback (undertaken preferably by independent government agencies) will be an essential part of whatever management action is ultimately implemented.

83. **Question 31 Regarding the identification of key unburnt areas, or refuge sites, including under future climate scenarios:**

A	Please describe the characteristics, function and importance (if any) of key unburnt areas or refuge sites (or refugia) for Greater Glider following the 2019/2020 bushfires.	Refuge sites: all sheltered gullies and drainage lines and forests on protected (southern) slopes. All remaining uneven-aged and old growth wet forest with > 0.5 large living senescent tree/ha All unburnt areas in coupes with more than 50% severity 1,2 burnt forest
B	To your knowledge, have all key unburnt areas, refuge sites, or refugia, for Greater Glider been identified?	No, I am not aware of any Glider fire refuge mapping based on either unburnt refuges or topographic refuges
C	Do you agree with the identification of the Bendoc area in East Gippsland as a future climate refuge for Greater Glider.	Yes, I have read Wagner et al 2020 and it supports conclusions that I have previously reached myself.
D	Are some or all Sample Coupes, Sample Coupe Groups (per Agreed Map series 8- 32), or regions, likely to fall within, or constitute, key unburnt areas or refuge sites for Greater Glider? Please explain why or why not, and if only some, please identify which and the approximate geographic area of the key unburnt area or refuge site.	See Appendix 1 for some comments, mapping unburnt refuges is beyond the scope of this report
E	What is the impact on the Greater Glider species of past and continuing harvesting in the Sample Coupes prior to the identification and protection of key unburnt areas or refuge sites for the species?	There is a high risk that some key corridor or fire refuge habitat required to facilitate population recovery after recent or future fires will be eliminated without proper fire refuge and corridor habitat mapping and retention. Any such impacts may be disproportionately large.
F	Does VicForests statement that there are 72 coupes on the TRP in Bendoc district representing ~2400 ha of gross coupe area or roughly 10% of the high-quality modelled habitat of Greater Glider in the unburnt area of Bendoc outside the fire footprint, not accounting for coupe-level protections which are likely to reduce the area harvested by at least 25% (VF Draft PP Report (Mar 2020) p23), have the	No. modelled habitat may be meaningless. Temporary reservation of isolated patches of glider habitat in just a small part of their range offers no protection against long term decline. I have not seen any evidence that normal coupe level protections retain 25% of glider habitat on coupes. Protection needs to occur across the

	effect that such harvesting in Bendoc would avoid serious or irreversible damage to Greater Glider, and arrest and reverse its decline?	Gliders geographic range not just in high density patches.

As previously stated in Para 30 there is an urgent need to identify unburnt short term fire refuges for Gliders and other fauna based on distance to intense fire and proportional area burnt statistics derived from fire intensity maps after the 2019/20 fires in East Gippsland. This needs to be done on coupe by coupe or whole region basis. Mapping and determination of unburnt fire refuges was not of major importance in the bulk of case studies investigated in Appendix 1 of this report because these coupes are mostly located in the Central Highlands some 10 years after the last severe fire. The situation is different in eastern Victoria where Glider recovery will not yet have occurred so careful evaluation of the need for protection of unburnt or lightly burnt forest will be more critical. Until such time as some reasonable algorithms and procedures have been developed to identify and protect temporary (5-15yr.) unburnt forest refuges (e.g. such as all unburnt or lightly burnt areas of forest in areas in which the percentage of forest burnt in the top 2 severity classes exceeds 50% within a 2 km radius) I would support any recommendation that all unburnt forest within the 2019/20 fire envelope be protected from timber harvesting.

84. **Question 32 Was the logging in the logged Sample Coupes (as you have observed on the ground or in photographs and in light of the material at Annexure A Part B above), and is the planned logging in the scheduled Sample Coupes applying the measures at Annexure A Part B above (inc. 40% retention), consistent with**:

1	Carefully managing unburnt areas within or adjacent to recently burnt ground that provide refuges?	No evidence of this.
2	Carefully managing unburnt areas that are not adjacent to burnt areas?	No evidence of this.
3	Avoiding clearing that results in population fragmentation for the species?	No evidence of this and much for the contrary.
4	Applying adapted forestry prescriptions that prevent habitat patches becoming too small to support viable populations?	No evidence of this, no data on or consideration of patch size and linkages
5	Protecting areas that have become more strategically important for Greater Glider due to the fires?	No evidence of this.
6	Management of unburnt areas (within or adjacent to recently burnt areas) to protect/maintain this habitat to support population recovery?;	No evidence of this.
7	Protecting all habitat projected to be suitable as refuge sites under future climate change scenarios and establish connectivity to facilitate movement where possible?	No evidence of this
8	Effective prescriptions to support subpopulations of the Greater Glider (southern), including appropriate levels of habitat retention, logging exclusion and logging rotation cycles, maintenance of wildlife corridors between logged patches, protection of existing hollow-bearing trees with appropriate buffers, and adequate recruitment of hollow-bearing trees?	No evidence of most of this, some improved effort to recruit habitat trees but little evidence of consistent application and efforts mostly undone by post logging burning.
9	What would be required to conduct logging operations in a manner consistent with, or which has proper and careful regard to, each of the above management actions?	See my first report (Smith t2020) para 23 Table 2, para 49. LTBAR60 selection harvesting in all mixed species forest and 75% of wet forest, CAR60 aggregated retention harvesting with corridor retention and permanent protection in 25% of wet forest
10	Please specifically address whether 40% retention in all FMAs and retention of 500ha of suitable habitat within 3.5 km of coupes in fire-affected FMAs is consistent with the above.	Only if retention increased to 60% and link dispersed or aggregated retained habitat to 500 ha reserves by 100m wide corridors of Glider habitat not more than 2km long without small reserves (100ha)

In my opinion current harvesting practice will cause the permanent loss of gliders from all logged coupes in the short term to long term. Loss will be immediate to short term (within 20 years) in coupes logged with normal retention (<25% of coupe area), and medium to long term (20+ years) in coupes logged with 40% aggregated retention, even in coupes adjacent to National Parks. I say this primarily because retained forest is not protected and is available for future harvesting, and it is not mandatory for retained forest to be linked to large reserves and refuge areas by wildlife corridors.

85. **Question 33 Are the Greater Gliders in the Sample Coupes likely to form part of key populations? Please explain why. Was the logging in the logged Sample Coupes, and is the planned logging in the scheduled Sample Coupes, consistent with the protection and management of key populations in order to build long term resilience? If not, please explain what management options would be consistent with the protection and management of key populations in order to build long term resilience. Address this question for some or all the Further Coupes if you wish or time permits**. I have previously (Smith 2019a) identified populations of the Greater Glider in the Central Highlands of Victoria and the Strathobogie Ranges to be important populations. Based on high concentrations of Glider records and my own observations of the area I consider that part of East Gippsland east of the Snowy River, centred on the Erinundra Plateau and including all wet and dry (mixed species) forests above an elevation of 200m to also be an important population. This area includes all of the coupes which are part of these proceedings except those in the Mt Delusion-Nunniong and Mount Buller areas. High elevation populations of Gliders like those in the Central Highlands in ecotonal wet and dry forests provide the largest most stable and least patchy habitats for Gliders including the best areas for protection from long term climate change (Wagner et al 2020). In my opinion the problem of how to protect and link high elevation populations of poor dispersing species (vulnerable to fragmentation and isolation) like Greater Gliders has not been properly addressed in Victoria. This has been attempted for Greater Gliders and other species on regional scales elsewhere (Smith et al 2002).

86. **Question 34 Regarding the DELWP identification of high-density populations critical to the recovery and persistence of Southern Greater Gliders in Victoria: (a) Was the logging of Coupes, and is planned logging of Coupes or others that contain or are likely to contain Greater glider or its habitat, in Toolangi and Acheron consistent with recovery and persistence of Greater Glider in Victoria?** Timber harvesting undertaken and proposed for coupes in this area is similar to that undertaken elsewhere and will in my opinion lead to the continued decline and eventual local extinction of the Glider in this region due largely to failure to apply a precautionary approach to compliance with the objectives and actions required under the forestry Code of Practice for Timber Production (2014) (see below). **(b) What other areas do you consider to be disjunct areas of the Central Highlands with remaining high density Greater Glider populations critical to the recovery and persistence of the Southern Greater Glider in Victoria? Which Coupes fall in these areas**? It is not possible for me to reliably assess disjunct areas within the matrix of logged forest across Victoria because there is not currently sufficient information on the occurrence of Glider habitat

in SPZs, reserves and (recently) unlogged forests across the state. Models are not sufficiently reliable for this purpose, and current approaches to design and location of SPZs and reserves are insufficiently precautionary to have any certainty of providing an effective wildlife corridor network that links retained unlogged Glider habitat with National Parks and large conservation reserves, despite the requirement for such a corridor network in the forestry Code of Practice (see action 2.2.2.8 in table below). There is an urgent need for a more detailed mapping and aerial photo-interpretation study to identify the current pattern of fragmentation and isolation of all remaining unlogged forests in Victoria as a basis for landscape scale design of protected wildlife corridors and fire refuges to halt the decline of Gliders and other fauna.

	Summary of Code of Practice Requirements (Biodiversity)	**Notes on Compliance**
Objective Principle	Biological diversity and the ecological characteristics of native flora and fauna within forests are maintained.	
Operational Goal	Harvested native forest is managed to ensure that the forest is regenerated and the biodiversity of the native forest is perpetuated.	
Mandatory Actions	Addressing biodiversity conservation risks considering scientific knowledge	
2.2.2.11	Use silvicultural systems that suit the ecological requirements of the forest type.	Not done in mixed species and some ash
2.6.1.6	Silvicultural methods for regeneration must suit the ecological requirements of the forest type, taking into consideration the requirements of sensitive understorey species and local conditions.	Not done in mixed species and some ash
2.2.2.2	The precautionary principle must be applied to the conservation of biodiversity values. the precautionary principle will be consistent with relevant monitoring and research that has improved the understanding of the effects of forest management on forest ecology and conservation values	No evidence of Precautionary approaches
2.2.2.3	The advice of relevant experts and relevant research in conservation biology and flora and fauna management must be considered when planning and conducting timber harvesting operations.	My advice on unreliability of GG habitat models provided in 2019 appears to have been ignored.
2.2.2.8	Long-term (strategic) forest management planning must incorporate wildlife corridors, comprising appropriate widths of retained forest, to facilitate animal movement between patches of forest of varying ages and stages of development, and contribute to a linked system of reserves.	No evidence that current limited SPZ network satisfies these criteria.
2.2.2.9	Modify coupe size and rotation periods to maintain a diversity of forest structures throughout the landscape.	No, forest structure has been shifted to uniform early regrowth at the expense of uneven-aged and old growth
Code	**Habitat Tree Retention**	
2.2.2.10	Retain and protect habitat trees or habitat patches and long-lived understorey species to provide for the continuity and replacement of old hollow-bearing trees and existing vegetation types within each coupe.	No, frequently logged or burnt, and in long term decline
4.1.4.1	Prioritise hollow bearing trees where they are present	Sometimes, but no use if burnt after retention
4.1.4.1	Prioritise trees most likely to develop hollows in the short term	Little evidence of this
4.1.4.2	Scatter habitat trees across the timber harvesting coupe in mixed species forest	No, mixed species forest are mostly clear felled
4.1.4.3	Where possible retain potential hollow-bearing ash eucalypts in clumps to increase protection from exposure windthrow and fire.	Little or no evidence of this
4.1.4.5	Retain habitat trees where they can be most easily protected from damage during harvesting and site preparation	Some evidence of this
	Central Highlands FMA	
Table 12	Ash/HEMS Retain all Ash eucalypts originating before 1900	No sometimes logged
	At least 40 trees per 10 ha for the length of the rotation in ash forests originating since 1900	No, usually less than this
	Retain at least 1 potential hollow-bearing tree where gaps between retained trees are greater than 150 meters,	No use to Gliders
	Mixed Species 40+ trees per 10 ha	No, usually less than this

87. **Question 35. Would your answers to 31(e) or 32 above differ for other coupes unburnt by the 2019 2020 fires which contain detections of or are likely to contain Greater Glider; or contain or are likely to contain Greater Glider habitat? If so, please explain the difference**. In my opinion Glider protection from fire in all forests will rely on dedication and protection (from logging) of a network of corridors in two types of fire refuges: a) "permanent natural fire refuges" along all drainage lines and sheltered aspects, and b) "temporary unburnt and lightly burnt refuges" (protected for 10-25 years), for example in areas with more than about 50% severely burnt forest (top two categories) in the surrounding 2km. The location of strategically important temporary refuges in areas of unburnt forest will need to be assessed and mapped on a region-by-region basis after surviving Glider habitat and populations have been located and mapped. Until such time as this has been done all remaining Greater Glider populations need to be protected "in situ" throughout their natural range by maintaining Glider populations in all coupes wherever they naturally occur. In logged wet forest habitats this requires the application of much higher levels of habitat retention and the dedication and protection retained habitat in a network of refuges along drainage lines linking medium to large sized (100 ha +) permanent reserves at regular intervals (2 km) with regional National Parks. In logged dry and mixed wet and dry forests it requires the use of low intensity selective harvesting that retains 60% of the large tree (>40 cm dbh) basal area.

88. **Question 8 (Supplementary instruction 20 July 21) Is proceeding with harvesting in the Sample Coupes, or the Further Coupes, prior to the conclusion of the actions identified in the State and Commonwealth Bushfire Biodiversity responses at Annexure B Part E at paragraphs 57 to 58 on pages 15-19 before implementing measures which consider the findings reached by those responses, consistent with: a) a careful evaluation of management options to wherever practical avoid serious or irreversible damage to Greater Glider; b) a proper assessment of risk-weight consequences of various options?** No, I have listed below some proposed actions which in my opinion need to be completed, or completed with modification, before any further timber harvesting is undertaken within the 2019/20 fire envelope in East Gippsland (in order to comply with a) and b) above). The recent 2019/20 fires have greatly exacerbated the pre-existing threat to Greater Gliders from inappropriate and ecologically unsustainable timber harvesting. These fires have had the effect of reducing surviving Glider populations to a series of fragmented and isolated "unburnt or lightly burnt patches" and natural "fire refuges". Until such time as the pattern and location of these refuges has been determined and mapped, and the time to recovery of surrounding vegetation predicted, it would in my opinion be appropriate to cease logging in all areas of potential Greater Glider habitat (all areas shown as low, medium and high-quality glider habitat in figure 4 b) within the fire envelope, and not just areas of potential high quality Glider habitat. This Precautionary approach is essential because the current habitat model has been found to be in unreliable and to under-predict Glider density in areas modelled as low-quality habitat.

Victoria's bushfire emergency: Biodiversity response and recovery Preliminary report – Version 1" dated 23 Jan 2020, identifies the following actions.	
identify and design protection for key unburnt areas and populations within the current fire extent (at least 49 species including arboreal mammals);	Agree
immediate reconnaissance of critical fauna and flora species to inform status and management following fire (at least 15 species including Greater Glider);	Agree
protect and manage key populations of species outside the current fire extent (at least 49 species including arboreal mammals);	Agree
protect and manage key unburnt areas and populations.	Agree
The Commonwealth Wildlife and Threatened Species Bushfire Recovery Expert Panel (Expert Panel)	
rapid on-ground surveys to establish extent of population loss and provide a baseline for ongoing monitoring;	Agree
protecting unburnt areas within or adjacent to recently burnt ground that provide refuge, as well as unburnt areas that are not adjacent to burnt areas.	Agree
The Commonwealth Expert Panel "Priority management interventions for the 119 animal species" dated Sep 2020	
avoid clearing that results in population fragmentation for the species; forestry prescriptions to adapt to prevent habitat patches becoming too small to support viable populations, and avoid salvage logging in burnt parts of its range;	Agree
The Commonwealth TSSC "*Petauroides volans* (Greater Glider (Southern)) Conservation Advice" 2021,	
In the aftermath of bushfires, manage unburnt areas (within or adjacent to recently burnt areas) to reduce risk from future bushfires and protect/maintain this habitat to support population recovery. In particular, protect hollow bearing trees from post-fire salvage logging and clean-up operations;	Agree
Protect all habitat projected to be suitable as refuge sites under future climate change scenarios and establish connectivity to facilitate movement where possible	Agree
Identify key subpopulations and implement appropriate measures to ensure suitable habitat is maintained and protected around these subpopulations, as well as in areas where subpopulations have already declined through loss of habitat. When protecting an area, retain sufficient suitable habitat for population viability.	Agree
Establish and maintain effective prescriptions in production forests to support subpopulations of the Greater Glider (southern). This includes but is not limited to: appropriate levels of habitat retention, logging exclusion and logging rotation cycles, maintenance of wildlife corridors between logged patches, protection of existing hollow-bearing trees with appropriate buffers, and adequate recruitment of hollow-bearing trees.	Agree
Biodiversity Division Advice to OCR Update to Species of Concern as at 17 Dec 2020".	
harvesting within the East Gippsland FMA fire footprint should be limited to areas subject to the highest intensity fires (fire severity classes 1 and 2) and surveyed pre-harvesting to demonstrate that very low biodiversity value remains (p8);	Disagree, exclude from all burnt mixed species forest
harvesting should be postponed in modelled habitat for Greater Glider outside the fire footprint in the East Gippsland FMA, unless VicForests can demonstrate nil or negligible impact on species of concern (p8);	Agree if modelled habitat includes all low medium and high quality habitat

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APPENDIX 1 COUPE ASSESSMENTS

1. **Individual Coupe Assessments.** This appendix provides a summary of reviewed data on Glider occurrence, habitat, logging history and logging impacts for 64 logged, partially logged or scheduled coupes ("the coupes"), determined from examination of maps, aerial photographs and site photographs provided as evidence in these proceedings. It also provides a summary of timber harvesting patterns and methods recommended and considered necessary to achieve ecologically sustainable forest management that maintains existing Greater Glider population in situ (within these coupes) in a manner that will reverse the current distribution and population decline term in Victorian timber production forests.

2. **Methodology** This summary assessment of timber harvesting impacts on Gliders in 64 logging coupes in the Central Highlands and elsewhere in Victoria, is based primarily on data and information provided in exhibits for these proceedings. This includes the results of Wotch (citizen) and FPSP Glider surveys, Atlas records of previous glider surveys, site vegetation photography, post-logging drone photography, aerial photography, and ViForests mapping of fire history, logging history, elevation, topography, land use, forest type, high value habitat modelling, and Glider habitat modelling. While this information is not complete for all coupes it was sufficient to predict the impacts of proposed timber harvesting, and in particular to determine whether Glider population size and abundance is likely to continue declining, stabilize, or recover under current VicForests harvesting plans, policies and practices.

3. **Abbreviations The following abbreviations are used in this summary:**

GG	Greater Glider **GL** Leadbeater's Possum
UA OG	uneven aged old growth forest
LTBAR60	selective logging that retains all large trees (>80 cm dbh) including old trees with hollows and advanced mature trees (with the potential to develop hollows within a short period of time) and 60% of the basal area of other large trees (> 40 cm dbh) relatively evenly distributed across the harvested area to maintain structure suitable for Gliders.
CAR40	timber harvesting that retains a minimum 40% of the coupe area unlogged in aggregated patches connected by corridors.
SPZ	Special protection zone
HTRRCP	habitat tree retention (a minimum of 4 evenly spaced trees per hectare), recruitment (a minimum of 8 evenly spaced trees per hectare), clumping (retain vegetation in 10 m by 10m clumps round all habitat trees), and protection (push all flammable material away from habitat and recruitment tree clumps before burning, or regenerate by soil disturbance only).
HT	habitat tree, being any tree with a hollow used by or potentially suitable for Greater Gliders, and including any tree with a visible stem or branch hollow > 10 cm diameter and a depth > 30 cm. This includes but is not limited to all trees classified as Type 1-3 Habitat Trees by VicForests (2019) including dead and living trees.

4. **Findings a) Abundance**. There are recent (within the past 5 years) pre-harvesting records of Greater Gliders in all but one of the 64 coupes. There were no recent Glider records on Cottonwood Arena but

habitat on this site appears suitable on aerial photographs and this absence may simply reflect a lack of survey. The average number of Glider records (>50 m apart) in coupes was 0.2 per hectare (range of 0.02 - 0.77/ha.). The high frequency and abundance of Gliders across these coupes indicates that the Glider population in forests above 420 m elevation that have not previously been logged at high intensity or severely burnt (category 1) is widespread, healthy and abundant.

5. **Findings a) Distribution Models.** No significant or near significant correlation was found between the density of Glider records in coupes and the ranking of coupes as modelled by the Greater Glider Post-fire Habitat Distribution Model, and between the density of Glider records on coupes and the proportion of each coupe mapped as Top 20% Highest Value Habitat for Priority Species Modelled Post Fire. It can be concluded that neither of these models have practical use or merit in planning and management of Greater Glider conservation at the coupe scale in Victoria **and should be disregarded** for this species.

6. **Findings b) Climate** The Coupes are located at moderate to high elevations (420-1120 m) within the core of the species preferred climate zone. There is no evidence that recent drought and warming has reduced Glider distribution within this region given the high frequency of occurrence and abundance of location records. No significant correlation was found between coupe elevation (a correlate of rainfall and temperature) and the density of Glider records within coupes suggesting that climate is not an important determinant of Glider distribution within these forests.

7. **Findings c) Fire** There are frequent recent records of Gliders within the 2009 fire envelope including many records in areas affected by moderate crown scorch (category 3). There are some records of Gliders on forests on three coupes (Sundownies, Updownies and Jokes) that were partially burnt by category 2 intensity (crown scorch) fire. No coupes had substantial areas of intensively burnt (category 1) fire. These findings are consistent with previous studies which indicate that Glider populations can withstand and recover from moderate to high intensity fires (category 2-4), that do not kill overstorey trees, within 10 or more years after fire.

8. **Findings d) Forest Type** Coupes supported a mixture of mapped wet forest (mostly in gullies and protected slopes) and mapped dry forests (mostly on ridges and sunny exposed slopes). About half of the coupes supported only mapped wet forest and about half supported a mixture of both, with an average 40% dry and 60% wet forest. Gliders were most abundant on coupes with a mix of both wet and dry forest. This preference can be explained by the relative abundance of habitat trees in these forest because of the ability of dry forest tree species to survive fires.

9. **Findings e) Forest Structure** Forests structure apparent on aerial and site photographs and evident from habitat tree mapping on coupe plans was mostly uneven-aged old growth with a mix of young, mature, and senescent trees in virtually all dry forest and mixed wet and dry forest. Some even-aged mature forest without habitat trees was apparent in patches, mostly on ridges, in some wet forests. Almost all coupes are greater than 50-70 years of age and are therefore dominated by mature trees with large stems (40 – 80 cm dbh) preferred by Greater Gliders (Smith 2019 and unpublished). On the basis of forest structure Gliders are expected to occur in all of these forest coupes wherever there are habitat trees (large trees with hollows) at densities of > 0.5/hectare (Smith 2019).

10. **Findings f) Habitat Trees**. Habitat trees on logged coupes have been surveyed, classified into four types (Type 1 senescent with hollows, Type 2a dead tree with hollows, Type 2b mature trees with hollows, and Type 3 mature with small hollows and the capacity to develop larger hollows in the near future) and mapped by VicForests on most coupe plans. Despite going to the trouble to map these

trees little or no effort is made to protect them, especially Types 2-3, with many either felled or left to burn during regeneration burns (see exhibit BTN 176 Glanworth, exhibit BTN 184 Blue Streak, and others listed in the Index to evidence of damaged or destroyed hollow-bearing trees). Type 1 habitat trees generally receive some individual attention and protection in coupe plans but the approach appears to be ad hoc and inconsistent. The only consistent factor in most plans is a relative shortage of mapped and marked habitat trees to be protected relative to code and HCV plan requirements. The density of mapped habitat trees (types 1-3 inclusive) averages about 2.3 /ha. This is considerably below levels expected in the predominantly ecotonal mixed wet and dry forest in this region of 7-9/ha. (Smith 2019). This suggest that VicForests habitat tree mapping is substantially underestimating the true number of habitat trees in forest scheduled for harvesting. The VicForests Habitat tree typing protection system has a commercial focus, it protects Type 1 trees which are generally too old to have commercial value, and fails to adequately protect Type 2-3 Habitat trees which are often mature and have high wood values because the hollows are in branches and not the main stem. This is an issue of major concern as Type 2 and 3 habitat trees typoically dominate the forest canopy and provide the major part of timber volume within dry (Mixed Species) and ecotone forests. It is in the interests of VicForests and harvesting contractors to under-mark or under-protect Type 2-3 habitat trees. ***For this reason, it would be my recommendation that habitat tree mapping for coupe plans be carried out by an independent authority.*** I am not aware of any ecological justification for VicForests claim that only the Type 1 Habitat Trees category "include trees that VicForests is obliged to identify retain and protect under existing regulatory controls in Victoria". ***In my opinion regulatory controls for Habitat Trees in Victoria will be inadequate and ineffective unless they include all trees with hollows used by Gliders, including but not limited to all Type 1-3 habitat trees.*** High Conservation Value (HCV) planning in some coupes proposes Glider and Habitat Tree protection measures only when Habitat Trees density exceeds a specified threshold. The example below from Bauble coupe HCV Plan states that protection will increase where Type 1 HTs are more abundant. This approach aims to protects existing areas with an exceptionally high habitat tree density but does nothing to restore and recruit habitat trees in areas that have previously been depleted by logging and fire**. Furthermore, the thresholds for protection has been set so high (relative to mapped habitat tree abundance) that no coupes may achieve them. In this study not a single coupe was found to have a mapped Type 1 habitat tree density higher than 3/ha in the logged or scheduled area.** This means that proposed mitigation measures such as those below may never be applied. This outcome cannot be considered effective or precautionary for Glider conservation and management. The average density of mapped Type 1 habitat trees per hectare on coupe maps was 0.4/ha, and the range was only 0.08 -1.7 (HT/ha.). No significant correlation was found between the abundance of Glider records on coupes in this study and the abundance of Type 1 habitat trees indicating that they are not of great importance in determining Glider abundance. A significant correlation ($P<0.05$) was, however, found between the abundance of Glider records on coupes and the total number of all mapped Habitat Trees (Type 1-3). This indicates that it is the abundance of the Type 2-3 habitat trees is more important in determining Gliders abundance, so it is essential that these habitat trees be given equal protection to Type 1 habitat trees.

2. HBT Silvicultural Approach (Attach HBT flowchart for detail)			
Habitat Tree Threshold (note if multiple approaches are used)	**Retention Type**	**Expected Outcomes (use Harvest Retention DSS for assistance)**	
3-6 HBT 1 / ha	Variable 1	Retain all type 1 habitat trees identified and retain an additional 2 trees for each type 1 identified. Seed trees, recruitment and non-merchantable trees to be retained across the Variable 1 silviculture system.	
7-9 HBT 1 / ha	Variable 2	Retain all type 1 habitat trees identified and retain an additional 1 tree for each type 1 identified. Seed trees, recruitment and non-merchantable trees to be retained across the Variable 2 silviculture system.	
			Map attached (Yes/No)

Habitat trees can reasonably be assumed to be abundant in all dry forests, mixed wet and dry forests, and wet (Ash) forests with a mapped aged older than 1939. Dry forests dominated by tree species that are adapted to survive fires have a naturally uneven-aged or old growth structure (in the absence of intensive logging) dominated by large old fire scarred trees. In a survey of 57 coupes in the Central Highlands Smith (2019) found habitat trees to be present in all dry forest plots at an average density of 7.4/ha. (range 1-16/ha). Habitat trees were also present in all ecotone plots with a mix of wet and dry forest at an average density of 8.7/ha (range 2-16/ha). The abundance of Habitat Trees was more variable it wet forests depending on time since fire, fire intensity and logging history. Habitat trees were present in all "old growth" plots mapped or confirmed on site as pre 1939 in age habitat at an average density of 3.0/ha. (range 1-7/ha.). In forests mapped and confirmed on site as 1939 ("mature") or younger living HTs were present on 20% of sites as scattered individuals at an average density of 0.33/ha. Dead (1939 fire-killed) habitat trees ("stags") were present on 53% of these at an average density of 1.7/ha., but most of these dead trees had decayed to tall stumps (forms 6 & 7 in Smith et al 1985) likely to be unsuitable for Greater Gliders***. In my opinion VicForests policies that focus on protection of only high density occurrences of type 1 habitat trees an allow the harvesting and destruction by burning and felling of Type 2 (living) and Type 3 habitat trees, represents (in conjunction with high intensity clear-felling), the single greatest threat to Greater Glider survival in Victoria and the principal cause of its past and expected future decline.***

Table 1 Summary of Code of Practice Requirements (Habitat trees) and Glider Conservation Strategy Requirements

Code	
2.2.2.10	Retain and protect habitat trees or habitat patches and long-lived understorey species to provide for the continuity and replacement of old hollow-bearing trees and existing vegetation types within each coupe.
4.1.4.1	Prioritise hollow bearing trees where they are present
4.1.4.1	Prioritise trees most likely to develop hollows in the short term
4.1.4.2	Scatter habitat trees across the timber harvesting coupe in mixed species forest
4.1.4.3	Where possible retain potential hollow-bearing ash eucalypts in clumps to increase protection from exposure windthrow and fire.
4.1.4.5	Retain habitat trees where they can be most easily protected from damage during harvesting and site preparation
Central Highlands FMA	
Table 12	At least 40 trees per 10 ha for the length of the rotation in ash forests originating since 1900
	Retain at least 1 potential hollow-bearing tree where gaps between retained trees are greater than 150 meters,
	Mixed Species 40+ trees per 10 ha
Glider Conservation Strategy	
5.2.1	As the density of Type 1 habitat trees increases, the retention of other hollow bearing trees (HBT's) and recruitment trees (Type 2 and 3) increases, which results in the implementation of a less intensive harvesting. ie Variable retention 2 or Selection harvest system. This approach allows habitat features to be identified and protected regardless of Greater Glider detections. (AS note, this strategy will not protect any GG populations in the coupes because they are all clear felled on short rotation and retained habitat trees are too widely spaced to be used as remnant habitat. The habitat of GG is more than hollows, it is also a minimum stocking of large trees (preferably > 20/ha trees over 75 cm dbh see figure 10)
	Consideration should be given to the protection of live, large, hollow-bearing trees through all forest management activities including regeneration burning. Provisions for the reduction in intensity of regeneration practices is built around the number and type of habitat trees present within a coupe. Generally, as the density of habitat trees (and other High Conservation Values) increases, there is a subsequent reduction in the intensity of regeneration practices through cooler burns and mechanical disturbance.

11. It is clear from the above and previous studies (Smith et al 1985, Smith and Lindenmayer 1988, Smith 2010, 2016, 2019) that current timber harvesting practices in VicForests are habitually failing to adequately identify, protect and recruit habitat trees in harvested forests. There is abundant evidence from this and previous assessments that critically important habitat trees are felled and harvested during logging operations or killed and burned during post logging slash burns. Current policy allows for habitat trees to be removed if they are considered a safety risk. This loophole potentially allows all habitat trees to be felled, and there must be a great temptation for contractors to do so when such trees contain significant wood volume, which is likely to be the case in most dry and mixed wet dry forests. There is little evidence of any serious effort to identify and protect habitat trees in patches and clumps or recruit new habitat trees in areas in which they are scarce or absent as a result of past fire and logging. Current timber harvesting on short rotations without adequate fire refuge and corridor protection is causing a gradual and cumulative loss of habitat trees throughout the Victorian timber production forest. ***The loss of habitat trees is sufficiently critical in wet forests that in my opinion it justifies immediate protection of all remaining trees with hollows, and all trees > 1m dbh with the potential to develop hollows in the shortest possible time, within 200m diameter unlogged SPZ reserves linked by corridors to refuges and large regional reserves.***

12. **Findings: Adequacy of 40% Retention and Retained Unlogged Patches g)** Current Vicforests policy relies heavily on temporary retention of small disjunct and isolated unlogged forest patches totaling 40% of coupe area to mitigate impacts on Gliders. While there is some evidence that gliders may survive in small, retained patches within coupes immediately after harvesting there is no evidence, or theoretical likelihood, that these remnant populations will survive over the long term (60-120+ years) unless they adjoin a permanent network of protected corridors and fire refuges linked to large, nearby viable conservation reserves. There is currently no evidence of such a network in Victoria. SPZs and retained patches which could fulfill this function are often disjunct, small, variable in width, located in non-forest (riparian or swamp) vegetation, long and narrow, vulnerable to fire or disjunct (as evidenced from coupe clearing patterns on aerial photographs in this study). Until such a corridor/reserve system is in place it is reasonable, to conclude on a precautionary basis that over the next 50-120 years Greater Gliders will either be eliminated or reduced to many hundreds of tiny non-viable isolated populations throughout the timber production estate. If this eventuates surviving Glider populations in National Parks will also be threatened by isolation from one another and the natural ecological (elevation and topographic) gradients necessary to adapt and respond to periodic intense wildfire and climate change will have been removed.

Table 2 summary of VicForests Glider Conservation Strategy Requirements

	Greater Glider Conservation Strategy
5.3.2 pre log surveys	Surveys for greater Glider are to be undertaken in accordance with the DELWP Survey Standards: Greater Glider (DSE, 2011), whereby the recommended approach is to undertake at least 2 spotlight transects on foot covering a distance of at least 1 km per transect. Assuming observers are searching 25m on either side of this 1 km transect, this equates to a survey area of at least 5 hectares. This would equate to an equivalent per hectare density of 1 per hectare. It is also assumed that 1 km of spotlighting should take up to 40 mins to complete, so an equivalent rate per hour of spotlighting would be 7 or more per hour of searching.
5.3.3 40% retention	Wherever a density of Greater Gliders equal to or greater than five individuals per spotlight kilometre (or equivalent measure) is identified VicForests Harvest and Regeneration systems will identify prior to harvest live, large, hollow-bearing trees (Type 1) and additional Type 2 and 3 trees as feed trees and recruitment trees. The 40% Basal Area retention pattern and design will be determined during coupe planning. Pre-harvest basal area is based on the average across gross coupe area and the retention requirement is also based on this area. Retention pattern

	may be either dispersed or aggregated, with arrangement of retained basal area governed by the characteristics of the forest stand.
Links and Corridors	High density patches of Type 1 trees may be excluded and retained as habitat 'patches' or 'clusters'. The position of these 'patches' should take into account consideration of the connectivity of these high-density hollow-bearing tree areas to other retained habitat.
Duration of retention	Other retained habitat is defined here as any intact forest unlikely to be harvested within the next 20 years, including Code mandated buffers and any permanently reserved areas. (AS note this measure is useless unless protection is permanent or applied for 60+ years)
Gap width	As a guide, a distance of less than 75m should be used when considering the provision to provide habitat connectivity needed for the Glider to make optimal use of the hollow-bearing trees and retained habitat features. (AS note 75m is much too wide to be of any use need to reduce to about 25m)
	Where Greater Gliders are found below the thresholds described in the Action Statement additional feed and recruitment trees should be retained around hollow-bearing trees in the sighting area. The above connectivity requirements should also be considered. (AS note this measure is ineffective unless patch linkage is mandatory)

13. **Conclusions** VicForest Glider Conservation Strategy (table 2 above) is ineffective and current Silvicultural and timber harvesting methods proposed in coupe plans can be expected to eliminate Gliders from nearly all logged and scheduled coupes the subject of these proceedings over the short to long term. Gliders will be eliminated immediately from all clear- felled forest and gradually from retained unlogged patches within logged coupes once the retained patches become isolated by roads and a lack of dedicated permanent corridors and fire refuges along drainage lines linking them to large conservation reserves. Continuation of current harvesting practices is likely to gradually reduce and eventually eliminate the Greater Glider from almost all areas of wet and dry native timber production forests in Victoria. The impact of timber harvesting on Gliders is the sum of everything that has been done in the past plus everything that will be done under proposed coupe plans, plus everything that will be done in the future under existing forward plans and commitments. The current downward decline and cumulative loss of Gliders and other old growth dependent fauna in Victorian forests can be expected to continue until VicForests reduces its future annual yield and forward timber harvesting commitments to much lower levels that permit a shift to genuine low intensity ecologically sustainable harvesting methods. The only certain way of protecting Gliders and preventing further declines in their geographic range and abundance in Victoria is to retain Glider population “in situ” within logged coupes by applying low intensity single tree selection harvesting methods that retain a significant proportion (> 60%) of all large trees (> 40 cm dbh) and all remaining or a minimum density of large old senescent trees with hollows (> 4/ha) throughout the natural forest, or by permanently retaining, protecting and linking 50% of habitat in all logged coupes linked to a network of proven viable and effective wildlife corridors, fire refuges and reserves.

14. **INDIVIDUAL COUPE ASSESSMENTS.** The following paragraphs provide more detailed descriptions, harvesting impact assessments and suggested impact mitigation recommendations for individual coupes.

15. **Acheron Coupes (logged):** These coupes supported exceptionally high numbers of GG including six records (2020) in areas shown as burnt to category 2 (crown scorch) in 2009 and 10 records from areas burnt to category 4/5a (no crown scorch). **Empire State, Camp David and Mt Rushmore** adjoin an SPZ corridor along the Acheron River. The coupe plan says “*Minimum 40% basal retention applied to all three coupes. Type 1, 2 and 3 habitat trees will be retained for habitat as well as feed/seed trees, stags and other hollow bearing recruitment trees*”. The average density of mapped habitat trees in logged coupes is less than 2/ha well below the Code required 4/ha. The higher quality wetter low elevation forest on these coupes has been logged. My recommendation for sustainable logging on these sites

would have been to protect the area that has been logged and limit harvesting to 60% large tree basal area retention selective logging (LTBAR60) in the dry forest on the ridge tops with more uniform mature structure. By way of remediation, my recommendation would be to protect the remaining unlogged forest on these coupes and incorporate into an expanded (400m wide) SPZ, wildlife corridor and fire refuge along Acheron River.

16. **Big Pats APU (Scheduled)** Aerial photography indicated that this site is likely to be dominated by uneven-aged old growth (UAOG) wet forest. A check of habitat trees on the coupe plan showed this to be correct, old growth large old living trees with hollows are present on coupe plan habitat tree mapping at a density of about 1/ha, and mature trees at a higher density. Vicforests described the forest in the coupe plan as 1939 regrowth foothill mixed species forests, but the species composition is described as Manna Gum, Mountain Gum and Mountain Ash which is wet forest. Wet and ecotone forest with remnant large old trees is now so rare in the Central Highlands and of such critical importance as future fire refuge and long term habitat for Greater Gliders and Leadbeater's possum that my recommendation would be to protect all such forests with an average density of more than 0.5/ ha living senescent trees (VicForests Types 1 - 3) with hollows. And in areas with only scattered living large old trees (< 0.5/ha) my recommendation would be to protect all such trees by 200 m diameter unlogged buffers linked to a new wildlife corridor/fire refuge SPZ that captures similar UA OG (apparent on aerial Photographs) in the surrounding region. The site supports a giant tree (> 2.5m dbh). Vicforests proposes to clear fell the forest around this tree (and all the other large living trees with hollows) leaving it partially isolated in a clear felled paddock where it will have no conservation value for Gliders and could be killed in a regeneration burn.
17. **Big River North** All five coupes have moderate to abundant GG. **Rumba, Pumba and Kumba** are mapped as dominated by wet forest and appear from aerial photography to have a rare UA OG structure on at least the moister lower slopes. **Kumba** is described in the coupe plan as predominantly messmate dry forest but abundant Acacias and records of Leadbeater's possum in adjoining habitat are indicative of wet Ash Forest. Coupe mapping shows the area to be predominantly wet forest and HCV mapping shows Mountain Ash on the northern boundary. The coupe plan calls for retention of 5 large HTs (/ha?) and states that "***several Type 1,2 and 3 habitat trees have been marked and will be retained***"(Why not all Type 1,2and 3 HT?). The plan notes that "***high quality Glider habitat has been defined as areas of mixed species forest where at last 15 living large, hollow-bearing trees per 3 hectare are located"***. Pre-logging surveys detected abundant Gliders on the site and recommended 40% aggregated retention in habitat "islands" and in the less productive low yielding part of the forest, rather than the most suitable area for Gliders. This coupe plan indicates that habitat was not selected for retention because it is the best Glider habitat, but either because it is already excluded (streamside strips and Leadbeater's possum exclusion areas) or because it is low yielding forest. Coupe habitat tree maps show the vegetation is high value uneven-aged forest in the ecotone between wet Ash Forest and dry Mixed Species forests of the type that regenerated after moderate burning in 1939. Coupe HT mapping shows that it supports an average of at least 1 large living tree with hollows per hectare (more may be present than are mapped by VicForests) and an average of 2.5/ha Type 1-3 habitat trees. Like Big Pats this is a rare and valuable structural type of critical importance as future fire refuge and long term habitat for Greater Gliders and Leadbeater's possum. The wetter lower two thirds of this coupe is the best habitat and the area that should be protected to maintain Gliders, but this is the area that is proposed for harvesting in the coupe plan. **Rumba and Pumba** are similar in floristics, structure and habitat value to **Kumba** and the same comments apply. My recommendation would be to protect the lower two thirds (66%) of these coupes and link them to **Grenadine** via a wide unlogged and protected wildlife corridor network along the main drainage line down koala Creek. The remaining part of these coupes could be available for selective logging with 60% retention (LTBAR60) and protection of all large trees > 80 cm dbh with hollows.

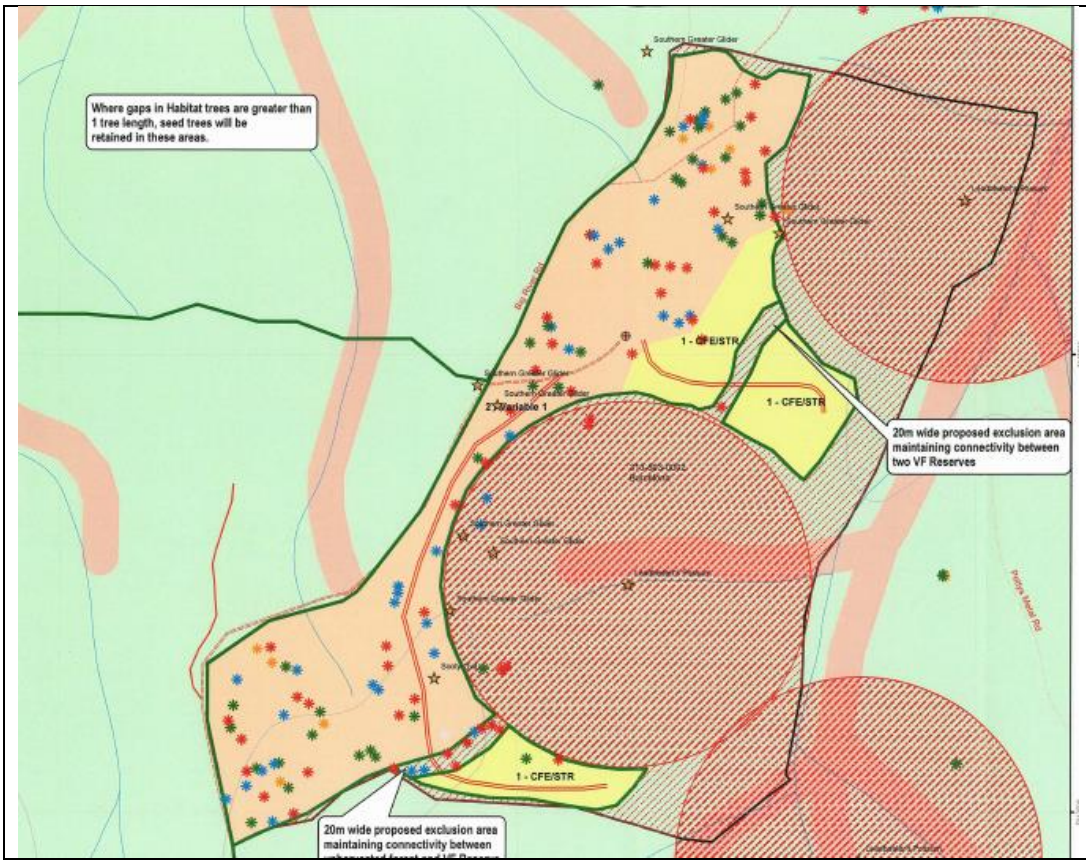
Photo JRM-206 LL03 (upper) and LL08 **lemon lime** showing abundant habitat trees in the logged area which do not appear to be mapped in the operations map

18. The coupe plan for **Lemon Lime** shows about 60% aggregated retention along stream filter strips, boundary strips and an area with a concentration of Glider records. A major deficiency of the plan is a lack of habitat trees marked for retention in logged areas. There are only 0.5 HT marked for retention per hectare in cleared areas, and no recruitment trees, but on photos of the logged area (see below) Habitat trees appear to be common, widespread and abundant on the coupe. The HCV map for this coupe includes Type 1 habitat trees only. Types 2 and 3 are presumably present but have not been mapped so that they are available for harvesting. This is an issue of major concern if VicForests coupe planning is greatly underestimating the number of Habitat Trees in areas to be logged. Aerial photos suggest that the planned boundary retention strips may have been cleared. My recommendation would be to restrict further harvesting in **Lemon Lime** to the plan area, re-map, retain and protect all habitat trees (Types 1-3) and require that all retained forest patches within the clear felled area be linked to unlogged boundary areas by corridors, ensure that forest regeneration is by soil disturbance without post logging burns, and that unlogged boundary strips be protected in adjacent coupes as well as Lemon Lime, that habitat and recruitment habitat trees be retained at a minimum density of 4/ha

in the logged area, and that all retained unlogged areas be linked to a new wildlife corridor SPZ long Arnold Creek encompassing the general area in purple on map 11 L. Under current VicForests policy patches of retained forest retained within coupes such as this are not protected and can be logged at a later date. **It is noteworthy that this coupe is mapped as having been logged in 1973 but it still retains Gliders and sufficient number of large trees to merit re-harvesting after 45 years, this indicates that low intensity selection harvesting that retains Gliders and Glider habitat is practical and sustainable for Gliders in these forests.** Aerial photographs and glider surveys of **Grenadine** Coupe indicate that it is dominated by high quality uneven-aged old growth habitat. My recommendation would be that 60% of this coupe be permanently protected in extra wide strips down drainage lines and around the coupe boundary and that harvesting be limited to LTBAR60 dispersed selection harvesting in two patches between drainage lines.

19. **Big River South.** All of these coupes appear on aerial photographs and site photographs to be dominated by UA OG. They all support high to very high numbers of GG. **Porto, Toledo and Barcelona** are all dominated by old growth wet forest and consequently merited 100% protection because of the rarity of this structural type and its long-term importance as refuge habitat for GG and GL. These coupes are all close (within 2km) to National Park and are important areas for corridor retention to provide linkages to retained unlogged habitat patches to the north. The coupe plan for Barcelona notes that Gliders are present and states that "***At a minimum 40 percent of pre harvest basal area across the gross area will be retained. Preservation of Type 1 trees are prioritised where safe to do so. Where there isn't a high density of type 1 trees, the recruitment of type 2 and 3 trees will occur where safe to do so***." In the VicForests Habitat Tree and Resource Inventory survey Guideline Type 2 HT include living and dead trees***.*** But dead trees are not suitable as recruitment trees because they are prone to rapid natural decay, removal in post logging burns, removal by contractors for safety reasons or by VicForest for fire risk reduction. Suitable recruitment trees are essentially Type 3 and younger (mature trees without small hollows) only. The HCV map for Barcelona shows an exceptional density of habitat trees in the logged area (about 6.3/ha) indicating that before logging this area was very rare, high quality uneven-aged old growth wet Forests of prime conservation importance for Gliders and Leadbeater's Possum. This coupe has such important habitat that in my opinion timber harvesting should have been excluded from the entire area and it should be mapped as protected old growth. Timber harvesting removed 40% of the coupe in the area with the highest density of Gliders. **The area selected for retention was already excluded in a Leadbeater's Possum protection zone and was not "additional to existing retained areas" as required under VicForests policy**. In my opinion the logging of Barcelona (as shown in the figure below***) could not have been undertaken without the harvesting of Habitat Trees.*** The coupe plan for **Porto** requires retention of minimum 40% of the gross preharvest basal area, prioritizing areas containing large, live hollow-bearing trees where they are present and maintaining connectivity of these areas to other exclusions or reserves. The plan shows that the retained area is dominated by already excluded Leadbeater's possum habitat. The plan shows some coupe boundary protection but this could have been wider and more complete. My recommendation for this coupe would have been complete protection.

	UA OG Wet forest on **Barcelona** during harvesting (exhibit JRM 122) showing prime Greater Glider habitat
	**Barcelona** JRM 206 (BAO4 IMG 1340) post logging showing retained isolated large old senescent trees with hollows



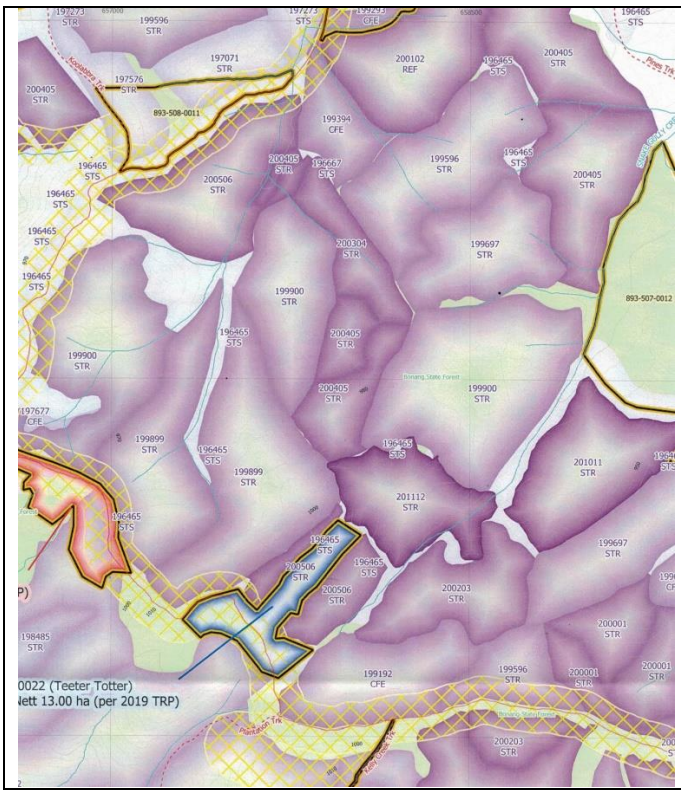
Barcelona coupe map (JMG 17) showing that retention area (cross hatched in red) is primarily within an existing Leadbeaters possum habitat reserve and is not "additional" to existing retained areas.

Porto JRM 206 (IMG 1173) after logging showing patch of lightly logged forest that reveals uneven-aged and old growth structure before harvesting

20. **Madrid and Faro** are dominated by dry forest on the ridge tops and wet forest in the drainage lines and gullies, both have large numbers of glider records. My recommendation would be to permit selection harvesting (LTBAR60) at 60% retention with habitat tree protection (HTRRCP) on the ridge top 40% of each coupe. My recommendation would be to retain the wet portion of these forests and the ecotone with dry and wet forest on **Madrid** as important fire refuge and rare uneven aged old growth habitat for GG where not already protected for Leadbeater's Possum. **Faro, Madrid** and **Toledo**

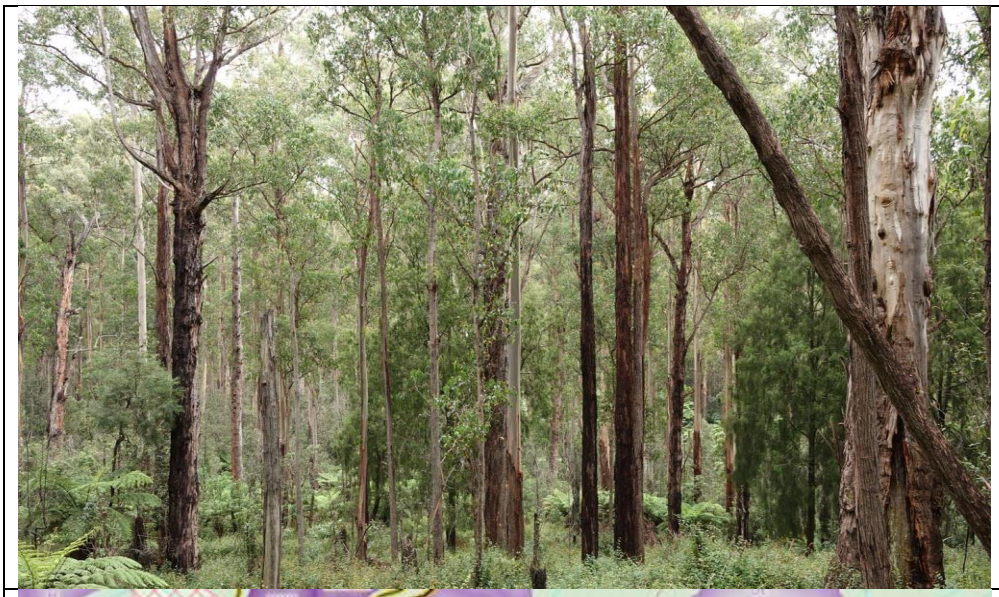
adjoin a National Park, but a wildlife corridor of wet forest 200m wide is needed through these coupes to link with retained forest on **Port and Barcelona** and coupes to the north.

21. **Cotton wood**. The distribution and pattern of logging in the area surrounding **Arena** and **Teeter Totter** coupes is a good example of the cumulative impact of timber harvesting over time that arises when no adequate provision is made to retain wildlife refuges and corridors. Logged forest coupes are shown in purple on the figure below. Aerial photographs show that there is very little remaining unlogged forest in this region and most of what remains within logged areas is patchy and disjunct with no unlogged boundary corridors between coupes, no unlogged corridors on road edges and no designated SPZs to provide future fire refuges and corridors for GG and other wildlife movement and dispersal. Retained habitat trees (HT) in logged areas are also irregular or sparse and generally below requirements of 4/hectare in regenerating logged forest due to chronic inadequate protection during harvesting and post logging burns and failure to provide recruitment habitat trees (RHT). Both **Arena and Teeter Totter** coupes are tiny "infill" patches that will have a much greater cumulative impact if logged than their small size suggests. They appear to be dominated by UA OG wet forest suitable for GG. My recommendation would be to protect both coupes and link with the few other surrounding remnants of unlogged UA OG forest in the region to provide an SPZ wildlife corridor through this heavily logged region within the general vicinity of the existing mapped (yellow cross hatched SMZ visible in the figure below). The coupe plan for **Arena** notes that modelled Glider habitat is present and calls for "*Ten retained trees/ha. Mineral earth fire break will be constructed around retained patches. 7.9ha have been excluded from TRP area of 13.7ha*". The operations map shows only an average of 1.7 habitat trees per hectare for retention which is 80% short of requirement and no trees are mapped for recruitment. The operations map shows five mapped Type 1 habitat trees within the planned logging area in total of which three are mapped as Hazardous Trees. One of these is protected in a retained clump of vegetation in the operations plan (which is the sustainable approach to protection of hazardous tree that I have recommended in this report) but the other two are presumably at risk of being harvested by logging contractors for "safety reasons".



Arena and **Teeter Totter** (Map 13 B) coupes showing their strategic location in a potentially important wildlife corridor through an extensively over-harvested region. Harvested coupes shown in purple

22. **Faith Creek Benefactor** coupe is another good example of an "infill" coupe within a previously heavily logged region that provides a last opportunity to mitigate cumulative impacts by protection as a small reserve and future fire refuge along a riparian corridor. **Benefactor** appears to be dominated by rare UA OG wet and dry forest ecotone and adjoins an unmapped narrow riparian corridor which could be designated as an SPZ, widened to 200+ m, extended, and linked to other remnant patches of UA OG in the region such as those on recently logged coupes 460510 0035 and 0030 (which prior to recent harvesting appear to have supported the largest and most extensive patches of UA OG remaining in the area). **Benefactor** is now the only remaining available option for protecting an intermittent (every 2 km) small intermittent reserve alkong SPZ corridors in this general region. The coupe plan confirms that the **Benefactor** includes a mix of Mountain Ash wet forest and stringybark dry forest ideal for Gliders and that it supports a moderate number of known Glider records. The coupe plan states that "*No detection based requirements exist for Greater Gliders within the Central Highlands FMA. Prioritise the largest diameter trees with large visible hollows for retention as habitat trees where possible where they exist*". **The coupe plan states "not present" for Greater Gliders under the column headed "identified during field check" despite the fact that Gliders have been identified on site by Wotch and FPSP**. This indicates that VicForests pre-logging surveys are not always adequate and that reliance of HDM models is unreliable**.** The HCV plan states that approximately 15 trees per hectare will be retained, that clumps will be retained around Hbt1 (type 1 habitat trees) with 4 additional recruitment trees. Mapping shows that Type 1 habitat trees occur at a density of only 1/ha, well short of Code requirements of 4/ha. Habitat mapping shows that types 2 (living) and 3 habitat trees which are the sensible and obvious priority for the shortest time to hollow development are together present at densities of 1.3 /hectare, again well short of requirements***. In order to be consistent with VicForests Code of Practice (see Table 1) habitat tree protection provisions would need to be greatly improved by retaining all habitat tree types and marking an additional 1.4 RHT per hectare for habitat tree recruitment. Simply retaining an excess of seed trees is no substitute for proper habitat protection as seed trees are often too young and easily killed in regeneration burns***. Mapping of **Benefactor** shows that 40 % of the site will be retained but the coupe plan states that only 28% will be retained. Aerial and site photographs of **Benefactor** show that it is UA OG forest of high ecological value at least in the western two thirds. There are abundant Yellow-bellied Glider records for the site, an old growth dependent species equally at risk from logging as the Greater Glider (Smith 2010,16). The Yellow-bellied Glider has a home range of 30-60 hectares, which is larger than Benefactor coupe (28 ha). It is likely that prior harvesting in this region has reduced the Yellow-bellied Glider population to this small remaining area and adjoining unlogged patches to the north. In my opinion the harvesting of Benefactor would have a disproportionately high cumulative impact and could cause the local extinction of both theses Glider species in the short term. My recommendation would be to limit harvesting to LTBAR60 selection harvesting in the structurally younger and more even-aged patch of forest evident on aerial photographs to the north east over no more than 30% of the coupe. The operations map for this site shows it all to be clear-felled except for small retained isolated patches and a perimeter boundary. This is an inappropriate design for the site. The western half-two thirds of the coupe adjoins a creek line and on aerial photographs is UA OG which warrants protection because of its inherent value and strategic importance for mitigating cumulative loss in a heavily logged region (see logging map below) especially in conjunction with retained unlogged habitat on nearby and adjacent coupes 460-510-0030 and 460-5100035, both of which can be seen on aerial photographs to have supported exceptionally valuable and important fire refuge and old growth habitat before they were recently (2020) logged.

	**Benefactor HSF-92 (DSC05240)** coupe showing UA OG wet forest (incorrectly classified as Mixed Species by VicForests)
	Showing the extent of cumulative logging around **Benefactor** (Map 14B) and its importance as a refuge

23. **Icy Creek Glanworth** coupe is an example of a clear-felled coupe that appears to have been inadequately assessed and planned before harvesting. So called “unmarked habitat trees” are shown on the HCV plan at a density of less than one per hectare, well below requirements. The site is dominated by Ash or Gums indicative of wet forests which are fire sensitive and appears to have been dominated by rare UA OG at least in gullies and lower slopes possibly with regrowth dry forest on the ridges (based on topographic position and structure of unlogged forest around the edges). The former merited ether protection or low intensity selection logging (LTBAR60%) retention to sustain resident GG populations. Before logging it was one of the last remaining unlogged potential refuge areas (wet forest) along the northern portion of the unmapped Icy Creek riparian corridor. BTN176 post logging aerial photography shows retained habitat trees that appear to have been scorched or killed by regeneration burns. Some of trees have no crowns and blackened trunks. Retained habitat trees are sparse and below minimum requirements, no habitat trees are retained in clumps. Logging is unreasonably close to streams and has removed potentially important fire refuge habitat.

Glanworth Coupe DJI 033 showing extensive clearfell harvesting, sparse habitat tree retention, lack of clumping and recruitment patches and inadequate protection of habitat trees from regeneration burning and what appear to be felled habitat trees on the ground.

24. **Icy Creek Hole** coupe supported rare UA OG mixed wet (Manna Gum) and dry forest (Brown Stringybark). It has an exceptionally high density of mapped habitat trees (4/ha). Spotlighting revealed an exceptionally high density of Greater Gliders (8/km) and Yellow-bellied Gliders (7/km) on site. The coupe has been clear felled up to the road boundary which has narrowed a potentially important movement corridor along Icy Creek. There is a clear need for a wide 200+ m dedicated SPZ fire refuge and wildlife corridor with periodic large (>100h) reserves at 3 km interval along Icy Creek to link all remaining remnant patches on previously logged coupes in the region. My recommendation for this coupe would have been mapping as old growth and complete protection.

Hole JRM-206 (IMG 0787) Coupe showing clear felled dry forest.

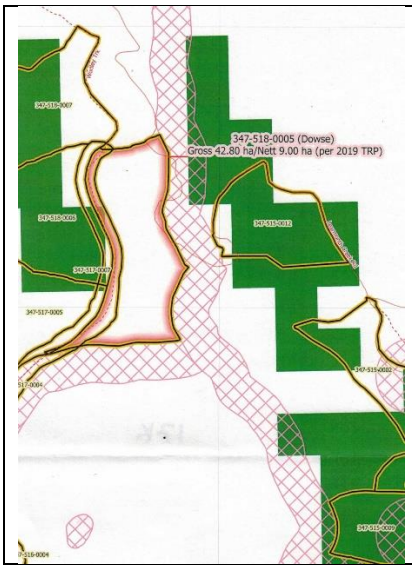
25. **Kinglake Wallaces** coupe appears from site and aerial photography to be dominated by predominantly dry uneven aged old growth and has an exceptional density of Greater Glider records (0.6/ha). Clear felling is not ecologically appropriate or necessary in this forest type (Lutze et al 1999,2004, Smith 2019). **Forest in the wetter northeastern half of the coupe is an ideal refuge area for extensive areas**

of category 2 burnt state forest to the east and merits protection as a long term old growth fire refuge habitat. My recommendation would be to limit harvesting to 40% of the site on the drier ridge tops dominated by dead habit trees using LGTBAR60 selection harvesting with retention of all trees with hollows (living and dead) > 80cm dbh. The harvest (HCV) plan does not show the types of habitat trees present other than "dead" and "habitat". There is an exceptional density of these trees on site (5/ha). The plan calls for additional habitat tree protection in some patches, but this will be ineffective as the patches are all isolated and any Gliders that survive immediate logging will die off in the short term. The plan also calls for retention of an unlogged screen buffer with private property on the west of the coupe, and an isolated retained patch in the centre. This retention planning is not based on the habitat requirements of the Glider. Areas with a concentration of Glider records are towards the centre of the coupe along the wetter drainage line which should be the focus of any retained habitat which should also be linked to external corridors.

Wallaces HSF-92 (DSC05433) coupes showing UA OG dry/wet forest

26. **La Trobe Dowse coupe** is a good example of an ideal location for streamside corridor reserve, it is located at the junction of two streamside SPZs 200m wide. It has a moderate density of recorded GG, is dominated by rare mature wet Mountain Ash forests which appears to be very rare structural type on aerial photographs. The HCV plan identifies the stand as 1926, which places it in an exceedingly rare structural type (see figure 7) that has been almost totally exhausted by timber harvesting and which is very important to retain because of the short time left before it ages to old growth and develops hollows. Together with adjoining SPZs it forms a substantial small reserve of almost 100 ha of the type recommended for protection at intervals of about every 2 km along wildlife corridors to mitigate the fragmentation and isolation impacts of cumulative clear felling. The coupe has been partially logged in small patches, but this would not compromise its use as a corridor reserve if further logging ceased. **The coupe plan for Dowse states that no modelled Glider habitat is present and that no action for this species is required. This is clearly inconsistent with the habitat description and survey records which shown 0.16 Glider records/ha.** The HCV map shows 8 type 1 habitat trees and no other habitat or recruitment trees. My recommendation for this coupe would be complete protection from further logging due to its rare mature structure and the presence of scattered large living old trees. **Jolimont** also supports what appears to be UA OG (now partly logged) wet/dry forest with Greater Gliders and **La Trobe** supports wet forest with apparent old growth structure along drainage lines on east and west and some mature forest (about 30%) on the central ridge. The coupe plan for **Jolimont** indicates that it is an ecotonal forest between Mountain Ash and Stringybark of a

type ideal for Gliders. **The plan states that Glider habitat was identified by manual check and found to be not present. This statement is further evidence that VicForests coupe assessments are unreliable as Wotch have identified four separate Glider records on this coupe and abundant habitat is present as shown by the moderate density of widely scattered Type 1-3 habitat trees on the operations map**. It would be my recommendation for this coupe to protect all Type 1 mapped habitat trees in the wet (Ash and Gum) part of the forest by unlogged 200m buffers, and to limit harvesting in the remaining area to LTBAR60 selection logging. I have seen no HCV plan or map for **La Trobe.** Aerial photographs indicate that it is likely to be UA OG wet forest in the gullies and on the slopes and UA OG dry forest on the ridge. My recommendations for this forest (subject to habitat tree mapping) would be low intensity basal area limited harvesting (LTBAR60 limited to about 30% of the coupe on the southern ridge top and protection of the remainder as a corridor linked to other unlogged uneven-aged and old growth remnants in the surrounding area (including those extensive patches evident on air photos in coupe 349 503 0010) by a major new SPZ and wildlife corridor along La Trobe River.



Location of **Dowse** (Map 17K) coupe in the corner of an SPZ

27. **La Trobe East. Magellan, The shard, and Wanderlust** coupes are largely "infill" coupes in areas that have already been substantially logged. It is therefore important that future harvesting in these areas be carefully planned to prevent cumulative impacts from isolation and fragmentation. To this end it is recommended that 50% of each coupe be protected from harvesting, including the wetter UA OG areas evident on aerial photographs on drainage lines and lower slopes and that a wildlife corridor/fire refuge SPZs be designated along Lavery Creek to connect to retained habitat on **Wanderlust**, and along Syd Creek between **Magellan** and **The shard** and extended along Pioneer Creek east Branch to join the existing SPZ corridor to the north west (in approximate location of purple riparian zone on map 18L but wider (200 m) to include taller forest). The HCV plan for the **Shard** indicates that about 29 unmarked type 1 habitat trees are present and 52 dead stags (Type 2) and surveys by Wotch indicate that Glider records are moderately abundant. The HCV plan includes no map and does not appear to provide any special protection for GG but notes that 5 internal patches and all habitat trees will be retained. **The coupe plan Even Steven states that Glider habitat is not present and was not identified by manual check which is inconsistent with Wotch records which have identified one Glider in the small, retained corridor of unlogged habitat**. The coupe plan also states that 36 hectares of forest were logged which is greater than the 30 hectares indicated on coupe maps. The HCV map shows that habitat trees were present across the coupe before logging. In my opinion this coupe is likely to have supported a moderate glider population before logging. My recommendations for harvesting would have been low intensity LTBAR60 selection logging in the dry forest ridges over not more than 50% of

the coupe and that all habitat trees and all trees > 80 cm dbh be retained and that the site be regeneration by soil disturbance without use of fire. It would have further recommended that a 200m wide riparian zone wildlife corridor/fire refuge SPZ be mapped to connect remaining unlogged forest on **Even Steven** and retained forest on **Wanderlust** with other remnant habitat to the north.

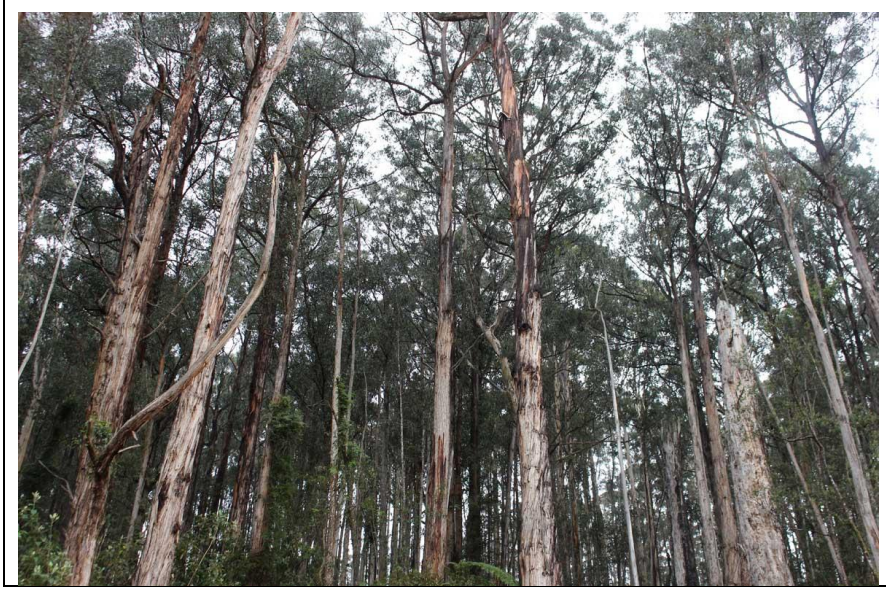
Even Steven (HSF-97 DJI0127showing extensive inappropriate clearfelling, sparse habitat tree retention and recruitment and lack of clumping

28. Limestone Ck Guanaco coupe is another example of an "infill" coupe that adjoins an SPZ corridor and would more appropriately be fully protected (in conjunction with the adjacent unlogged coupe (281-512-0006) to form habitat refuge patch of about 100 ha on the Ault Beeac creek SPZ and wildlife corridor. Aerial photographs and maps indicate that it is dominated by high Glider value UA OG wet forest. My recommendation would be full protection as a corridor reserve.

Guanaco, (Map 19B) showing strategic importance as potential fire refuge and small reserve located on a wildlife corridor to mitigate fragmentation and cumulative impacts in a region that has been heavily logged

29. **Loch Valley East. Frankinsense and Myrrh** coupes have moderately abundant Gliders and occur in ecotone wet (gum)/dry forest. Aerial photography suggests that the forest on the western and southern margins and internal drainage lines of these coupes supports UA OG and the remainder supports mature forest but site photography reveals that scattered senescent trees are moderately abundant within the canopy throughout forest that appears uniform on aerial photographs. The HCV plan shows an exceptional abundance of habitat trees (5/ha) which could have supported and exceptional abundance of Gliders before logging. The HCV plans calls for 40% retention in patches and intermittent border strips but it appears to be much less than this. There appears to have been no attempt to protect the best Glider habitat around areas with abundant Type 1-3 HTs. Coupes have been logged since aerial photography was taken. Prior to harvesting I would have recommended that at least 50% of each coupe, including all areas with UA OG or more than 0.5 habitat tree /ha. be protected from harvesting and incorporated into a designated SPZ wildlife corridor along Litaize Creek linking remnant habitat on these two coupes with other remnants in the surrounding area. Exhibit PTM 88 **Frankinsense** shows an example of a clearfelled coupe with no habitat tree recruitment, no protection of habitat trees in clumps to provide for future recruits, and habitat trees killed or crown scorched by post logging burns.

Myrrh (JRM-208 IMG 0661) coupe showing low (within or subcanopy) habitat trees



Frankinsense (JRM-206 IMG5571) showing UA OG wet/ dry forest

30. **Loch Valley Myrrh photo** BTN 190 shows that post log burn has killed and scorched retained clumps and Habitat trees. The Coupe plan for Myrrh states that "*Trees have been retained in habitat islands, habitat peninsula's within the Approved Timber Release Plan Habitat and seed trees and some habitat islands have been retained within the Harvest Unit. Most of retained trees marked, some GPSed only and some in CY area will be retained by contractor. Greater than 40% of the basal area of eucalypts across TRP coupe has been retained for Greater Glider*." Post logging drone photographs of Myrrh show that habitat has been retained in isolated clumps and habitat trees not within clumps have been burnt and most likely killed by post-harvest burns. The only habitat of immediate value to Gliders within this logged coupe is that retained unlogged around the perimeter of the coupe. Unless this retained forest is protected in a mapped SPZ it cannot be considered to have any merit as a method for mitigation of impacts on Greater Gliders because this retained forest could be removed during future harvesting of adjacent unlogged coupes.

31. **Loch Valley. Maxibon is** wet forest with a high proportion of UA OG. The HCV plan shows that this forest has a high density of habitat trees. It is a potentially important local reserve area in a region that has been extensively clear felled to the east. Because of its rarity and importance I would have recommended that all type 1 habitat trees be protected by 200m diameter unlogged buffers and the almost the whole (75%) of the coupe be protected and connected with a designated new SPZ wildlife corridor to east. The HCV plan noted that Gliders were present on the site and recommended 40% retention and stated "***Habitat and Seed trees retained within the harvest area will provide connectivity for current population of glider species across the harvested area to adjacent retained areas. Habitat patches outside boundary will be connected via scattered seed/habitat tree and islands***." For this to happen harvesting would need to be low intensity with abnormally high (60%) dispersed retention. It is apparent from the aerial photo of **Maxibon** that harvesting has been by clear felling and not dispersed retention. The proposed pattern of habitat retention in the HCV is also less than ideal with many scattered retained patches that will likely be burnt and killed. The mitigation measures proposed in the HCV plan in this coupe are likely to be ineffective and result in 100% Glider loss in the short to medium term.

Maxibon JRM-210 (DJI 0826) Aerial post logging showing use of clear-fell harvesting and lack of dispersed trees suitable for glider movement.

32. **Turkey Feet** appears to be mostly mature wet 1939 Ash Forest, a structural type that needs greater protection to provide future old growth, and to re-balance forest natural age structure to make it resilient to future fires (see Smith 2019). There appears to be some older UA OG wet forest adjacent to the creek on the western side of this coupe. The HCV map shows scattered senescent old growth Type 1 habitat tree at an average density of about 2/ha, on the eastern half of the coupe. ***The operations plan states that Gliders are not present on this coupe and were not found during a manual check. It is clear to me from aerial photographs and habitat tree maps that at least half the area of this coupe is likely to support Greater Gliders and Wotch surveys have identified 5 Glider locations on the coupe. This is another example of a coupe that has not been adequately assessed by VicForest prior to harvesting, resulting in the loss of Glider populations and habitat and failure to apply appropriate mitigation measures that would retain the species within the coupe.*** I would have recommended that harvesting be excluded from 200m diameter buffers around any living type 1-3 living senescent trees in the coupe and that a 50m wide boundary buffer and a wide unlogged strip (100m) be retained adjacent to the SPZ wildlife corridor on east side. **Turkey Feet** has recently been partly intensively clear felled (as photographed in exhibit PTM 81) leaving few or no habitat trees or recruitment trees. The density of HT is well below the required minimum of 4/ha.

33. **Matlock North** An unusual area with comparatively little recent timber harvesting that provides opportunity for effective corridor and refuge planning to prevent cumulative impacts. **Monster** coupe supports apparent UA OG on aerial photographs. The norther tip of **Monster** and the southern tip of **Tenderloin** are joined by a riparian gully system that forms an appropriate location for designating a wide wildlife corridor/fire refuge SPZ. **Tenderloin** is dominated by wet Alpine Ash forest with about 40% apparent UA OG in the gullies and slopes that requires protection because of its rarity and importance as refuge habitat. The central 40% of **Tenderloin** appears to be dominated by mature forests which could be sustainably harvested to maintain Glider populations in situ by LTBAR 60 selective harvesting. The coupe plan for Tenderloin notes that Gliders are present on the coupe but essentially proposes to take no additional ameliorative action, the plan states ***"No detection based requirements exist for Greater Gliders within the Central Highlands FMA. Apply VicForests Greater Glider Conservation Strategy prescriptions. Prioritise the largest, live, hollow-bearing trees for habitat retention".*** This statement is at odds with VicForests Glider conservation strategy which includes mandatory surveys and special protection of high-density populations with 5 or more Gliders per spotlight Km. (see Table 2). My recommendation for **Tenderloin** would have included 200m diameter retention zones around all living trees with hollows which are very rare in this forest type, LTBAR 60 selective harvesting (protected from burning) and a 200m wide buffer in the north west boundary (the only boundary not protected in the plan) because this is the area with the greatest concentration of habitat trees. **Monster is another coupe in which the coupe plan states that no Gliders are present and that none were detected in manual checks.** But HCV plan states that 3 Greater Gliders and and 8 Yellow-bellied Gliders were detected and that in response to this "86% of the gross coupe area's basal area will been retained. This basal area will be retained in exclusion areas outside of the planned nett harvest area, retention islands within the nett harvest area and retention of habitat Type 1 trees. This exceeds the requirement outlined within the Greater Glider 2019 Action Statement which requires VicForests to *'Retain at least 40% of the basal area of eucalypts across each timber harvesting coupe, prioritising live, hollow bearing trees, wherever* a *density of Greater Gliders equal to or greater than five individuals per spotlight kilometre (or equivalent measure) is identified.'***.** My recommendation for harvesting would not have differed greatly from the plan except to specify that all HT (types 1-3) be retained and that all HT and recruitment trees be protected from post log burns (HTRRCP).

34. **Matlock South Fergana** coupe appears from aerial photographs to be dominated by UA OG wet Ash Forest on slopes and creeks draining into a south flowing creek that feeds the Thomson River. The HCV plan shows a very high density of type 1 habitat trees (2.7/ha) indicating that this forest could more appropriately be mapped and protected as old growth. The forest in the surrounding region has not been extensively logged except for a part of the coupe logged in 2018-19. This provides an opportunity for more effective spatial reserve planning to prevent cumulative impacts, fragmentation and isolation in this general region. This would include mandatory protection of unlogged inter coupe boundary strips (100m), unlogged roadside protection strips (50m), and drainage line protection strips linked to a wide (200 m) SPZ corridor/refuge along the drainage line feeding to the Thomson River. However, as all wet forest UA OG warrants full protection because of its rarity and importance as future fire refuge I would have recommended full protection of this coupe. The coupe plan is well short of this, it advocates normal clear-felling with type 1 and 2 habitat tree retention (most of which will likely be burnt and killed) which will eliminate Gliders from the coupe.

35. **Mt. Bullfight**. **Bauble** coupe appears from aerial photographs to be dominated by UA OG ecotonal Ash/Gum forest on slopes draining into a south flowing creek that feeds the Torbreck River. The forest in the surrounding region to the east was extensively logged in the 1970s but the effects of this logging are not readily apparent on aerial photographs indicating that it was likely to have been low intensity selective harvesting that retained large (defective) old trees with hollows. The HCV plan for this coupe shows very abundant Type 1 habitat trees. **This is another coupe in which the plan states that Gliders are not present and were not found in manual checks, but the HCV plan notes that Glider were detected by third parties "** Within the gross coupe area 7 Greater Gliders *(Petauroides volans)* were observed in 3rd party surveys. In response to these observations 48% of the gross coupe area's basal area will been retained". ***It is matter of real concern that on this and other coupes harvesting would be much more extensive if third party citizen volunteers had not undertaken pre-logging Glider surveys***. There are other limitations with this coupe plan, the HCV plan for this coupe shows more like 30% retention, rather than 48% retention. ***Sixteen habitat trees are mapped as hazardous which is excessive and ecologically destructive if these trees are felled, a more ecologically appropriate approach would be to leave them surrounded by unlogged buffers***. The coupe supports and exceptionally high abundance of habitat trees consistent with its UA OG structure. The surrounding region provides an opportunity for more effective spatial reserve planning to prevent cumulative impacts, fragmentation and isolation. This would include protection of unlogged inter coupe boundary strips (100m), unlogged roadside protection strips (50m), and drainage line protection strips linked to a wide (200 m) SPZ corridor/refuge along the drainage line feeding to the Torbreck River. Harvesting to the west has been more recent and intensive leaving a network of retained sparse open forest or scrubs along drainage lines which currently have no mapped protection as SPZs. **The entirety of this coupe appears to be dominated by UA OG which is a rare type that warrants full protection**, there may be some scope on the higher ridges (that have < 0.5 large living habitat tree/hectare) for small gap (4 ha) clear-felling with habitat tree retention, recruitment, and protection from regeneration burning (HTRRCP). The coupe plan for this site calls for 48% retention harvesting but aerial photography indicates that CAR80 is more appropriate.

36. **Mt Delusion Groves Manna and the Falls** coupes are "inliers" within an extensive area of SPZ that forms an important corridor link between two parts of the SPZ. Both coupes appear from ground and aerial photography to be dominated by unburnt UA OG wet (Manna Gum) forest ideal for GG (see figure below). **Groves Manna** and the **Falls** were scheduled to be partially logged under a 40% retention (CAR40) harvesting plan but only logging on Groves Manna is evident on aerial photographs. ***The Coupe Plan for Groves Manna is another that states that Modeled Glider Habitat is not present, Gliders are not present and were not identified by manual check but the HCV plan notes that more***

than 5 GG detections per km. (the maps indicate 7 detections by Wotch) and 40% of gross basal area retention will be applied. The HCV plan also states that the gross coupe area is 29ha. and the retained area will be 9.3 ha., which is only 31% of the gross coupe area not 40%. The HCV plan shows that retained areas are mostly in isolated patches or islands of not short or long term value to Gliders, and which may likely be burnt in regeneration burns. My recommendation for these coupes prior to logging would have been complete protection because of their structurally rare and important old growth refuge wet forest habitat and location as a wet forest fire refuge and wet forest corridor linking two areas of SPZ (the SPZ is linked to the west but in a drier more fire prone forest type).

	Wet Forest on **Groves Manna** JRM-206 (IMG 9409) showing large old trees with hollows and UA OG structure
+ 	Wet Forest on **Falls** JRM-206 (IMG9504) **showing** large old trees with hollows and UA OG structure

37. **Mt Despair Pony and Brumby** This area has been extensively logged to the south and extensively severely burnt to the east which has greatly reduced the size, extent and connectedness of remnant GG habitat in the region and increased the importance of surviving Glider populations in the region as source population for dispersal to the east as the forest recovers from fire. Both coupes are dominated

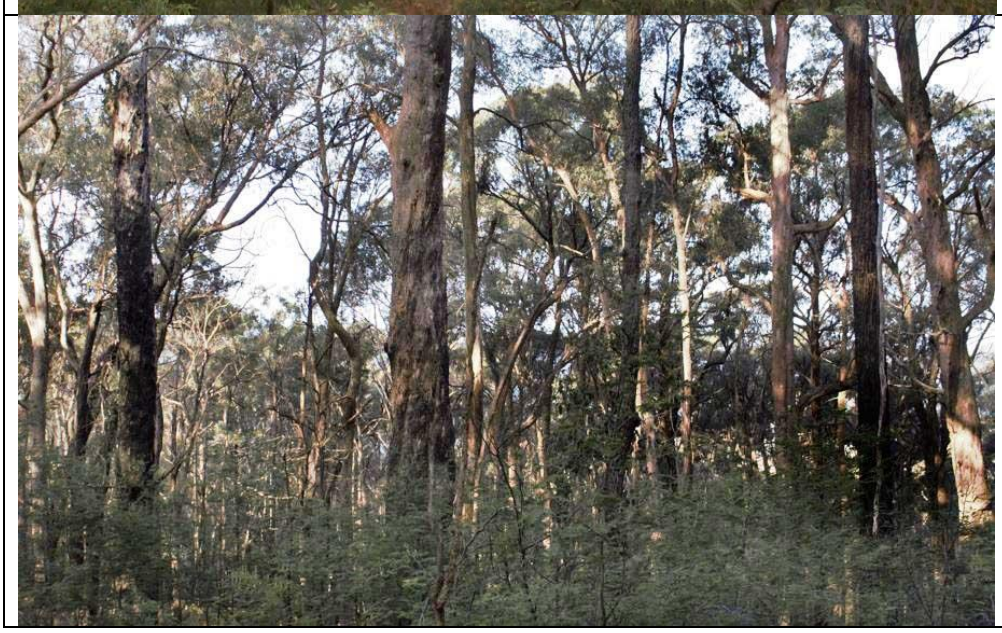
by UA OG predominantly dry/wet forest of high GG and fire refuge value. The HCV plans show a very high density of Type 1 (senescent) HT indicative of old growth forest. Both Coupes support a high density of Glider records. The coupe plan for **Pony** identifies Gliders as present and says "***Several type 1, type 2 & type 3 habitat trees have been marked and will be retained. Retention islands will be used throughout the area to maintain connectivity with the surrounding forest."*** These mitigation measures are minimal, ineffective and are indicate a lack of understanding of Glider habitat requirements (retained islands decrease connectivity). ***The HCV plan for Pony states that 40% of habitat will be retained but the plan allows for retention of only 28%.***, and most of that is located in islands that are likely to be isolated and burnt or retained in narrow filter strips, rather than being additional to normal retention. The HCV plan states that all type 1 habitat trees will be identified and retained and an additional 4 trees will be retained for each type 1 habitat tree, it also states that 10.2 hectares of the coupe will be harvested under the Selection Harvest silvicultural system. This area contains a high number of Greater Glider & Yellow-Bellied Glider observations along with a high density of type 1 and type 2 Habitat trees. Habitat on **Pony** and **Brumby,** along with that on adjacent coupe 298-510-0003, provides a rare and important large (about 120 ha) patch of GG habitat of sufficient size to sustain a viable Glider population over the period of about 120 years or the time required for surrounding regenerating wet forest to reach maturity. Consequently, I would recommend 100% protection of Brumby and Pony as a refuge/corridor reserve on a new wildlife corridor SPZ to be designated along Kalatha Creek, rather than the CAR40 in the coupe plan. The Coupe Plan for Brumby is another that states that mapped Glider Habitat is not present, Gliders are not present and were not identified by manual check but the HCV plan notes multiple Greater Glider and Yellow-bellied Glider detections across the coupe and proposes selection harvesting on 16 hectares where HBT density exceeds 10/ha. and normal clearfelling where HBT is < 3/ha. The HCV map shows an area to be selection harvested but mapping in this area shows only 3 HBT/ha. This discrepancy raises concerns that Habitat Tree numbers are being under-represented on coupe maps. **Shetland Carriage** coupe falls within an important unmapped riparian corridor that runs along Horseyard Creek. It is dominated by rare UA OG Mountain Ash. Logging of this coupe has damaged the integrity of this corridor along with recent logging of adjacent coupe 298-510-0002. **Exhibit PTM 95 Shetland Carriage**, shows a felled large tree which should have been retained as HT and shows limited effort to windrow felled waste stems away from HT to reduce killing of HT in regeneration burns.

38. **Mt Klondyke Updownies and Sun Downies** are "infill" coupes within a substantially logged region that will have higher than normal cumulative impact if harvested. My recommendation for these coupes would have been to retain 100 m wide unlogged border strips on the west, south and east of the combined coupes and to link this with a 100m wide SPZ wildlife corridor running from the northern 25% of each coupe through coupe 2975120002 down Katy Creek to link with an existing SPZ. ***The coupe plan for Updownies and Sundownies calls for 40% retention but the plans shows less retention and reliance of existing retained areas in filter strips and Leadbeaters Possum habitat***. Normal clear felling and burning is proposed across most of the coupes which is ecologically unsustainable, unnecessary and inappropriate because the coupes are dominated by dry (Messmate) forests which have a naturally uneven-aged structure that demands harvesting by low intensity selection logging to maintain suitable structure for Gliders. This area could be logged by LTBAR60 selective harvesting within the available envelope. My Recommendation for **Propeller** would be selection harvesting (LTBAR60) since this is a predominantly dry forest type that is resistant to fire and regenerates naturally from soil disturbance.

	Dry/wet forest on **Updownies** HSF-92 (DSC05089) showing UA OG structure and abundant large old trees with hollows
	Dry forest on **Sundownies** JRM_206 (IMG 5445) showing UA OG structure and abundant large old trees with hollows, this structure can only be maintained by LTBAR60 selection logging

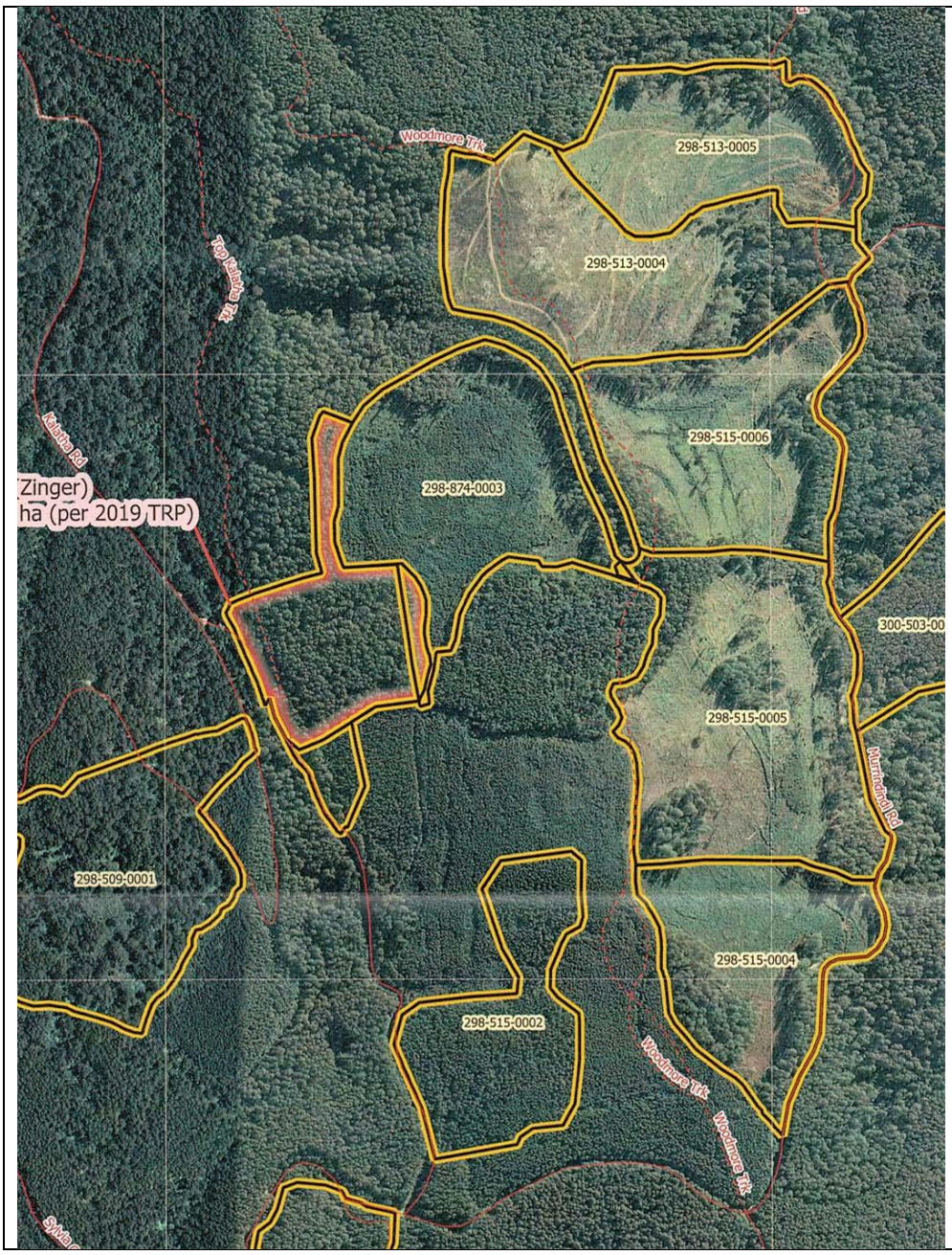
39. Mt Torbreck much of the forest surrounding **Triple Don and Don Too** coupes is mapped as having been logged in the 70s but there is not much evidence of damage to forest structure on aerial photographs suggesting that this harvesting was of low intensity. **Both coupes support exceptional numbers of GG providing proof that low intensity selective harvesting is consistent with the maintenance of GG populations in situ and is a real practical solution to ecologically sustainable forestry**. The coupes are dominated by dry forest and both have a natural UA OG structure suitable for LTBAR60 selective logging with corridor retention. There is opportunity for greatly improved planning to mitigate cumulative impacts of fire and logging in this region by crating SPZ wildlife corridors and refuges along the moister gullies and creek lines and linking these with Eildon National Park to the north. The coupe plan for Triple Don calls for 40% retention of coupe area through selection harvesting. Site photos point to a relative scarcity of mature stems of these sites due to past logging, so there is a real risk that timber harvesting would fell and utilize the "defective" old trees with hollows for woodchip which could lead to effective clear felling, so it would be essential that any retention harvesting was "dispersed" with at least 60% retention across 40-80 cm tree size classes.

The HCV plan shows very narrow unlogged boundary buffers I would recommend widening these to 100m.

	**Don Too** JRM-206 (IMG0484) coupe showing UA OG structure with old trees with hollows and younger trees
	**Triple Don** JRM-206(MG5270) coupe showing UA OG structure with old trees with hollows and younger trees

40. Murindindi Sth On aerial photographs **Zinger** is an infill coupe adjoining a heavily logged area dominated by UA OG wet Ash forest, a rare structural type that requires protection to rebalance forest structure and provide refuge habitat in the event of future fires. Half the coup is located as an indent within an SPZ riparian zone corridor (see map 30d) along Kalatha Creek. My recommendation for this coupe would be to protect 100% and include it within the SPZ to provide a corridor link with remnant habitat evident on aerial photographs to the east, north and south. It is noteworthy that coupe 298 874 0003 to the northeast of Zinger has been extensively clear felled with no apparent habitat tree retention or recruitment and no boundary strip retention adjacent to **Zinger**. A boundary strip is retained between this coupe and four intensively harvested coupes to the east. The application of boundary retention strips in this region appears ad hoc and inconsistent, resulting in gaps which cause

fragmentation of retained habitat making isolated patches such as those in coupes 298-5150005 and 298515-0004 (see below) death traps for Gliders in the short and long term. The coupe contains a giant tree (>2.5m dbh) which will be left exposed by adjacent clear felling. The presence of this tree is an indication of the high fire refuge status of the region.



Aerial photograph (30M) showing pattern of harvesting and retention in the vicinity of **Zinger** coupe. Note the scarcity or absence of habitat trees and habitat tree recruitment in adjoining clear felled coupes, and the disjunct isolated retained habitat patches

41. **Neerim East Walkindapark** coupe is critically located on an unlogged saddle between two large areas of pine plantation that forms an important corridor link between drainage lines to the east and west. It is an important location for a dedicated wildlife corridor at least 200m wide along Hard UP Creek and over the saddle to the west. Wet Forest occurs along the drainage line on the northern edge of the coupe and dry forest upslope on the remainder. Because the remainder of the stand is dry forest it is ecologically appropriate that it be logged by selection harvesting and regenerated by soil disturbance rather than clear felling and slash burning. The Coupe Plan calls for a stream buffer on the north, 20 m road buffers and retention areas on the western and eastern boundaries, retention of large trees with hollows, 40% habitat retention for GG and clear felling and burning or the harvest

area. The plan also calls for no tree retention or trees and removal of dead trees within 1 tree length (about 50m) of all boundaries and roads which could eliminate tree hollows from retained boundary strips making these retained areas unsuitable for Gliders. **This plan will cause elimination of gliders from the harvest area and will almost certainly cause elimination of Gliders from the retained areas once surrounding areas of forest have been logged in a similar manner due to the narrow width of retained corridors and small size of retained patches**. For this coupe I would have recommended retention of a wide corridor (100m along the northern boundary of the coupe adjoining the creek and selection harvesting (LTBAR60) with retention of all large trees with hollows in the balance of the coupe in order to retain Gliders in situ over the long term.

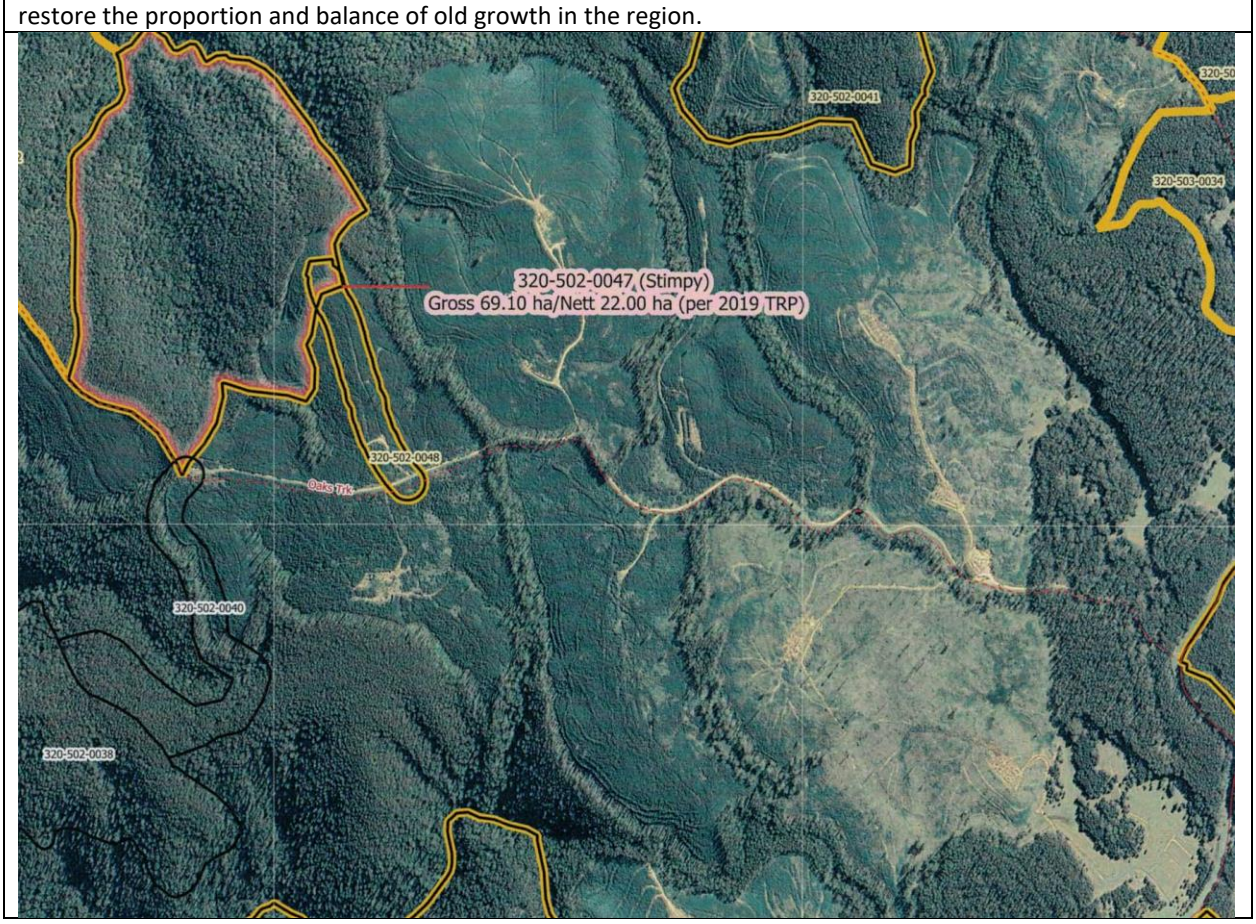
Walkindapark JRM-210 (DJI 0973)coupe showing ecologically inappropriate clear felling in dry forest, and 40% retention in narrow filter strips and perimeter areas

42. **Nuniong** The forest on and around **Windy Road** coupe was extensively logged in the 1970s and early 1980s but much of the coupe still appears from aerial photographs to have an uneven aged UA OG structure especially in the riparian zones. There is one Greater Glider record for this site despite its remoteness near Errinundra Plateau and the HCV plan calls for 40% retention harvesting. Given the relative scarcity of mature wet forest in this region (see figure below) my recommendation would be 100% retention to retain the UA structure which is extremely rare in Alpine Ash.

Windy Road JRM-206 (IMG9640) Coupe showing UA OG wet forest

43. **Oaks Creek.** Timber harvesting in the area around **Stimpy** coupe can be seen on aerial photographs to be a good example of "tree cropping", intensive clear felling in Ash Forest with no or minimal consideration to habitat tree retention and recruitment within coupes. There has been some retention of narrow unlogged corridors around the margins of some coupes, and some retention of unlogged strips along part of one road edge but these retained areas are not protected in designated and mapped SPZs and are likely to degrade and become cleared or fragmented over time. The forest on **Stimpy** appears on aerial photographs to be UA OG in the north flowing drainage lines and gullies and uniform mature (1939) forest on the ridges. Given the absence or near absence of habitat trees on clear felled coupes in this region the retention of all forest areas with a density of > 0.5 large living tree with hollows is of critical importance for GG and Leadbeaters Possum. It would be my recommendation to protect 200m buffers around any senescent trees and harvest the remainder of the forest by LTBAR 60 retention. The reason for selective harvesting in this coupe is that 1939 regrowth is now 80 years of age and some trees in this cohort are just beginning to get buttress hollows. It will need only another 40 years for this forest to reach senescence and form stem and branch hollows for use by GG and other species. Selective harvesting of this forest will create a future UA OG structure in about 40 years' time. The importance of retaining suitable structure for Gliders in **Stimpy** is greatly elevated by the lack of retained habitat and recruitment trees in adjacent logged forest (see below)

Aerial photograph (map 33M) of clear felling in the vicinity of **Stimpy** showing: scarcity of retained habitat or recruitment trees in adjacent logged coupes, the importance or retaining any forest patches with large old trees with hollows in this region, and the importance of saving and recruiting a significant percentage of 1939 regrowth in this region to provide future old Growth forest with hollows in the quickest possible time (about 40 years) to restore the proportion and balance of old growth in the region.



44. **Spraggs West (Exhibit MFR-5D) Jokes** and the adjoining **coupe 297-504-0001 Gags** are examples patch retention logging (CAR 40% retention) specified in coupe plans which is not suitable for sustaining Greater Gliders. Forest structure on the site appears from habitat tree mapping and drone photos to be mature dry forest (although it is mapped by Vic forests as predominantly wet forest) with a moderate density of scattered senescent habitat trees. It has a low density of habitat trees concentrated in the drainage lines so focus should have been on protection of the existing large habitat trees and recruitment of new habitat trees. Patch Retention Timber harvesting has clear felled to the coupe boundaries, and retained small patches of forest that appear to lack hollows and are too small in size to and isolated to sustain resident gliders over the short or long term dispersed across the coupe. Some of these isolated patches have been reported to support Gliders post logging (exhibit MFR 5D) but any such animals are likely to die out in the near future if clear fell logging is continued in this area. These retained patches are not large enough to support breeding pairs and too exposed for gliders to avoid predators. My recommendation for timber harvesting on these coupes would have been to maintain and promote UA OG structure by limiting harvesting to LGTBAR60 selection logging harvesting that retained all trees with hollows and all trees > 80 cm dbh, and to retain a wide (100m) unlogged wildlife corridor extending northwards along Gutter Creek.

45. **Spraggs West and Castella. Castella East** has an exceptional density of mapped habitat trees (5/ha). **The HCV plan states that any habitat with at least 5 habitat trees per hectare in mixed species forest is defined as High quality Greater Glider Habitat.** This coupe clearly qualifies for 40% retention but no special protection measures are applied and the coupe plan shows clear-felling with limited border retention. The coupe plan for **Funny** states that ***"40% of the TRPs basal area must be retained. This is to be achieved through widened boundaries, retention corridors, islands and retained trees within the harvest area. This will better support the Greater Glider and other arboreal mammals present in the general area".*** Clear-felling is not ecologically appropriate for the dry forest type on **Funny** and will convert the current UA OG forest structure to uniform regrowth which is not suitable for Gliders. My recommendation for harvesting in **Funny** would be to protect the entire coupe as a small reserve on the adjacent SPZ wildlife corridor. So much of the surrounding area has been inappropriately clearfelled that protection of this coupe is important to prevent cumulative impacts in the region. On **Castella East** coupe I would recommend protection of all the UA OG wet forest along the riparian drainage, creation of an SPZ wildlife corridor/fire refuge along eastern edge of this coupe extending north to reach retained forest on **Funny**, and low intensity selective harvesting (LTBAR60) on the structurally mature remaining 50% of the coupe with protection of all existing tree hollows and recruitment where less than 4/ha.

46. **Thomson River Tense** coupe was previously logged in 1964 and in a small patch in the south in 1974 but still supports GG and an apparent UA OG dry/wet forest structure evident on site and aerial photos. Ecotonal wet/dry forest with this structure is preferred by GG. Habitat on the coupe is ideally located for protection in the headwater of creeks draining into the adjacent National Park. The coupe plan notes that GG are present on the site and recommends that "*Areas identified with higher habitat values such as HBT 1 trees are retained and excluded from harvesting in islands incorporating recruitment and Glider feed trees."* Harvesting is by clear felling with no Glider habitat retention. This will destroy the existing UA OG structure preferred by gliders and change the forest to unsuitable uniform regrowth in which retained habitat trees will have no value. My recommendation would be to limit harvesting LTBAR60 selective logging that retains all trees > 80 cm dbh.

Tense coupe JRM-206 (IMG 6402) showing UA OG structure in mixed wet dry forest.

47. Timbertop All three coupes (**Wales, Ruprecht, Princess Di**) have recently (post 2017) been partially logged by intensive clear felling without adequate habitat tree protection or recruitment (**Princess Di and Wales**). The Coupe Plan for **Wales** notes that Glider are present and recommends that "Additional feed and recruitment trees should be retained around hollow-bearing trees in the sighting area giving consideration to the connectivity to other retained habitat." The unlogged southern portion of this coupe appears to be dominated by extremely rare UA OG Alpine Ash. My recommendation would be to protect all remaining unlogged forest given the rarity of old growth Alpine Ash and proximity to National Park. I would also recommend that a new SPZ wildlife corridor 200m wide be mapped down Blackbird Creek to link and capture extensive areas of wet forest UA OG evident on aerial photographs to the south of this general region. **Ruprecht** coupe is structurally similar to Wales but according to the coupe plan is more dominated by dry forest (messmate) rather than Alpine Ash. My recommendations for this coupe would be to protect all senescent Gums and Alpine Ash with hollows by 200m unlogged buffers and to LGTBAR selectively harvest the rest with retention of all trees > 80cm dbh. This should maintain existing UAOG structure. The HCV and coupe plans for **Princess Di** do not note Gliders as present although there are mapped records on the northern boundary. An aerial photos forest structure on this coupe is similar to the other coupes in this area so my recommendations for silviculture would similar to those for **Ruprecht**.

48. **Torbreck North**. No coupe or HCV plans supplied. My recommendations for Coupes **Gulmarg and Kinabalu** would be 100% protection due to dominance by wet forest UA OG a rare structural stage of ash forest that need immediate protection to re-balance forest structure to provide hollows and refuge habitat. Adjacent **coupe 289-504-0001** is another example of inappropriate patch retention timber harvesting, that leaves retained habitat as small, unviable isolated patches. This pattern of harvesting is based on northern hemisphere logging principles that have no relevance to Australian Eucalyptus forests.

	**Gulmarg** BTN-168 (DSC04937 coupe showing UA OG wet forest
	**Kinabalu** BTN-168 (DSC04967) showing UA OG wet forest

49. **Torbreck North**. Coupes **Laundry and Hills Hoist** appear to be dominated by a mix of mature forest and Uneven aged Old growth (UA OG). Site photos show old growth trees with hollows. These coupes adjoin a conservation reserve along Snobs Creek. In these coupes I would recommend 100% reservation of **Laundry** and 50% protection of **Hills Hoist** on the lower and northern edges with 200m unlogged buffers around all large Ash trees with hollows, and with a mix of small gap (< 4 ha per patch) clear felling and LTBAR60 selective harvesting (where existing habitat trees are less than 4/hectare) in the matrix surrounding the clear felled gaps in the remaining 50%, subject to ground survey and validation of forest structure. Hot burning regeneration to be limited to pushed heaps in 4 hectare clear felled gaps, no burn soil disturbance or cool individual tree head burn for regeneration in selectively harvested forest.

	**Laundry PTM-80 (DSC 01719)** showing UA OG wet forest
	**Hills Hoist** PTM-80 (DSC 01758) showing UA OG wet forest

50. **Upper Thomson Rock A Rhyme** coupe appears to be rare UA OG Mountain Ash forest with some uniform age 1939 mature forest on the ridge. The HCV plan recommends clear felling of the central area and retention of 40% around the boundary. I would recommend protection of all individual Ash trees with hollows by 200 m unlogged buffers and LTBAR60) selection harvesting of the remaining area to re-balance forest structure away from uniform 1939 regrowth. I would also recommend a new protected SPZ wildlife corridor/refuge 200m wide down Whitelaw Creek West Branch. Previous clear fell harvesting in adjacent **coupe 458-501 0009** in **2016-2018** shows evidence of an unnecessarily excessive hot burn which has killed retained trees leaving a bare area of about 30 hectares. This has increased the importance of retaining habitat Rock a Rhyme and other as yet unlogged coupes. Live Habitat tree density in these logged coupes appears to be near zero, and dead (fire killed) habitat tree density is about 0.25/ hectare instead of the required 4/ha under the Code of Practice. **Coupe 458-511-0008** to the west also shows evidence of hot regeneration burn, inadequate habitat tree protection and recruitment and failed regeneration after intensive clear-felling in 2014/15.

51. **Wombat Ridge Whiska** coupe is dominated by wet and dry forest. It has an uneven-aged old growth structure on aerial photography with large trees with hollows evident on-site photographs. Given the

rarity of this structural form and the location of the coupe on a saddle between east, south and west flowing streams it is recommended that the coupe be fully protected and linked to riparian SPZ wildlife corridor/fire refuges designated along streams flowing to the east, south and west.

Whiska JRM-206 (IMG6034) coupe showing UA OG structure.

52. **Wombat Ridge Blue Streak** Prior to logging these coupes appear from remnants left unlogged on aerial photographs to have been dominated by mixed regrowth and UA OG forest with an open structure and scattered old trees possibly left after selective harvesting in the 1960's. The coupe has recently been clear-felled and subject to a hot regeneration burn which scorched the retained trees and forest patches. The coupe has also been logged to the road and creek boundary in the west where it would have been appropriate to leave a 100m wide strip adjoining the natural corridor along the riparian zone. A wildlife corridor SPZ is critical in this location to link large areas of SPZ 500m to the south with another very large area of SPZ to the northwest as shown on map 39A. My recommendation for silviculture in this coupe would have been to apply a pattern of logging more similar to that seen in the adjacent recently logged **coupe (485-507-0015**) but with less intensive harvesting (Dispersed CAR60 of LTBAR60), no isolated retained patches and no intense regeneration burn, to maintain and improve forest structure for Greater Gliders throughout the remaining areas of 1939 regrowth forest.

	**Blues Streak** photo DJI 0280 showing how retained patch has been burnt by post logging regeneration burns

ATTACHMENT 1 CV

Andrew Peter Smith: summary cv

Address: Mail: PO Box 4130 Elanora Qld. 4221
Ph 07 55983952 mobile 0402432622
Email: setscan@gmail.com

Nationality: Australian

Qualifications

B.Sc.Hons 1 University of Sydney, 1975
Ph.D Monash University, 1981

Current Position

1992-2021 Director & Principal of Setscan Pty Ltd T/A Austeco Environmental Consultants

Previous Positions

2010-17 Director, Trustee & Manager Anna Cove Pty Ltd and Waezone Pty Ltd Commercial Investment Property Trusts on behalf of private unit holders (asset value $13 Million)
2003-2004 Chairman, Board of the Nature Conservation Trust of NSW
2001-2007 Professional Conduct & Ethics Committee, Ecological Consultants Assoc. NSW.
1999-2001 Foundation President, Ecological Consultants Association of NSW
1991-96 Associate Professor of Natural Resources, University of New England
1986-93 Sub Dean of Natural Resources, University of New England
1980-85 Lecturer in Natural Resources, University of New England
1989-90 Leader, World Wildlife Fund / USAID Biodiversity Planning Mission Madagascar
1977-80 Commonwealth Postgraduate Scholar, Monash University
1976 Experimental Officer, CSIRO Division of Entomology, Darwin.

Management Experience

- Director and Principal of Austeco Environmental Consultants (budgeting, tendering, client liaison, team leader for a wide range of ecological projects) 1992-p
- Director and Chairperson for two commercial unlisted property trusts (arranging finance, loans, leasing, general property management, trustee duties for unit holders).2011-2017
- Director of Newholme, University of New England Natural Resource & Agricultural Research Centre (funding, staffing, strategic planning, environmental and agricultural enterprise management).1985-92

Environmental & Scientific Expertise

- Environmental Law: expert witness in the NSW Land & Environment Court on a wide range of environmental matters including provision of evidence, reports, negotiation, mediation, and joint conferencing, for a wide range of private and government clients including Department of Planning, DECCW, and various Councils. (1990-p)
- Environmental Planning and Management: team leader for design, assessment, implementation, review and monitoring of ecological components of a wide range of major projects including subdivision, utility services, & mining.1987-p
- Independent reviewer for ecological components of a wide range of environmental development projects including subdivisions, power lines, pipe lines, road works, dams, sewage treatment for Department of Planning, Councils, solicitors, major developers and various private clients.1992-p
- Threatened Species: survey, impact assessment, research, monitoring and management. 1976-p
- Endangered Ecological Communities: survey, classification, management & remediation.1992-p
- Vegetation Survey, Classification, Mapping, Restoration & Management. 1992-p

- Air Photo (and Satellite Image) interpretation, classification and mapping. 1977-p
- Biodiversity Methods; wildlife survey, habitat survey, statistical analysis, modelling 1977-p
- Invertebrates: survey methods, ecology, conservation significance, insectivore diets.1970-p
- Native Vegetation Clearing & Conservation: policy, compliance, remediation, tree ageing.1995-p
- Possums, Gliders and the Koala: ecology, conservation and management.1977-p
- Ecologically Sustainable Forestry 1978-p
- Eucalypt Dieback 1978-p

Report Writing & Publication

- Author or co-author of more than 50 refereed original scientific research papers
- Author of co-author of more than 60 major environmental reviews, assessments, & reports
- Author and co-author of major policy reports, guidelines and expert systems for the NSW government to facilitate implementation of environmental legislation including ecologically sustainable forestry guidelines for private lands, clearing in the western Division (WISE), and threatened species protection on Protected Lands (Habasys).

Teaching, Extension & Media Presentation

- 16 years academic experience teaching natural resource management at a tertiary level
- 20 years experience presenting professional short courses and workshops
- Presentation of more than 35 invited lectures and talks to institutions, organizations, and the media.

Some Key Service Positions

- Foundation Member and Chairman of the NSW Nature Conservation Trust (2002-2004)
- Foundation President of the Ecological Consultants Association of NSW (1999-01)
- Member, Hastings River Mouse Recovery Team 1992-2001
- Member, International Union for Conservation of Nature Marsupial Specialist Group 1985-p
- Member, Leadbeater's Possum Management Advisory Committee 1980-96
- Member, Inter-agency Advisory Committee on clearing controls in the Western Division of NSW Department of Land and Water Conservation 1995-7.
- International Team Leader, National Park Design, Madagascar, WWF International, 1989-95
- Convener (Biological Conservation) International Mammal Congress Rome 89, Sydney 93.
- Convenor Maurice Wyndham National Sustainable Forestry Conference, UNE, 1993
- Convenor, possum and glider symposium University of New England, 1984
- Scientific referee for more than 13 scientific journals

Appointments to Expert Panels and Inquiries (1989-2015)

Appointments to government expert panels and inquiries into a wide range of conservation and natural resource management issues including the following examples:

Koala Expert Group

- ***EPA NSW Govt. (2015)*** Independent koala expert, koala habitat definition, mapping and conservation planning.

Ecologically Sustainable Land Use Planning

- ***Coffs Harbour City Council (2009)*** Independent review of regional corridor plan & strategy
- ***Great Lakes Council (2002)*** Chairperson Expert Panel, Ecological Constraints Planning, Hawks Nest Study Area

Biodiversity Conservation

- ***NSW National Parks and Wildlife Service (2000)****:* Koala Expert Panel, preparation of guidelines, methods & models for the koala under the Native Vegetation Conservation Act.
- ***Department of Urban Affairs and Planning, NSW (1998):*** Sustainable Forest Management Systems, member of expert panel appointed to review management systems, policies, environmental laws and

processes for achieving ecologically sustainable forest management in all New South Wales Government Departments involved in environment regulation (NPWS, DUAP, EPA, SFNSW, DLWC, DMR).

Ecologically Sustainable Forestry

- ***Department of Natural Resources, QLD (1998):*** Tree Hollows Expert Group, formulation of guidelines and prescriptions for managing habitat trees in Queensland state forests.
- ***Environment Australia (1998):*** Threatened and Significant Species Expert (nocturnal birds, arboreal mammals, frogs, bats, & terrestrial mammals), responsible for devising and recommending reservation and management strategies for threatened & significant species in forest CRA regions.
- ***Forests Task Force Department of Prime Minister and Cabinet and Resource and Conservation Assessment Council NSW. (1997).*** Fauna Expert, expert group report on forest management practices for Eden Regional Forest Agreement (RFA).
- ***Ministry for Land and Water Conservation, NSW (1996):*** Sustainable Forestry Expert, one of three experts appointed to review the proposed Gap and Cluster Silvicultural Method for the Minister for Land and Water Conservation.

Heritage Conservation

- ***Australian Heritage Commission (1993-94*)**: Expert adviser on procedures for identification of places of significance for listing on the National Estate.
- ***Ministry for Planning and Environment, Victoria (1989):*** One of three experts appointed to conduct a hearing and inquiry into a proposed wood-chipping and pulp mill development in East Gippsland.

Some Major Projects & Clients

- **Environmental Protection Authority 2015-16** of NSW Expert review of koala habitat mapping survey and validation study.
- **Environmental Justice Australia 2016** Supreme Court Proceedings impacts of forestry on Yellow-bellied Gliders in East Gippsland 2016.
- **Byron Bay West Landholders Association (2010-15):** Design, supervision, review and strategic planning of ecological components (all flora & fauna), major projects West Byron.
- **Gales Holdings (2003-11)** Design, supervision, review and monitoring of ecological components of proposed developments, including expert witness services, and preparation of ecological management plans for Wallum Froglet and Mitchell's Snail Kingscliff, Tweed Shire.
- **Newcastle City Council (2010):** independent peer review and expert witness ecological impacts of road works of threatened bats.
- **Environmental Defenders Office (2009-10)** Expert witness, review of ecological impacts (endangered ecological communities, fauna) of proposed limestone mining Hunter Valley.
- **Department of Environment and Conservation (2008-09):** Expert witness, assessment of illegal clearing impacts on threatened fauna and endangered ecological communities under the NVA 2003 and TSC Acts, Port Stephens and Pilliga regions of NSW.
- **Department of Planning (2008)** Expert review of development impacts on the Koala threatened fauna and endangered ecological communities Hawks Nest NSW.
- **Lake Macquarie City Council (2007-08):** preparation of Squirrel Glider Conservation Plan.
- **Mirvac Pty Ltd, Walker Corp., Johnson Property Group Pty., Ltd., (2003-2010):** ecologically sustainable development planning (ecological constraints mapping, threatened species and endangered community assessment, koala management, habitat restoration, monitoring and management, liaison with Councils and Government) various localities in Great Lakes, Lake Macquarie, Port Stephens, Tweed and Wyong Shires.
- **Wyong Shire Council (1999-2003):** Biodiversity and threatened species conservation planning for Biodiversity Certification including: threatened species habitat modelling and mapping with GIS, corridor planning, population viability assessment, setting conservation targets & reserve design for the entire Shire .
- **Wyong Shire Council (2002):** Preparation of Squirrel Glider Conservation Management Plan.

- **Department of Land and Water Conservation (2000-03)**: Preparation of guidelines for sustainable land clearing, threatened species protection and native vegetation conservation in western NSW including the northern floodplains bioregion of NSW (for NPWS and DLWC) and review of southern mallee clearing guidelines (for DLWC).
- **ACI Glass (2000)**: review of mining impacts on threatened species and vegetation restoration on coastal dunes.
- **Department of Land & Water Conservation (1999-02)**: Preparation of guidelines and decision support system for ecologically sustainable forestry on freehold lands in NSW and for land clearing in central and western NSW.
- **NSW National Parks & Wildlife Service (1999-2000):** Preparation of guidelines for biodiversity planning and threatened species conservation in Western NSW.
- **NSW National Parks & Wildlife Service (1998-2000)**: Flora survey, vegetation classification, mapping, modelling, and threatened flora management for various national parks in the Dorrigo and Glen Innes regions of north east NSW.
- **State Forests of NSW (1996-97):** Koala survey, habitat modelling, forestry impact assessment, and conservation planning Pine Creek State Forest.
- **State Forest of NSW (1992-97):** Fauna and Flora Surveys, Impact Assessments, Mitigation Measures for Sustainable Forestry and Preparation of Fauna Impact Statements and Species Impact Statements for various State Forests in north east NSW (Glen Innes, Coffs Harbour, Urunga, Grafton, Murwillumbah)
- **Hastings River Mouse Recovery Team (1995-97):** Preparation of Hastings River Mouse Recovery Plan, including additional survey, diet research, habitat modelling and conservation planning.
- **Department of Urban Affairs & Planning (RACAC, 1997):** Assessment of forest management practices on biodiversity (flora and fauna) in the Eden Management Area.
- **Department of Public Works and Services (1996)***:* Assessment and mitigation of sewerage outfall impacts on aquatic communities, Port Macquarie.
- **State Forests of NSW (1991-1995)**: Fauna and flora surveys and preparation of fauna impact statements and species impact statements for proposed forestry operations in Murwillumbah, Grafton, Casino, Glenn Innes, Coffs Harbour and Urunga forestry districts.
- **World Wildlife Fund & USAID (1989-95)**: Nature reserve design in Madagascar using rapid biodiversity survey methods and biodiversity modelling with Geographic Information Systems.
- **World Wildlife Fund Australia and (1985-87)** Survey and management of Leadbeater's Possum

Supreme Court Experience

- Environment East Gippsland Inc v VicForests. 2010 VSC 335 Expert evidence on impacts of forestry practices on possums and gliders.
- Gales Holdings v Tweed Shire Council 2011. Expert evidence on vegetation change (from air photos and ground surveys), and threatened fauna (wallum froglet, Mitchell's Rainforest Snail) habitat change following alterations to drainage and hydrology.

NSW Land & Environment Court Experience

Court Appointed Expert

- Threatened Fauna and Flora, KR Nash v Minister Administering Environmental Planning and Assessment Act 1927 no 10530 of 2006
- Threatened Fauna and Flora, Jarberg Investments PL v Great Lakes Council LEC Proceedings 10277 of 2005;
- Squirrel Gliders, First Cape Management PL v Lake Macquarie City Council. LEC Proceedings 11475 of 2004;
- Squirrel Gliders, CBD Prestige Properties Holdings v Lake Macquarie City Council. LEC proceedings 11067 and 11110 of 2004.

NSW National Parks and Wildlife Act:

- Expert witness for Corkill in Corkill vs Forestry Commission of NSW, one of 10 expert witness in the landmark Chaelundi case which gave rise to the NSW Endangered Fauna Interim Protection Act 1991).

Endangered Fauna Interim Protection Act:

- Expert witness for NSW National Parks and Wildlife Service, first prosecution under the Endangered Fauna Interim Protection Act,1994 (for taking and killing Koalas).

Mining Impacts & Rehabilitation:

- Expert witness limestone mining impacts on endangered ecological communities and threatened species (Upper Hunter Shire Council and Stoneco v Newcastle and Hunter Valley Speleological Society (LEC 10497 of 2009).
- Expert witness (provided preferred evidence on vegetation restoration, wallum froglet, and other threatened fauna) for ACI glass (sand mining) in ACI v Port Stephens Council, 2000.

Endangered Ecological Communities

- EECs on NSW coastal floodplains, provided key evidence for two landmark cases which clarified the identification of coastal floodplain EECs, Ports Stephens Council v Motorplex Australia LEC 11328 of 2004,
- EECs on NSW coastal floodplains, landmark case which clarified exclusion of sand plain communities from coastal floodplain EECs, Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209 10264 of 2005).

Threatened Species (Koala, Phascogale, Wallum Froglet, Squirrel Glider and others):

- Expert witness threatened fauna and flora, Motorplex Australia PL v Port Stephens Shire Council. LEC 11328 of 2004;
- Expert witness threatened fauna and flora Mahogany Ridge Developments PL v Port Stephens Council LEC Proceedings 10526 of 2004;
- Expert witness threatened flora and endangered communities, HEZ v Hunter Ecologically Sustainable Development Group Inc. LEC Proceedings 41046 of 2003;
- Expert witness Green and Golden Bell Frog, Kurnell Peninsula, Australand v Sutherland Shire (2003);
- Expert witness Phascogales, Koalas, squirrel gliders and native vegetation for Port Stephens Port Stephens v Excel Properties 200, Citizens Aged Care 2002, Plan Vision 2003
- Expert witness Squirrel Gliders the Heritage Lifestyle Resorts PL v Great Lakes Council LEC proceedings 10646 of 2002;
- Expert witness squirrel gliders for BHP and AV Jennings in Sinclair Knight v Lake Macquarie Council re subdivision of Apollo Drive, 1999, Hynes Urban Planners v Hawkesbury Council 2003.
- Commissioned by Byron Shire Council to review evidence on flora, fauna and waste impacts of proposed residential and tourism development, 1999.
- Expert witness impacts on threatened fauna Healesville Holdings v Pittwater Council, 1997.
- Expert witness habitat loss, Pittwater Council in Planning Workshop v Pittwater Council, a landmark case which established the principle of cumulative habitat loss, 1996.
- Expert witness, Yellow-bellied Glider, Sparks v Gosford City Council. 2002
- Expert witness, koala, Ronro v Port Stephens Shire Council, Plan Vision v Port Stephens Council 2003.
- Expert witness, threatened flora, Hunter Ecologically Sustainable Employment Group v HEZ and others, Cessnock 2003.

Coastal Development

- Commissioned by NSW National Parks and Wildlife Service to provide and independent assessment of the Fauna Impact Statements and evidence before the Commission of Inquiry for residential subdivision of Long Bow Point/Lake Wollumboola, Culburra, Shoalhaven CC,1999.
- Expert witness on koalas & SEPP 44, Camden Shores canal development Commission of Inquiry,1995.

Highways & Roads:

- Expert witness for VICROADs on highway extension impacts on threatened species habitat,1995.

SEPP 46

- Expert witness on environmental harm after vegetation clearing in central NSW, numerous cases, DLWC vs Hunter, DLWC vs Cameron, DLWC vs Orlando Farms; DLWC vs Bungle Gully, DLWC vs Pye, DLWC vs Ikaro, DLWC vs Locke; DLWC vs Prime Grain,1997-98.

- Expert witness on environmental harm caused by rainforest clearing DLWC vs Robson, 1998.

Native Vegetation Conservation Act 1997

- Expert witness, impacts of native vegetation and threatened fauna habitat clearing, habitat remediation, DNR v Taylor 2007 NSWLEC 530
- Expert witness, impacts of native vegetation clearing, age of regrowth, Dalimen Pty. Ltd v Director General DIPNR, LEC Proceedings 11375 of 2003
- Expert witness on age of trees, regrowth and vegetation, and impacts on threatened species in spotted gum ironbark coastal forests, DLWC vs Wilkinson, 2001.
- Expert witness on environmental harm following woodland clearing in western division, DLWC vs Greentree, 2001.

Native Vegetation Act 2003

- Expert witness, whether vegetation is older than 1 January 1990, DECC v Fish/Orogen 2010 NSWLEC 144.

Land Valuation

- Expert witness, estimated damages caused by illegal logging and clearing on proposed ecotourism site Ferrato vs Hayward & Ors, 2000.
- Expert witness, estimation of damages for burning impacts on natural areas for P. Khuen, 2000.

Key Talks & Presentations (Environmental Legislation)

- Trends in best practice ecological consulting 1977-2008. Keynote address, annual conference of the Ecological Consultants Association, 5 Sept. 2008, Sydney NSW
- Creating and Energy Efficient Future, workshop presentation Ecole D'Igenieurs, (institute of Female Engineers) Sceux Paris (July 2007).
- Role of the expert witness and assessing environmental harm, presentation to DLWC Vegetation Compliance Officers course, Goulburn Police Academy (Aug 2001).
- Fauna impact assessment and mitigation, Annual Conference of Judges of the Land and Environment Court of NSW (Oct. 1995).
- Australian Environment Institute, Fauna Impact Assessment Seminar Series, seminar on new directions for endangered fauna legislation in NSW, Sydney (Aug. 1995).

Andrew Peter Smith: cv details

PROFESSIONAL SHORT COURSES AND WORKSHOP PRESENTATIONS

Continuing Education (UNE)

1981 Rainforest mammals, Lismore field school
1984 Rainforest mammals, Lismore field school
1985 Coastal wildlife, Limeburners Creek field school
1986 Arboreal Mammals of Armidale region, spotlighting excursion.
1986 Mammals of the Tamworth region, seminar Tamworth.
1988 Role of forest remnants for nature conservation, Agroforestry and re-forestation workshop, Valla Beach.

Professional Short Courses (UNE)

1987 Environmental Planning and Management Workshop (contributions on: ecological impact assessment, cost-benefit of wildlife values and integration of wildlife conservation and timber production).
1992 GIS and developing countries
1993 Economics of Resource and Environmental Management course: contribution on GIS and sustainable land planning and management, 13 April 1993.
1993 Rural planning and development in the Philippines, role of GIS, June 93
1993 Sustainable rural development 11 Nov 93
1994 GIS and developing countries- 16 May 93
1994 Economics of Resource and Environmental Management course: contribution on GIS and sustainable land planning and management, 6 May 94.

Department of Land and Water Conservation

1993 Endangered Fauna Management on Protected Lands: workshop and field school - Newholme Field Lab. UNE, 16-17 Feb.
1994 Endangered Fauna Management on Protected Lands: workshop and field school - Grafton NSW 15-16 March
- Newholme Field Lab. UNE, 8-9 June
1996 Keynote Speaker, workshop on processing SEPP 46 clearing applications by officers of the Department of Water and Land Conservation.
1999 Key speaker, workshop for DLWC vegetation compliance officers, Manly.
2001 Role of the expert witness and gathering evidence of environmental harm: Professional short course for DLWC compliance Officers Goulburn Police Academy, Goulburn 7 Aug.

Judiciary of the NSW Land and Environment Court

1995 Methods of Fauna Impact Assessment, Annual Conference of the Land and Environment Court, Wyong, October 1995.

National Parks and Wildlife Service of NSW

1998 Presentation to workshop on impacts of grazing on forests. 14 May.

Soil Conservation Service of NSW/ Dept. Water Resources NSW:

1992 Endangered Fauna Management Workshops, Procedures for assessing applications for clearing and development of endangered fauna habitat on protected lands two day workshops Dorrigo (21- 22 July), Mittagong (27-29 July) Scone 15-16 Sept)

VOLUNTARY POSITIONS & BIODIVERSITY CONSERVATION SERVICES

Austin College University of New England

1983-91 College Fellow, Austin College

Australian Heritage Commission

1993 AHC Invited expert adviser, AHC Workshop on " Procedures for identification of places of fauna significance for listing on the National Estate" Canberra 28-29 Oct.

1993-94 Adviser to AHC and Department of Conservation and Natural Resources on development of fauna habitat classes for the Central Highlands National Estate Project

Australian Geographic

1990 Scientific Representative, Cape York Scientific Expedition 9-17 JunE

1992 Scientific Representative, Central Australia Scientific Expedition Aug 22- 29 1992.

Australian Mammal Society

1983 Convenor, Australian Mammal Society Annual Conference and Possums and Gliders Symposium

1984 Senior Editor Australian Mammal Society, Possums and Gliders Symposium proceedings 1985.

Conservation International

1995 GIS specialist, Conservation International Conservation Priorities Workshop, Antananarivo, Madagascar, 10-14 April.

Department of Land and Water Conservation (NSW)

1995-7 Member, inter-agency advisory committee on clearing controls in Western Division NSW.

Department of Conservation and Natural Resources (VIC)

1980- Member, Leadbeater's Possum Management Advisory Committee 1980-96

Ecological Consultants Association of NSW

1999-2004 Foundation president, chair of accreditation and standards committee, member of Council

International Union for Conservation of Nature (IUCN)

1985-2006 Member, Marsupial Specialist Group

International Mammal Congress

1989 Co-convener Biological Conservation Symposium, V th International Theriological (mammal) Congress Rome

1993 Co-convenor Biological conservation Symposium V1th International Theriological (mammal) Congress, Sydney 1993.

Invergowrie Environmental Action Society

1988-95President Invergowrie Environmental Action Society

Maurice Wyndham Conferences

1993 Co-convenor Maurice Wyndham National Sustainable Forestry Conference, University of New England Armidale, February 1993

NSW National Parks and Wildlife Service

1992 Fauna survey design workshop. Iluka N.R. Sept.

1992-p Member, Hastings River Mouse Recovery Team 1992-2001

NSW Government, SFNSW and NPWS Joint Oldgrowth Forest Project.

1993 Consultant adviser on methods of fauna survey design.

NSW Nature Conservation Trust

2002 -4 Foundation Board Member and Chairman 2003.

National Resources Audit Council (NRAC)

1994-5 Member Technical Advisory Group.

Senate Standing Committee on Science and Environment

1979 Adviser, woodchip inquiry, 1979.

World Wildlife Fund Australia

1985-87 Leader: Leadbeater's possum conservation and management study

World Wildlife Fund International and US-AID

1990 Leader: feasibility study for establishment of a computer-based (GIS) "Biodiversity Planning Service", for threatened flora and fauna conservation in Madagascar.

1991 Leader: Pilot study to evaluate application of GIS to biodiversity planning in Madagascar.

Scientific Referee (for papers in following national & international journals):

Biological Conservation	Pacific Conservation Biology
Physiological Ecology	Wildlife Research
Forest Ecology and Management	Zoological Society of London
Australian Journal of Botany	Australian Journal of Zoology
Australian Journal of Entomology	Australian Journal of Ecology
Australian Mammalogy	Ecological Management & Restoration

GUEST LECTURES, TALKS AND MEDIA PRESENTATIONS

A.B.C. Radio

1978 Social Organisation of Leadbeater's Possum, Radio Talk.
1985 Management and Conservation of Leadbeater's Possum, radio interview.
1989 Long-footed Potoroo in NSW, radio interview
1990 Management of Leadbeater's possum, radio interview.
1990 Computer based conservation in Madagascar, radio interview.
1991 Biodiversity conservation in Madagascar, radio interview
1992 Lemur conservation in Madagascar radio interview
1994 Endangered fauna legislation, implications for clearing and development on rural lands

A.B.C./B.B.C Television

1979 Research studies of Leadbeater's Possum featured on "Earthwatch" programme.
1979 Assistance to Natural History unit in filming Sugar Glider "gliding sequences" for David Attenborough's Life on Earth and other series.
1987 Supply of research photographs and material on wasp nest building behaviour for James Gould's "animal intelligence" series.
1991 Biological control of New England Dieback by Sugar Gliders, ABC series "Quantum".
2000 BBC/Green Umbrella “Triumph of Life” series on instinctive behaviour of insects featured my research on nest building behaviour by wasps.

Australian Institute of Foresters.

l979 Maintenance and management of Leadbeater's Possum, Seminar, Australian Institute of Foresters.

Australian Geographic

1990 Invited keynote speaker, Australian Geographic Awards night, Sydney

Creswick Forestry School

1984 The role of natural predators in control of New England Dieback, Seminar, Excursion.

Department of Land & Water Conservation

2001 Address to the Northern Floodplains Regional Planning Committee on development and application of the WISE threatened species guidelines.
2001 Address to the Lismore Regional Vegetation Management Planning Committee on ecologically sustainable forestry on private lands.

Ecological Consultants Association of NSW

2006 The Role of Corridors: invited paper, annual conference ECA Sydney.
2008 Keynote address: trends in ecological consulting. Annual Conference ECA, Manly NSW

International Institute of Women Engineers.

2007 Invited address: An energy efficient future the role of forests and carbon credits. Sceaux School of Engineers, Paris.

Mammal Survey Group of Victoria.

1979 Ecology of Leadbeater's Possum, Seminar. Melbourne Zoo.

National Parks Association (New England Branch).

1979 Effects of logging on Leadbeater's Possum, Field Day
1980 Dietary ecology of Possums and Gliders, Seminar.
1981 Life Histories of Australian Marsupials, Seminar,
1981 Natural History of New England Mammals, Seminar.
1983 Effects of logging on wildlife, Seminar.
1986 Desert National Parks of S. West U.S.A. ancient history, natural history and geology.
1986 Arboreal mammals of Mt. Duval, Field Excursion, New England Tree Group
1991 Biological Control of New England Dieback by Sugar Gliders

Nature Conservation Council of NSW

1998 Squirrel gliders, Pittwater Council and housing development. Univ. Sydney 1-2 May
1999 Ecological assessment of fire on forests. Univ. of Sydney 14-5 Feb.

Society for Growing Australian Plants

1984 Wildlife Conservation in the Rural Environment, Seminar.
1988 Biological control of sawflies and scale insects in native gardens.
1992 Biological Control of New England Dieback by Sugar Gliders

Universities/CSIRO Guest Seminars and Lectures

1984 Possums and Glider Ecology, Zoology Department, La Trobe University
1986 Possums and Glider Ecology, Zoology Department, La Trobe University

1986 Management of Leadbeater's Possum, Zoology Department, La Trobe University
1988 Plant animal interactions, Department of Zoology, University of Sydney.
1992 Biodiversity conservation in Madagascar, Department of Zoology, Univ. Qld.
1994 Endangered Fauna Management in NSW, CSIRO Division of Wildlife and Ecology, Helena Valley, Perth

Victorian Field Naturalists

1978 "Ecology of the Sugar Glider", Seminar.

Whitehouse Technical College

1978 'Ecology of Leadbeater's Possum', Seminar.
1979 'Ecology and management of Leadbeater's Possum, Seminar.

REFEREED SCIENTIFIC PUBLICATIONS & PUBLISHED REPORTS 1972-11

Smith, A. P. (l972). "The Michelangelo of Mud Wasps", *Animals Mag*. l4(ll):496-498.
Smith, A. P. (l974). "Mud Wasps", *Wildlife* 16(7):300-303.
Smith, A. P. (l978). An investigation of the mechanisms underlying nest construction in the mud wasp *Paralastor sp*. (Hymenoptera: Eumenidae). Anim. *Anim. Behav*. 26:232-240.
Smith, A. P. (l978). "On the trail of the rare Leadbeater's possum", Habitat 6 (6): 3-5.
Smith, A. P. (l979). Life strategy and mortality factors of *Sceliphron laetum* (Hymenoptera: Sphecidae) in Australia. *Aust. J. Ecol*. 4: l8l-l86.
Smith, A. P. (l979). The host preference, taxonomy and pest status of Northern Territory Fruit Flies. Internal report, C.S.I.R.O. Division of Entomology, Canberra. 2l Pp.
Smith, A. P. (1980) Ecology and Management of Leadbeater's Possum and the Sugar Glider. Ph.D thesis, Monash University, Melbourne.
Smith, A. P. and Alcock, J. (l980). A comparative study of mating systems of Australian Eumenid wasps (Hymenoptera). *Z. Tierpsychol.* 53:4l-60.
Smith, A. P. (l982). Leadbeater's Possum and its Management. In "Species at Risk: Research in Australia", Pp. l29-l45. ed. by R. H.. Groves and W. D. Ride, Australian Academy of Science, Canberra.
Smith, A. P. (l982). Diet and feeding strategies of the sugar glider in temperate Australia. *J.Anim. Ecol.* 5l: l44-l66.
Smith, A. P. (l982). Is the striped possum an arboreal anteater? *Aust. Mammal.* 5:229-235.
Smith, A. P. and Russell, R. (l982). Diet of the yellow-bellied glider in North Queensland. *Aust. Mammal.* 5:37-4l.
Smith, A. P., Nagy, K. A.., Fleming, M. and Green, B. (l982). Energy and water turnover in free living Leadbeater's Possums (*Gymnobelideus leadbeateri*) *Aust. J. Zool*. 30:737-749.
Smith, A. P. (l983). "Leadbeater's Possum", pp 142-3 in "The Complete Book of Australian Mammals" ed by R. Strahan, Angus and Robertson, Sydney.
Smith, A. P. (l984). Diet of Leadbeater's Possum. *Aust. Wildl. Res.* ll: 265-73.
Smith, A. P. (l984). Demographic consequences of reproduction, dispersal and social interaction in a population of Leadbeater's Possum (*Gymnobelideus leadbeateri*) Pp. 359-373 in "Possums and Gliders" ed. by A. P.. Smith and I. D.. Hume. Surrey Beatty and Sons, Sydney.
Smith, A. P. (l984). The species of living possums and gliders. Pp. xiii-xv in "Possums and Gliders" ed. by A. P. Smith and I. D.. Hume, Surrey Beatty and Sons, Sydney.
Smith, A. P. (l984). "Ringtail possums, pygmy possums and gliders" pp 359-73 in The Encyclopedia of Mammals, 2 " ed. by D. Macdonald. George Allen & Unwin, London.
Smith, A. P. and Hume, I. D. eds. (l984). Possums and Gliders, Surrey Beatty and Sons, Sydney. 598pp.
Smith, A. P. and Lee, A. K. (l984). Evolution of strategies for survival and reproduction in possums and gliders. Pp. l6-34 In "Possums and Gliders" ed. by A. P.. Smith and I. D.. Hume, Surrey Beatty and Sons, Sydney.
Smith, A. P. and Phillips, K. (l984). A systematic technique for census of sugar gliders and other small arboreal mammals. *Aust. Wildl. Res.* ll: 83-87.
Smith, A. P. and Winter, J. (l984). "Key and field guide to the Possums, Gliders and Koala" Pp. 579-94 in "Possums and Gliders" ed. by A. P.. Smith and I. D.. Hume, Surrey Beatty, Sydney.
Smith, A. P. (l985). Adaptations to gummivory in marsupial possums and gliders. Abstract. *Am. J. Physiol. Anthropology* 66:229.
Smith, A. P., Lindenmayer, D. and Suckling, G. (l985). The ecology and management of Leadbeater's Possum. Report to World Wildlife Fund Australia for Project 51. Department of Ecosystem Management, University of New England, 56Pp.
Smith, A. P. (l986). Stomach contents of the Long-tailed Pygmy Possum *Cercartetus caudatus*. *Aust. Mammal.* 9:l35-37.
Dunning, A. and **Smith, A. P**. (1986). Integration of arboreal mammal and reptile conservation with timber production in moist hardwood forests of New South Wales. Report to the Forest Wildlife Research Advisory Committee. Department of Ecosystem Management, University of New England, 141 Pp.
Smith, A. P. and Green, S. (l987). Nitrogen requirements of the Sugar Glider (*Petaurus breviceps*), an omnivorous marsupial, on a honey-pollen diet. *Physiol. Zool.* 60:82-92.
Alcock, J., and **Smith, A. P.** (l987). Hilltopping, leks and female choice in the carpenter bee *Xylocopa varipuncta* (Hymenoptera: Anthophoridae). *J. Zool. Lond.* 2ll: l-l0.
Smith, A. P. and Lindenmayer, D. (l988). Tree hollow requirements of Leadbeater's Possum and other arboreal marsupials in logged Mountain Ash Forests. *Aust. Wildl. Res.* .15, 347-62

Smith, A. P., Lindenmayer, D., Begg, R. J., Macfarlane, M., Seebeck, J. H.. and Suckling, G .C.. (1989) An evaluation of the stagwatching technique for census of possums and gliders in tall open forest *Aust. Wildl. Res.* 6, 575-80.

Smith, A. P., Wellham, G. S. and Green S. W. (1989) Seasonal foraging activity and microhabitat use by echidnas (*Tachyglossus aculeatus*) on the New England Tablelands *Aust. J. Ecol.* 14, 457-466.

Henry, S., Lee, A. K.. and **Smith, A. P.** (1989). The trophic structure and species richness of assemblages of arboreal mammals in Australian forests. pp 229-240 In Patterns in the structure of Mammalian Communities ed by D. W.. Morris, Z. Abramsky, B. J.. Fox and M. R. Willig. *Proc. IVth International Theriological Congress,* Edmonton, Canada l6 pp.

Lindenmayer, D. B.., **Smith, A. P.**, Craig, S. A.. and Lumsden, L. F.. (1989). A survey of the distribution of Leadbeater's possum Gymnobelideus leadbeateri McCoy in the Central Highlands of Victoria. *Victorian Nat.* 5,174-176.

Ferrier S. and **Smith A. P.** (1990) Using geographic information systems for biological survey design, analysis and extrapolation. *Australian Biologist* 3, 105-116.

Lindenmayer, D. B., Cunningham, R. B., Tanton M. T. and **Smith, A. P**.(1990). The conservation of arboreal marsupials in the montane ash forests of the Central Highlands of Victoria, south east Australia. 1. Factors effecting the occupancy of trees with hollows. *Biological Conservation*, 54, 111-131.

Lindenmayer, D. B., Cunningham, R. B., Tanton M.T and **Smith, A. P**.(1990). The conservation of arboreal marsupials in the montane ash forests of the Central Highlands of Victoria, south east Australia. 11. The loss of trees with hollows and its implications for the conservation of Leadbeater's Possum *Gymnobelideus leadbeateri* McCoy (Marsupialia: Petauridae). *Biological Conservation*, 54, 133-145.

Lindenmayer, D. B., Cunningham, R. B., Tanton M.T., **Smith A. P.** and Nix H. A. (1990) The habitat requirements of the Mountain Brushtail Possum and the Greater Glider in the montane ash eucalypt forests of the Central Highlands of Victoria. *Australian Wildlife Research,* 17, 467-78.

Lindenmayer, D. B.., Cunningham, R. B., Tanton M.T and **Smith, A. P.**(1990). Characteristics of hollow bearing trees occupied by arboreal marsupials in the montane ash forests of the Central Highlands of Victoria, south eastern Australia. *For. Ecol and Manag.* 40, 289-308.

Smith, A. P. (1991) Forest policy: fostering conflict in the Australian timber industry In Conservation of Australia's Forest Fauna, ed by D. Lunney, Roy. Zool. Soc. NSW, Mosman.

Lindenmayer, D. B., Cunningham, R. B., Tanton M.T and **Smith, A. P.**(1991). Predicting the abundance of hollow-bearing trees in montane ash forests of south eastern Australia. *Aust. J. Ecol.* 16, 91-98.

Smith, A. P. and Lindenmayer, D. (1992) Forest succession and habitat management for Leadbeater's Possum in the State of Victoria, Australia. *Forest Ecology and Management. 49, 311-332*.

Smith, A. P. and Broome, L. (1992) The effects of season, sex, and habitat on the diet of the Mountain Pygmy-possum, *Burramys Parvus*. *Aust . Wildl. Res. 19*: 755-68

Smith, A. P., Moore, D. M. and Andrews, S. A. (1992) Proposed forestry operations in the Glen Innes Management Area, impacts on fauna, Austeco Pty. Ltd., 97 pp.

Quin, D. G., **Smith, A. P**., Green, S. W. and Hines, H. (1992) Estimating the home ranges of sugar gliders, *Petaurus breviceps* (marsupialia: Petauridae), from grid trapping and radio telemetry data. *Wildl. Res*. 19, 471-87

Smith, A. P. (1993a) A sweet way to regenerate the land. *Australian Geographic* 30 , 24-25.

McIntyre S., Huang Z. and **Smith A. P**. (1993) Patterns of abundance in grassy vegetation of the New England Tablelands: identifying regional rarity in a threatened vegetation type. *Aust J. Bot. 41*, 49-64

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Smith, A. P., Andrews, S. A. and Moore, D. M. (1994) Terrestrial fauna of the Grafton and Casino State Forest Management Areas, description and assessment of forestry impacts. State Forests of NSW, 136 pp.

Andrews, S. P.. Gration, G. Quin, D. and **Smith A. P.** (1994) Description and assessment of forestry impacts on fauna of the Urbenville Forestry Management Area. Report to State Forests of NSW. SFNSW 150 pp.

Smith, A.P. (1995) The natural history of Leadbeater's Possum Pp1-9 in Myroniuk, P. O. (ed)_ Leadbeater's Possum, International Studbook 1995. Zoological Board of Victoria.

Smith A.P., Andrews S. A., Gration G., Quin, D., and Sullivan. B. (1995) Description and assessment of forestry impacts on fauna of the Urunga-Coffs Harbour Management Areas. Supplementary Report No 4. Coffs Harbour and Urunga Forest Management Area. Environmental Impact Statement. State Forests of NSW. 160pp.

Alcock, J. and **Smith, A. P.** (1995) Landmark defence and scramble-competition mating systems in two Australian tachinid flies (Diptera). *J. Kansas Entomol. Soc.*

Quin, D. G., **Smith, A.P.** and Norton T. W. (1996) Eco-graphic variation in size and sexual dimorphism in sugar gliders and squirrel gliders (Marsupialia: Petauridae). *Aust. J. Zool.* **44**:19-45.

Smith A. P. and Ganzhorn J. (1996) Convergence and divergence in community structure and dietary adaptation in Australian Possums and Gliders and Malagasy Lemurs. *Australian Journal of Ecology* **21:** 31-46.

Smith A. P. and Quin, D. (1996) Patterns and causes of extinction and decline in Australian Conilurine Rodents. *Biological Conservation.* **77** 243-267.

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Jarman, P. **Smith A.P.** and Southwell C. (1996) Copmlete Counts, chapter 10 in in 'Measuring and monitoring biological diversity standards for mammals. Ed by Wilson D. E., Cole F. R., Nichols J. D., Rudran R., and Foster, M. S. Smithsonian Institution Press, Washington.

Laurance, W. F., Bierregaard, R. O., Gascon, C., Didham, R., **Smith, A. P.**A.J. Lynham, Viana V., Lovejoy T.E., Sieving K.R., Sites, J.W., Anderson J. M., Tocher M., Kramer E., Restrepo C., and Moritz C. (1997) Tropical forest fragmentation: synthesis of a diverse an dynamic discipline. In Tropical Forest Remnants. Ed by W. Laurance and R. O. Bierregaard Jr., Univ. Chicago Press.

Bierragaard R., Laurence W. F. Sites J.W., Lynham A.J., Didham R.K., Anderson M., Gascon M., Tocher M., **Smith A**. **P.** Viana V., Lovejoy T.E., Sieving K.R., Sites, J.W., Kramer E., Restrepo C., and Moritz C. (1997) Key Priorities for the study of fragmented tropical ecosystems. In Tropical Forest Remnants. Ed by W. Laurance and R. O. Bierregaard Jr., Univ. Chicago Press.

Smith, A. P. Horning N. H., and Moore, D. M. (1997) Lemur conservation planning in western Madagascar. *Conservation Biology*. **11** 498-512.

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Eyre T. and **Smith, A.P.** (1997) Floristic and structural habitat preferences of Yellow-bellied Gliders *Petaurus australis* and selective logging impacts in south east Queensland, Australia. *Forest Ecology and Management* **98**: 281-295.

Smith A.P. (1997) Science and ecosystem management. In ecosystem management: the legacy of science. Ed by C. Copeland and D. Lewis. Halstead Press.

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Smith A. P. and Murray M. (2003) Habitat requirements of the Squirrel Glider and associated possums and gliders in the New South Wales central coast. *Wildlife Research* **30**, 3, 291-301

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Smith A. P. (2009) Why coastal floodplain forests and freshwater wetlands on coastal dunes, swales, sand plains, and beach ridge plains of the north east NSW bioregion are not Endangered Ecological Communities. Consulting Ecology 23pp36-45.

Quin, D.G., Riek, A., Green S., **Smith A.P.,** and Geiser F. (2009) Seasonally constant field metabolic rates in free-ranging sugar gliders (*Petaurus breviceps*). Comparative biochemistry and physiology A 155, 336-340.

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