

Impacts of selective logging on native fauna in southern Queensland

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There is a number of studies showing the impacts of selective logging on arboreal marsupials in southern Queensland. This paper presents a review of those studies. The purpose of the paper is principally to address the issue of 40 cm diameter limit harvesting (40 cm+) and its expected impacts on fauna. Hence, there is a focus on logging intensity. Overall, the paper focuses on impacts of logging on the Greater Glider (*Petauroides volans*) which in 2022 was declared endangered in Queensland and nationally. However, the Greater Glider has been identified as an indicator species of forest disturbance (Kavanagh and Stanton 2005) and if it is being impacted by 40 cm+ logging it is likely that other species are also impacted. A recent global assessment by a large number of herpetologists, including nine Australians, found logging to be high among the main threats to forest-dwelling reptiles (Cox *et al.* 2022).

Some history

In the final stages of negotiations that led to the 1999 South East Queensland Forest Agreement (SEQFA), Australian Rainforest Conservation Society (ARCS) put forward a proposal to phase out native forest harvesting in the area and transition to hardwood plantations over a 20-year period. The timber industry indicated a preparedness to accept the proposal but on the condition that the phase out occur over 25 years. It had been established that there was sufficient timber outside the proposed immediate additions to the protected area estate to supply the industry for 20 years under the standard harvesting regime current at the time.

In order to extend supply for a further five years, forestry officers proposed that 40 cm+ harvesting be applied to certain areas. Conservation representatives accepted the proposal on the grounds that the more intense logging would be over a limited area and the areas would never be logged again. A clause in the SEQFA defines Part A areas, high conservation value forests, where the standard logging regime would be applied.¹

It would appear that the SEQFA was effectively abandoned by the Liberal National Party (LNP) government which was elected in 2012. We understand that shortly after taking office, the LNP government applied 40 cm+ logging across the region as standard practice, including in the Part A areas which were excluded from 40 cm+ logging in the SEQFA.

When Labor returned to office in 2012, it did not reverse the LNP decision but continued to apply the more intensive 40 cm+ harvesting regime across the south-east Queensland supply zone including the Part A areas. Further, an even more intensive 30 cm diameter limit harvesting regime has apparently been used in some areas. ARCS has submitted a Right to Information request to try to establish when and why this regime was introduced and where it has been applied.

The Code of practice

Native forest logging in Queensland is subject to the *Code of practice for native forest timber production on Queensland's State forest estate 2020* (the Code). The Code requires retention of six live habitat trees and two recruitment habitat trees within the range of the Greater Glider and four live habitat trees and one recruitment habitat tree per hectare in hardwood forests outside the Greater Glider range.

¹ Part A areas were initially considered for inclusion in the protected area additions. Conservation representatives accepted their exclusion given the 'safeguards' incorporated in the Agreement including the first-right-of-refusal for the State to buy out sawmills that came up for sale and a 'logging as a last resort' condition.

The Code refers to Species Management Profiles (SMP) as being designed to meet statutory requirements. The SMP for the Greater Glider does not provide any management provisions beyond those within the Code itself and notes that the Code “requires an increased retention and protection of large hollow-bearing trees as habitat and selective harvesting regime that retains structure and species mix of forest”. Whereas the Objective of the Code is to “ensure the forest can, in time, recover its pre-harvesting species composition, structure and function”, there is no specific provision to retain forest structure and species mix.

We note that the SMP for the Greater Glider was prepared by the Department of Agriculture and Fisheries, presumably by Forest Products unit.

Statutory obligations

The *Nature Conservation (Animals) Regulation 2020* (the Regulation) defines the management intent for endangered wildlife which includes (Schedule 1, section 26(i)) “to protect the critical habitat, or the areas of major interest, for the animal”.

The term ‘critical habitat’ is defined in the *Nature Conservation Act 1992* as “habitat that is essential for the conservation of a viable population of protected wildlife” which can include areas where the wildlife is not currently present. An ‘area of major interest’ is defined as “an area that contains natural resources of significant nature conservation value”.

The Queensland Herbarium has mapped modelled Greater Glider habitat in Queensland (Eyre *et al.* 2022). The map in Appendix 1 was prepared by ARCS from data provided by Queensland Herbarium and shows a significant area of habitat occurs within State Forests in southern Queensland.

The Regulation (section 26(j)) also proposes the following requirement:

- to monitor and review environmental impact procedures to ensure they—
 - accurately assess the extent of the impact, on the animal, of the activities to which the procedures relate; and
 - provide for effective measures to mitigate any adverse impact of the activities on the animal; and
 - if there is an adverse impact of the activities on an area in which the animal normally lives, provide for the enhancement of other areas where the animal normally lives.

It is not clear that 40 cm+ harvesting meets the statutory obligations. This is discussed later in this paper.

Impacts of logging on Greater Glider habitat in southern Queensland

A range of studies has shown Greater Glider occupancy to be influenced by logging disturbance, particularly because of a reduction in hollow-bearing trees and the loss of old-growth forest e.g., Lunney *et al.* (1987) and Lindenmayer *et al.* (1990). Incoll *et al.* (2001) showed the abundance of greater gliders in the montane forests of the Victorian Central Highlands was significantly related to the overstorey basal area, a parameter that, in turn, relates to the intensity of logging.

Eyre (2006) studied habitat selection of the Greater Glider in southern Queensland, specifically the South East Queensland and Brigalow Belt Bioregions. Eyre modelled Greater Glider habitat based on glider numbers and habitat attributes recorded at 428 sites across the study area. The most significant feature in habitat selection by greater gliders was found to be the number of live hollow-bearing trees. The model predicted that three hollow-bearing trees per hectare were required to maintain one glider per 3 hectares. However, the study found the mean number of live hollow-bearing trees in glider habitat types in southern Queensland was 2.2 ± 0.1 . Eyre noted the difficulty in locating the number of hollow-bearing trees required by the Code to be retained during harvesting.

The model predicted a negative response of greater gliders to more intensive logging. It also predicted that *Corymbia citriodora* (Spotted Gum) and *Eucalyptus tereticornis*

(Queensland Blue Gum) were important in glider habitat selection. Both are favoured timber species.

This study also concluded that at least 85% of the original basal area needs to be retained to maintain at least one glider per 3 hectares. We are not aware of the basal area retention limit currently applied under 40 cm+ harvesting but the Code envisages removal of greater than 50% of basal area.

As a summary statement, Eyre concluded “The introduction of a new, more intensive harvesting regime in areas of greater glider habitat in south-east Queensland will therefore have a significant impact on glider populations, unless current habitat tree prescriptions are adjusted to specify the retention of large *C. citriodora* and *E. tereticornis* trees, and species that rapidly form hollows.”

Impacts of logging on Greater Glider habitat in the Western Hardwoods area

Eyre *et al.* (2010) studied the impacts of forest management on forest structure in the Brigalow Belt South Bioregion. This region includes the major part of the Western Hardwoods Area (Western Hardwoods Supply Zone). The study aimed to determine the response of a range of habitat features to variation in disturbance history and intensity at the stand scale. Timber harvesting was one disturbance considered. A total of 120 sites was studied.

The mean number of live trees with hollows across the study area was 4.0 ± 0.4 per hectare. For harvesting in this area, the Code requires retention of six live habitat trees and two recruitment habitat trees per hectare.

The study found that live trees of the five most common species were more likely to have hollows if the diameter at breast height (DBH) was greater than 60 cm.

Disturbance variables selected for the study included time since logging and logging intensity. The latter was determined as the ratio of basal area removed (stumps) to total basal area (live trees plus stumps). Data from the sampled sites were used to model the response of habitat features to the disturbance variables. With respect to impacts of timber harvesting, logging intensity was the most important variable affecting the abundance of hollow bearing trees and large living trees. Time since logging was a very poor predictor of the abundance of the relevant habitat features. This can be explained by the extremely slow recovery of habitat features as a result of the slow growth rates in the region because of the low rainfall compared to coastal areas.

The results of this study raise serious concerns about the impacts of 40 cm+ logging, and especially 30 cm+ logging, on habitat quality for the Greater Glider in the Western Hardwoods Area in particular but also in South East Queensland where 40 cm+ logging is being practised.

It is noted that the Federal Government’s recently released *2022–2032 Threatened Species Action Plan — Towards zero extinctions* includes Brigalow country, Queensland as a Priority Place.

Queensland Herbarium recommendations regarding habitat for the Greater Glider

In 2022 Queensland Herbarium published a report *Guide to greater glider habitat in Queensland* (Eyre *et al.* 2022)(the Guide) which was prepared for the federal Department of Agriculture, Water and the Environment.

Six tree species were identified as dominant or co-dominant in habitat of the Greater Glider — *Corymbia citriodora* (Spotted Gum), *Eucalyptus moluccana* (Gum-topped Box), *E. tereticornis* (Queensland Blue Gum or Forest Red Gum), *E. crebra* (Narrow-leaved Ironbark), *C. intermedia* (Pink Bloodwood) and *E. portuensis* (White Mahogany). All of these species are used for timber with Spotted Gum representing around 70% of hardwood log timber produced from State-owned forests (State of Queensland 2016).

The Guide notes that trees preferentially selected by greater gliders for foraging are generally greater than 30 cm DBH and greater than 50 cm DBH for denning.

Whereas hollow-bearing trees are an essential habitat feature for greater gliders, a review of the literature (Eyre *et al.* 2022) found there is high variability and low reliability in ground-based detection of tree hollows. In studies carried out in European forests, Cosyns *et al.* (2020) illustrated bias among observers. The researchers compared habitat tree selection by a group of foresters with that by a group of conservationists. Foresters typically chose smaller trees with low commercial value while conservationists chose large trees with high commercial value.

It is now generally considered that tree size is a better indicator of habitat and the authors conclude that retention of an adequate resource of appropriately large sized trees is critical for maintaining populations of the Greater Glider. The authors note that the number of hollow-bearing trees is no longer accepted as an attribute in condition assessments in Queensland. This is also the case in New South Wales where the attribute ‘number of trees with hollows’ has been replaced by the attribute ‘number of large trees’ in determining native vegetation integrity benchmarks (Office of Environment and Heritage 2017).

The Guide determined thresholds and benchmarks for large trees based on data for regional ecosystems considered to be habitat for the Greater Glider. Data for southern Queensland were considered adequate to determine thresholds and benchmarks. In South East Queensland, Brigalow and New England Tableland bioregions, the DBH threshold for large trees averaged around 46 cm, ranging from 35 to 61 cm. The average density of large trees varied between bioregions, being 32 per hectare in South East Queensland and 15 per hectare in the Brigalow Belt.

The Guide provides a number of recommendations, two of which have implications for timber harvesting regimes:

- densities of hollow-bearing trees should not be used to define whether an area is greater glider habitat or not habitat,
- improve reliability for indicating greater glider habitat or potential habitat by measuring densities of ‘large trees’.

Victorian Supreme Court decision

Environment East Gippsland Inc and Kinglake Friends of the Forest Inc sought declarations and permanent injunctions in the Supreme Court of Victoria to enforce VicForests to identify and protect greater gliders and yellow-bellied gliders in State forests in East Gippsland and Central Highlands. On 4 November 2022, Justice Richards handed down her judgment based on the expert ecological evidence presented in the hearings. The judgment, which can be downloaded at <https://arr.news/wp-content/uploads/2022/11/2022VSC668.pdf>, can be summarised as follows:

- VicForests must carry out surveys to detect the presence of the gliders in any coupe proposed for logging,
- harvesting operations must exclude from logging an area equivalent to the home range of the species (~3 ha) around the point of detection, and
- harvesting operations must retain at least 60% of the basal area of eucalypts in the harvested area.

Climate change

The Conservation Advice (Department of Climate Change, Energy, the Environment and Water 2022) considers climate change as a major threat to the Greater Glider. The species is vulnerable to high temperatures and low water availability (Rübsamen *et al.* 1984). The sensitivity of greater gliders to heat may explain the species preference for higher elevations (Moore *et al.* 2004).

This sensitivity to heat and preference for higher elevations indicates the importance of areas such as Bigge, Expedition, Dawson and Coomingleh Ranges and the State forests that occur on those ranges (Presho, Theodore, Belington Hut, Mt Nicholson, Expedition,

Shotover, Arthurs Bluff, Dawson Range, Coomingleh (northern part) and Grevillea State forests). All these areas are mapped, at least in part, as greater than 80% greater glider habitat (Eyre *et al.* 2022 and Appendix 1). These areas in the Western Hardwoods supply zone may have been subject to 30 cm+ logging.

The Precautionary Principle

The Precautionary Principle has been the subject of numerous discussions. The Queensland *Planning Act 2016* defines the Precautionary Principle thus: “the lack of full scientific certainty is not a reason for delaying taking a measure to prevent degradation of the environment if there are threats of serious or irreversible environmental damage”.

Regarding the impacts of 40 cm+ logging on the endangered Greater Glider, it may be debated as to whether there is “full scientific certainty”. However, the evidence considered here clearly indicates a threat of serious damage to greater glider habitat. Whereas that damage may not be irreversible in the longer term, it is likely to persist for decades. Application of the Precautionary Principle requires measures to be taken to prevent further habitat degradation.

The Precautionary Principle featured prominently in the Victorian Supreme Court case cited above. Justice Richards made the following judgment:

In order to apply the precautionary principle to the conservation of greater gliders and yellow-bellied gliders, VicForests must survey the whole of any coupe proposed for harvest which may contain glider habitat. It must do so using a survey method that is likely to detect any gliders that may be present in the coupe, so as to locate the gliders’ home ranges wherever practicable. This is necessary in order that their essential habitat can be excluded from timber harvesting operations, as the precautionary principle requires.

In contrast to the procedures now required to be followed by VicForests, in Queensland neither the Code nor the SMP for the Greater Glider require any assessment of the presence of the species prior to logging.

It should be noted that VicForests has replaced clear-fell harvesting with variable retention harvesting which aims to retain key elements of stand structure in islands and patches. Justice Richards concluded that the available evidence is that variable retention harvesting is of no short- or medium-term benefit to the gliders.

Discussion

It is well established that the Greater Glider is sensitive to logging (Lunney 1987, Lindenmayer *et al.* 1990, Incoll *et al.* 2001). The Conservation Advice that led to uplisting of the Greater Glider to endangered status defines timber harvesting as a major threat (Department of Climate Change, Energy, the Environment and Water 2022).

The studies reviewed here have findings directly relevant to the impact of 40 cm+ logging on habitat for the Greater Glider:

- in southern Queensland there is a deficit in hollow-bearing trees which are an essential habitat attribute for the Greater Glider,
- even where sufficient hollow-bearing trees can be retained to meet the Code requirements, 40 cm+ logging will deplete the resource of larger trees required to develop hollows in the future,
- greater gliders respond negatively to more intense logging,
- tree species that are important in habitat selection by greater gliders, particularly species favoured for foraging, are species sought by the timber industry,
- the Code does not include any specific provisions designed to maintain species mix,
- greater gliders preferentially select trees greater than 30 cm DBH for foraging,

- the foraging resource will be depleted by 40 cm+ logging (and especially by 30 cm+ logging).

The Guide makes a number of recommendations relevant to the issues being considered here. Whereas these recommendations are not directly related to logging, they define the habitat attributes that are necessary to maintain an area of forest as habitat for the Greater Glider.

It can reasonably be concluded from available evidence that 40 cm+ logging in many areas will lead to a loss of essential habitat attributes for the Greater Glider and the species will no longer be able to occupy the logged forest.

The recommendations in the Guide also have significant implications for the Code. It depends on assessment of tree hollows from the ground. Such assessment is shown to be unreliable and should not be used in assessing habitat attributes. Instead, the density of large trees (>46 cm DBH in southern Queensland) should be used. Given that 40 cm+ logging aims to remove all merchantable trees 40 cm DBH or larger (apart from the required number of habitat and recruitment trees), it is clear that the provisions of the Code will not maintain habitat for the Greater Glider where 40 cm+ logging occurs.

Given that available evidence supports the conclusion that 40 cm+ logging is negatively impacting greater glider habitat, it can reasonably be considered that the Queensland Government is not meeting its statutory obligation regarding the management intent for endangered wildlife as defined in the Regulation (Schedule 1, section 26(i)), namely, “to protect the critical habitat, or the areas of major interest, for the animal”.

Conclusion

It is clear from the considerable volume of evidence available from studies in southern Queensland and elsewhere that 40 cm+ logging will have significant negative impacts on habitat of the endangered Greater Glider and the species is likely to become locally extinct in a significant part of its range in the Brigalow Belt South and South East Queensland bioregions.

The evidence-based recommendations from the Queensland Herbarium require an urgent review of the Code of practice.

The available evidence indicates that the State of Queensland is not meeting the statutory requirement “to protect the critical habitat, or the areas of major interest” in respect to the endangered Greater Glider.

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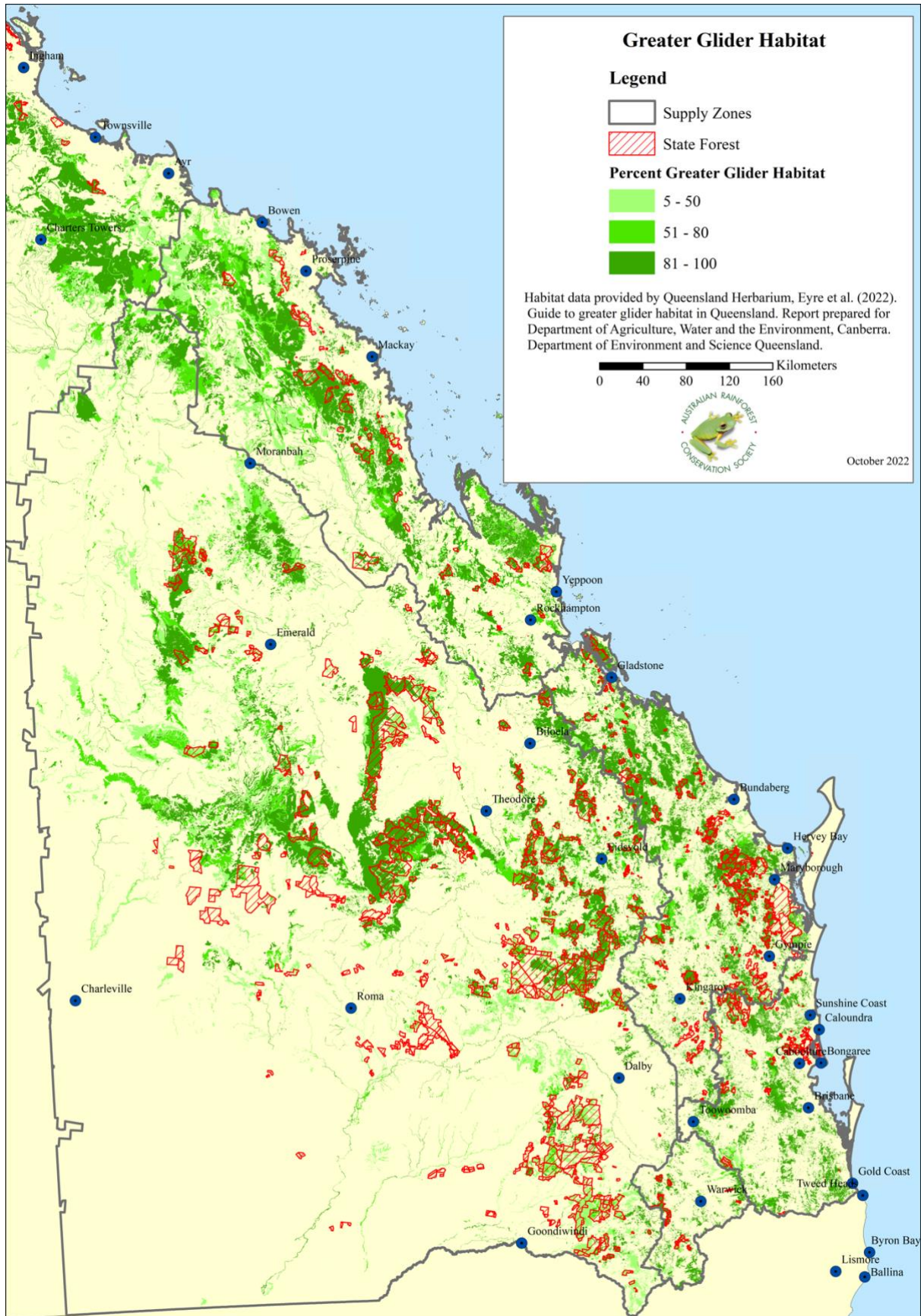
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Appendix 1



Greater Glider habitat as modelled by Eyre *et al.* (2022) and State Forest boundaries in southern Queensland.