

Mapping glider songlines*: development of a landscape management policy for the Yellow-bellied Glider *Petaurus australis* (Shaw 1791) in the Eurobodalla Shire on the south coast of New South Wales

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ABSTRACT

This paper outlines the development in 2001 of a management policy for the Yellow-bellied Glider *Petaurus australis* in the Eurobodalla Shire in response to case studies conducted by the author for a development proposal. The proposal to clear habitat for a school indicated that significant impact on the Yellow-bellied Glider was likely after addressing the “eight part test” under section 5A of the NSW *Environmental Planning & Assessment Act* (1979). The subsequent Species Impact Statement placed the impacts of the development into a regional context in respect to the distribution of the glider and included an estimate of population size and identified a habitat corridor in the Broulee area. The local government then requested concurrence from the NSW National Parks and Wildlife Service. A ‘condition of concurrence’ was that a policy be developed by the Local Government Authority to conserve Yellow-bellied Glider habitat in the Broulee subregion. The policy to conserve the Yellow-bellied Glider in the Broulee area identified a major limitation in the EP&A Act, that is, the failure to consider the cumulative impact of development.

Key Words: environmental planning, legislation, threatened species management, Yellow-bellied Glider.

Introduction

Although there are mechanisms for landscape planning for threatened species such as recovery planning, threat abatement plans, property management plans, local and regional environmental planning, catchment management planning and the operation of vegetation management legislation, there is a general failure of such mechanisms to protect threatened species habitat across various land tenures. One of the problems is that legislation that deals with the protection of flora and fauna does not require an assessment of impacts caused by previous developments that have resulted in the removal of habitat within a region. Similarly, there is no provision for assessing a proposal with respect to cumulative loss that will occur on undeveloped land that is zoned for a landuse that allows for the removal of habitat.

One aim of this paper is to describe a case study in 2001 of a proposed development in relation to the threatened Yellow-bellied Glider *Petaurus australis*. The process of applying the NSW *Environmental Planning & Assessment (EP&A) Act* (1979) was assessed in 2001 and its efficacy in the conservation of the Yellow-bellied Glider is discussed. The process included an assessment of the

impact of the development through the “eight part test” under section 5A of the EP&A Act and the subsequent Species Impact Statement (SIS). Detailing the assessment process shows the evolution of the policy. The paper also describes the process that led to the development of a local management policy for the conservation of Yellow-bellied Glider habitat in the Broulee area. This background is also provided to give context to suggested changes to improve the efficacy of the policy and the EP&A Act. However, the legislation has changed since this work was conducted and some of the points being made are no longer directly applicable to the new legislative framework. The problem of cumulative impacts and foreshadowed impacts remains as an issue for the regional conservation of our fauna. This NSW case study may date in detail, but the central ecological concern remains valid.

The legislative environment in which the study was conducted in 2001

NSW State legislation, current when this work was carried out in 2001, required the assessment of the impact of proposed developments to threatened species,

*Songlines is a reference by Indigenous people to songs or stories telling of country that individuals of an appropriate totem could move through to secure critical resources – food, water and shelter (Chatwin 1987).

populations and ecological communities through the “eight part test” under section 5A of the EP&A Act (1979). If an assessment of impacts under the EP&A Act gives a result of significant impact and if the proposal can/is not modified to ameliorate the impact, then a Species Impact Statement must be prepared. The terms of the SIS are determined by the Director-General of the NPWS (the NPWS became part of the newly-created Department of Environment and Conservation in 2003).

Resolution of the problem at a local level

The proposal

The author applied the “eight part test” in April 2001, under section 5A of the EP&A Act, to a proposal for the construction of a school in the Broulee area on the south coast of New South Wales (Farrier and Whelan 2004). The development required the removal of approximately 10 hectares of bushland for an early childhood, Primary and Secondary school and associated administrative, sporting and parking facilities, and a chapel. The development also required the provision of a road for public transport.

The application of the “eight part test” indicated that the development would have a significant impact on a population of three Yellow-bellied Gliders. This triggered the necessity for a SIS.

Resolution of the problem

The author subsequently conducted fieldwork from 15-20 July 2001 and determined the total number of Yellow-bellied Gliders present on the development site, and an indication of the number and size of adjacent family groups (herein called troupes) of the species within the “locality” (as shown in Figure 1). The compilation of these data allowed the author to identify a habitat corridor for the Yellow-bellied Glider in the locality. The resulting SIS placed the impacts of the development into a regional context in respect to the distribution of the home ranges and populations of Yellow-bellied Glider (Gaia Research 2001a).

Eurobodalla Shire, the local government authority, then requested concurrence from the National Parks and Wildlife Service. A ‘condition of concurrence’ was that a policy be developed by the Local Government Authority to conserve Yellow-bellied Glider habitat in the Broulee subregion.

Eurobodalla Shire developed the policy for the Yellow-bellied Glider in the Broulee area in conjunction with the NPWS (Eurobodalla Shire 2002). Its purpose was to (i) define development or activities that will not significantly impact on the Yellow-bellied Glider or its habitat, (ii) to ensure the long-term persistence of Yellow-bellied Gliders within the Broulee Area through retention of suitable habitat and other development controls and (iii) to provide a platform for a similar approach to the entire coastal plains within the local government area.

The author’s role in the development of the policy was to provide data (within the SIS) on critical habitat resources (i.e. den trees and sap feed trees) that could be protected and, if required, isolated portions of land reconnected by revegetation programs. Development of the strategic plan would not only help protect critical habitat resources, but give a framework whereby future development proposals could be assessed within an overall conservation planning framework.

Study Area and Methods

The study area was situated on the south coast of NSW, some 23 km south of Batemans Bay (Lat 35° 51', Long 150° 10') near the coastal town of Broulee. The 11 hectare piece of land on which the development was proposed was zoned 2g residential. The major vegetation community on site was coastal sand Blackbutt *Eucalyptus pihularis* - Red Bloodwood *Corymbia gummifera* forest. There were minor occurrences of Bangalay *E. botryoides* and Rough-barked Apple *Angophora floribunda*. The forest was 25-30 m in height with individual Blackbutts attaining 35 m. The larger trees had numerous hollow branches. The presence of stumps indicated selective logging had occurred in the past.

The methods used to detect Yellow-bellied Gliders concentrated on the location of critical habitat components that the gliders require, that is sap feed trees (see Henry and Craig 1984; Goldingay 1987, Mackowski 1988), den trees and the examination of forest linkages to determine if the gliders were dispersing over breaks in the canopy, such as roads.

Searches were made for sap feed trees on the site of the proposed development and within 3 km of the subject site (termed the location). Sap feed trees are often located close to the centre of a troupe’s territory and den trees (pers. obs.). Large hollow-bearing trees near sap feed trees were then surveyed, at dusk, for emerging gliders. Surveys were conducted for 20 minutes at dusk over three nights. During this period no spotlights were used. The objective was to observe Yellow-bellied Gliders (as silhouettes) emerge from their den, glide to nearby trees and call.

Twelve transects, each of 300 m, were searched for 40 min each by spotlight. Additional spotlight surveys ranged from 10-60 minutes. Surveys at sap feed trees involved a quick spotlight surveillance of the tree, followed by the broadcast of owl calls, a listening period where no spotlights were operated, and finally spotlight searches on the sap feed tree and the surrounding area. The owl component included broadcast of Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens* and Masked Owl *Tyto novaehollandiae* calls. Calls were broadcast for approximately three minutes for each species. Broadcasting calls of large forest owls may “call up” Yellow-bellied Gliders and owls of the same species within the area. This method helps determine the location of and number of Yellow-bellied Gliders in a troupe.

Dark surveys were conducted on several nights along the intersection of two roads. The objective was to observe animals gliding over these roads. If Yellow-bellied Gliders

were detected moving over these easements, then this would help when assessing the connectivity of habitat and therefore the size of the local population.

The location of sap feed trees, den trees, calling animals and direct observation were the basis for determining the centre and home ranges of the gliders. This information was then mapped and put into the context of the habitat utilised by the gliders within the locality. This map formed the basis of determining a habitat corridor for the Yellow-bellied Gliders in the Broulee area.

Results

Field Assessment of habitat resources used by Yellow-bellied Gliders in the locality

Twelve trees of three species were incised by Yellow-bellied Glider for sap feeding both on and adjacent to the site. Yellow-bellied Gliders incised Red Bloodwood and Rough-barked Apple (Figure 2). The Rough-barked Apple had not previously been found to be utilised by Yellow-bellied Glider for sap feeding (NPWS 2001).



Figure 1. Study area for species impact statement in the Broulee area (red line).



Figure 2. Rough-barked Apple *Angophora floribunda* incised by Yellow-bellied Glider at Broulee.

Three den trees were located on, and adjacent to, the site (Figure 3). They were large (25-30 m) Blackbutts that contained several hollows. Three Yellow-bellied Gliders were observed emerging from a den (prime) tree on a property adjacent to the site. The troupe of three Yellow-bellied Gliders that utilised the site was considered to be confined to an area of approximately 11 hectares as a consequence of a natural barrier (river), the location of the adjacent troupes' territories, and clearing for roads and urban development.

To address the requirements of the SIS, the number and range of the Yellow-bellied Gliders on the school site was placed in context to the "locality", an area within 3 km of the site. The total number of Yellow-bellied Gliders in the locality was estimated to be 19 animals. The subpopulation of Yellow-bellied Glider was determined to be constrained within natural and artificial boundaries. The barriers to dispersal were Tomaga River to the north, Moruya River to the south, Pacific Ocean to the east and the 132 kV electricity easement (approximately 60 m wide) to the west of the Princes Highway (Figure 1). Approximately 43 Yellow-bellied Gliders from 19 troupes occurred in the broader area, although this figure was considered to be conservative (Table 1).

The distribution, and hence habitat corridor, for Yellow-bellied Gliders in the broader area was assessed. The location of sap feed trees and position of calling gliders indicated that Yellow-bellied Gliders crossed several roads including the Princes Highway at one location. They were gliding a distance of 35 metres between breaks in the canopy.



Figure 3. Blackbutt *Eucalyptus pilularis* utilised by Yellow-bellied Glider for denning.

Examination of an aerial photograph, combined with ground searches, indicated that despite approximately 50% of the native vegetation in the locality being cleared for agriculture, sand mining, quarrying and urban development, the Yellow-bellied Gliders that occurred on the development site were not isolated from a much larger population (Figure 1). This population extended over several lots of freehold land within 3 km of the school site. The identification of critical habitat resources and estimation of population size, habitat corridor and land tenure were important for the development of the Yellow-bellied Glider policy.

Discussion

Development of Yellow-bellied Glider Policy

The policy for the conservation of the Yellow-bellied Glider in the Broulee area (Eurobodalla Shire Council 2002) was developed by Eurobodalla Shire in conjunction with the NSW NPWS as a requirement of a condition of the approval for the construction of the school. The drafting of the policy utilised data presented in the SIS. For the Yellow-bellied Glider to persist in the area, critical habitat components, such as sap feed trees and den sites, required conservation. The animals also required areas of forest for dispersal.

The following two paragraphs are taken from the policy. Its objectives were to ensure the long-term persistence of Yellow-bellied Gliders within the Broulee area through retention of suitable habitat and other development controls, provide certainty with regard to future

Table 1. Estimate of Yellow-bellied Glider population in the locality

Troupe Site	Number of YBG	Detection method
1 Proposed School and environs	3	Observation
2 Captain Oldrey Oval	3	Observation and calling animals
3 George Bass Drive/Broulee Road intersection	3	Observation and calling animals
4 The Bower/Illawong Nature Reserve	3	Observation and calling animals
5 Candlagan Creek	2	Observation and calling animals
6 Protea Farm	2	Calling animals
7 South of George Bass Drive/Broulee Road intersection	3	Calling animals
8 South of locality (easement)	2	call playback
9 Princes Highway	2	Three incised <i>Corymbia maculate</i>
10 South of Waldrons Swamp	2	Two incised <i>Corymbia maculate</i>
11 Decommissioned car wrecking yard	2	One incised <i>Corymbia maculata</i>
12 Gravel pit beside Princes Highway	2	One incised <i>Corymbia maculata</i>
13 Brierley Avenue	2	One incised <i>Corymbia gummifera</i>
14 Brierley Avenue	2	Two incised <i>Corymbia maculata</i>
Potential habitat	10	Estimation based on habitat and area
Total 43		

YBG = Yellow-bellied Glider

development proposals in relation to potential conflict with the conservation of the Yellow-bellied Glider, and reduce costs to landowners and the development industry by reducing the frequency that Species Impact Statements needed to be produced.

A set of minimum standards applies to any development or activity occurring on land in the Broulee area. These are the retention of all sap feed trees and large, hollow-bearing trees, except where it can be demonstrated that Yellow-bellied Gliders do not utilise the hollow bearing trees. Clearing of vegetation around the retained habitat elements must not inhibit access of Yellow-bellied Gliders to these resources and retained vegetation must be configured to allow movement of individual Yellow-bellied Gliders across the property and onto habitat on adjoining properties. A total of 100% of small (<16 hectares) multi-aged forest patches on any property must be retained. A total of 60% of large (> 16 hectares) multi-aged forest patches on any property must be retained. The above minimum standards apply for the remaining 40% of the forest. A total of 50% of other suitable habitat on any given property must be retained. The above minimum standards apply for the remaining 50% of the forest. The policy is noted on section 149 certificates on subject land.

Proposed extension of the policy to the entire shire

To develop a shire-wide YBG policy, Eurobodalla Shire Council proposed planning to analyse forest structure growth stage mapping completed under the southern Comprehensive Regional Assessment (work conducted as a basis for Regional Forest Agreements). As well as core fauna habitat mapping developed by NSW NPWS (2001) as part of the Eurobodalla Coastal Environmental Capacity

Planning Project (<http://www.esc.nsw.gov.au/ECECP/index.asp>), and integrate these data with vegetation ecosystem mapping to determine potential YBG habitat (Coastal Lowlands Spotted Gum *Corymbia maculata* - Burrawang Cycad dry shrub forest and Northern Coastal Sands Shrub/Fern Forest) The final GIS mapped habitat outputs will be classed into three groupings based on age class and the presumption that old growth patches contain critical habitat components, such as hollows, that are used by gliders.

Select areas of freehold land within the potential habitat will then be considered for further field investigation. Priority areas to be selected for field studies will be those where there is a lack of records of Yellow-bellied Glider (NPWS wildlife atlas and the author's private database). Field investigations will include searches for incised trees, spotlight searches and location of large hollow bearing trees (via Global Positioning System). Individual habitat and feed trees will also be located on Council's GIS system. The proposed outcome is to have a more accurate picture of the glider's shire-wide distribution and potential habitat.

Specific prescriptions will be developed for protection of certain forest areas based on their overall habitat value. This will aid Eurobodalla Council in its decision-making process when assessing subdivision applications, and it will give applicants a clear statement regarding habitat retention prior to fauna assessments and subdivision plans.

The policy objectives will be consistent with the Yellow-bellied Glider Recovery Plan (NPWS 2003) Actions 2.3, 2.5 and 2.7 to map (GPS) habitat and critical habitat resources such as sap feed trees and den trees and set down prescriptions for conservation habitat that allow connectivity of populations across the landscape.

Effectiveness of the Yellow-bellied Glider Policy

The aim of the Yellow-bellied Glider Policy in the Eurobodalla Shire was to place restrictions on development so that compromises, made on individual lots, did not lead to the loss of critical habitat components and connectivity. However, even with such development controls, there are problems in the retention of hollow bearing trees, feed trees and linkages to such trees. In existing subdivisions (of 5-7000 sq metre blocks) that may contain suitable Yellow-bellied Glider habitat, there is an expectation of building a dwelling. In these instances some habitat is retained as a condition of consent, where this is appropriate. There is often a conflict of interest with conserving large hollow bearing trees, or even large sap feed trees, and the potential of council being liable if such trees fall on dwellings or other assets.

Another problem is in retention of "other suitable habitat" (as defined by the policy) requiring 50% retention on any given property. If a landholder meets this, and retains 50%, without a property notation on the file, 149 certificate or condition of consent, there is nothing to stop them from clearing 50% of the remainder in 2 or 3 years time as it would be difficult for Council staff to determine that the owner had already cleared suitable habitat historically (J. Morgan pers. comm. Eurobodalla Shire 2003).

The policy has been a success for new subdivisions. Council routinely requires hollow-bearing trees/sap feed trees to be mapped. It is then a condition of consent that these trees, plus linkages to them, are to be retained. If this conflicts with clearing for bushfire protection, then the subdivision layout would be required to be modified, or a significant impact would result (J. Morgan pers. comm. Eurobodalla Shire 2003).

Since the Broulee SIS, Eurobodalla Shire has also simplified some of the philosophical arguments put forward by some consultants in 8 part tests. This has been done by Council requesting that consultants consider a local population to be two or more animals (J. Morgan pers. comm. Eurobodalla Shire 2003).

Applying Planning instruments for the conservation of Yellow-bellied Glider

Concurrence for the development of the school was given in September 2001. The area that covered the home range of the school's troupe was resurveyed in 2004 and three Yellow-bellied Gliders were detected. There was a loss of habitat associated with the development of the school, including sap-feed trees. Habitat adjacent to the school site, and within the troupe's home range, had been compromised. The prime den tree had been removed for the construction of a road associated with urban development that had prior consent.

During a 2004 survey, a portion of land adjacent to the school site, and previously documented to be used by the local population of Yellow-bellied Gliders, was assessed for urban development. This area had previously been identified as supporting den and sap feed trees (Gaia Research 2001a). The Yellow-bellied Glider Policy determined (Clause 9) that

the land could be developed/cleared without significantly impacting upon the local population of the Yellow-bellied Glider in the Broulee Study Area. No explanation for this anomaly is given within the policy. However, given the gliders' reduced area of habitat, the authorities may have considered that the population was unviable. In contrast, when the author applied the EPA Act, it was concluded that the development would have a significant effect on the Yellow-bellied Glider by removing sap-feed trees, nectar feed trees and potential den sites. The initial advice of the Department of Environment and Conservation (DEC), and the Department of Infrastructure Planning and Natural Resources concurred with the author's conclusion. However, subsequent consideration by DEC was that the development was in line with the policy, and that a significant impact on the local Yellow-bellied Glider population would not eventuate from the development (M. Mulvaney pers. comm. DEC 2005). This raises the question: does a statutory planning instrument (EPA&Act) have precedence over a policy?

Impact of historical ill-informed decisions on a threatened species

Under the Eurobodalla Urban Local Environmental Plan 1999, the land proposed for the school was zoned 2g Residential – General zone. Therefore, while most developments such as dwelling houses, dual occupancies, schools that are permitted within this zone require development consent, it is reasonable to state that there is an expectation that development will occur, even when environmental constraints exist.

When assessing a development application on this land in 2001, the eight-part test under the EP&A Act (1979) needed to be applied. However, as the test is generally applied to residential housing blocks of 800 sq metres on average, the likelihood of significantly impacting on a threatened species by clearing 1 block is remote. If 20 blocks are assessed at the same time, the likelihood of a significant impact being discovered is greater. Herein lies the example of cumulative impact. A significant impact was discovered in the school assessment because of the area of land proposed for clearing.

The author is aware of several developments in the Eurobodalla Shire where development, in accordance with existing land use zonings, has led to Yellow-bellied Glider habitat being removed and populations fragmented (see Gaia Research 2001b). If threatened species and their habitats are to be retained over the wider landscape, then the issue of inappropriate land use zonings assigned in the past, with limited information, has to be reconsidered in terms of fauna and flora conservation Acts.

This point illustrates the importance of sound planning at a broader scale. Once land use zonings are established and subdivision layouts approved, the chance of saving threatened species habitat on individual parcels of land has all but disappeared. Conservation of threatened species habitat must be incorporated into Local Environmental Plans. As a last resort, there is scope to provide for conservation of threatened species habitat in subdivision design, as demonstrated by Eurobodalla Shire Council.

Cumulative Impact

One difficulty with the EP & A Act is the lack of provision to consider the proposed development with respect to development on adjoining land. One can state the loss of habitat that has occurred on adjoining blocks, but it is currently not acceptable to put previous loss of habitat into the context of a current proposal to trigger significant effect, and the need for a SIS.

The Broulee case illustrates that prior urban development and the construction of wide roads had removed Yellow-bellied Glider habitat and reduced the connectivity of forest. Based on Goldingay and Kavanagh's (1991) review of Yellow-bellied Glider home ranges (30 to 65 hectares), the area of bushland removed under the current and previous developments rendered the school's troupe unviable in the long term. Although the SIS led to the mapping of a Yellow-bellied Glider habitat corridor in the locality, and a Policy to conserve habitat within the broader area, the long-term persistence of the species on the subject land is unlikely. Currently there is no mechanism under the EP&A Act to consider the cumulative effect of gradual loss of habitat.

Consultations and amelioration of impacts

A key feature of the TSC Act is the replacement of the issuing of licences with concurrence and consultations that lead to the amelioration of impacts. Very few developments considered under the EP&A Act have been refused concurrence. Where developments are ameliorated to gain concurrence, then there is still a loss of habitat. With respect to developments that propose removal of native vegetation, the term "compromise" equates to habitat loss.

Under the *Threatened Species Legislation Amendment Act 2004* there is a shift in emphasis from assessments of individual developments to a "landscape" approach to managing biodiversity (including threatened species and their habitats). Although this scheme is still being developed (in late 2005) one major change is that the emphasis has now been shifted to the beginning of the planning pipeline, the Local Environmental Plan (LEP) (see postscript in Adam 2004) and not at the end (eight-part test or equivalent). In the Eurobodalla Shire, a regional (shire wide) conservation plan that addresses the requirements of the Yellow-bellied Glider will be required to fulfil biodiversity certification of the amended LEP. This will be necessary so that development "offsets" can be determined with respect to the habitat corridors. Not all habitat is equal, and losses of bottleneck areas of habitat corridors will lead to further fragmentation of Yellow-bellied Glider populations.

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Conclusions

It is easy to find fault with the existing system, but it is more difficult to amend legislation to better conserve biodiversity on land where development is proposed. Zoning regulates land use and development capacity. There is a conflict of interest at all levels of government with providing for an expanding human population and the retention of habitat of threatened species. There is also a potential conflict of interest with local government having dual roles as the consent authority and assessing reports under the EP&A Act (separation of power), particularly where there are no Australian Standards against which to assess a report, as there are for engineering matters.

The Broulee SIS provided data that led to the development of policy by local government to conserve habitat for a forest dependent species. The long-term efficacy of this policy will require review by resurveying the Yellow-bellied Glider population in the Broulee area over time. Recent surveys indicate that, within two years after adopting the policy, additional habitat was being lost due to the construction of roads and houses. A portion of this loss came through developments, which had prior consent (i.e. did not require application of the eight part test). The policy could be strengthened by an amendment to include developments that had prior consent, but were not assessed under the eight part test.

The policy evolved as a bottom-up response to a particular issue. The policy now has broad application over the entire shire and it would be appropriate to adopt similar policies to conserve habitat of the Yellow-bellied Glider in other local government areas.

The Yellow-bellied Glider policy was reactive. An alternative approach would be a proactive situation whereby habitat for species, such as the Yellow-bellied Glider, is mapped and registered for special consideration by State Government agencies (Daly 2000). This could then be used in broad and specific considerations. For example, if the location of critical habitat components, such as sap feed trees and hollow-bearing trees, were recorded accurately and noted on each property file, then council could assess if people had cleared such vegetation without consent. It would also be possible to place individual proposals within a broader context in any assessment.

At the broader scale, maps that show the distribution of the Yellow-bellied Glider could be part of Regional Environmental Plans that span various land tenures and local government boundaries. Such maps would then be a mandatory consideration of conservation strategies in any Local Environmental Plan and Development Control Plan. These data could also assist in revegetation programs, especially those to link fragmented landscapes.

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