

# Fauna Impact Statements: a review of processes and standards

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## ABSTRACT

Fauna Impact Statements (FISs) are now required in association with all actions in New South Wales which are, considered likely to "take or kill" "endangered" fauna. In this paper it is argued that "take or kill" is equivalent to having a significant impact on either individuals or the habitat of a species of endangered fauna. In addition, I review the context in which these FISs are required and consider the adequacy of FISs that have so far been produced as well as potential improvements in the FIS process.

## INTRODUCTION

The preparation and submission of a Fauna Impact Statement (FIS) is a relatively new legislative requirement in New South Wales. As a result of amendments to the *National Parks and Wildlife Act 1974* (NPW Act) and the *Environmental Planning and Assessment Act 1979* (EPA Act) brought about by the *Endangered Fauna (Interim Protection) Act 1991* (EFIP Act), an FIS must be prepared for any proposed development or activity that is likely to have a significant impact on one or more species of "endangered" fauna. A species is considered "endangered" if it is included on a list of species, known as Schedule 12, which forms part of the NPW Act (see below).

New South Wales legislation in relation to endangered fauna has been evolving and may change again in the relatively near future. The original EFIP Act was scheduled to be partially repealed at the beginning of December 1992 or upon the date of assent to an Act providing for threatened species conservation, whichever is the sooner (see EFIP Act 1991). However, this Act was extended by the EFIP Act 1992 and then again by the EFIP Act 1993 and is now due to be partially repealed on 1 October 1995. At least two alternative pieces of draft legislation have been put forward as potential replacements of the present EFIP Act. These have been called the *Threatened Species Conservation Bill 1993* and the *Endangered And Other Threatened Species Conservation Bill 1993*. However, given the limited time now available for these and other alternatives to be considered, it seems likely that the present EFIP will be extended again until the various alternatives can be fully evaluated.

Despite the dynamic nature of the procedures and processes whereby impacts of developments and activities on endangered fauna are evaluated, it is appropriate to consider these procedures and processes as they have occurred in the recent past and as they occur now. Such a consideration should lead to a better understanding of how these procedures and processes operate. I therefore hope that the present paper, though possibly somewhat out-of-date by the time you are reading it, will prove to be a useful contribution to the ongoing discussion of the subject.

There are two slightly different situations in which an FIS may be required. Firstly, according to the NPW Act, a person "shall not take or kill any endangered fauna" unless a licence, called a Section 120 licence, has been issued by the Director-General of the National Parks and Wildlife Service (NPWS) (i.e., the DG of National Parks and Wildlife — see NPW Act) under Section 120 of that Act (see NPW Act). This Act also requires that an application for a Section 120 licence for endangered fauna is accompanied by an FIS. Secondly, according to the EPA Act, any application for approval of a development or activity for which it is considered that "there is likely to be a significant effect on the environment of endangered fauna" must be accompanied by an FIS (see EPA Act). According to this Act, the form and content of an FIS is as specified in the NPW Act (see NPW Act and see below).

It is easier to know about and have access to those FISs that have been submitted to the NPWS than to those submitted to other Government Agencies. The number of these other Government Agencies is potentially

large and may include any Local Council. Notifications concerning FISs submitted to the NPWS are required to appear in newspapers with Statewide circulation, whereas there is no legal requirement for published notification concerning FISs submitted to other Government Agencies under the EPA Act (see NPW and EPA Acts). However, in those cases where an Environmental Impact Statement (EIS) has also been submitted, notification with regard to the associated FIS may be included in the necessary notification concerning the EIS (see EPA Act and EPA Regulation 1980). Copies of FISs submitted to the NPWS as part of a licence application must be available for inspection or purchase (see NPW Act). They may sometimes be purchased from the Service, but are usually available for purchase from the licence applicant at the direction of the Service (see NPW Act; J. Ravallion, NPWS, pers. comm.), whereas those submitted to other Government Agencies are generally only available for inspection, but may sometimes be copied (see EPA Act).

It is also easier to consider the processes involved in the assessment of an FIS submitted to the NPWS than an FIS submitted to another Government Agency. FISs submitted to the NPWS are always the principal document being assessed and are often the only such document. FISs submitted to other Government Agencies are generally assessed in conjunction with other documents such as Development Applications and Environmental Impact Statements (EISs).

For these reasons the present paper focuses primarily on the processes involved in the preparation and assessment of FISs submitted to the NPWS in association with applications for Section 120 licences. However, since most FISs that are submitted to other Government Agencies under the EPA Act will also be submitted to the NPWS and since all FISs must have the same form and content, much of the discussion in this paper applies to FISs in general.

The FISs that are received by the NSW NPWS fall (logically) into the following six categories:

- (a) No s120 licence is required because impact on endangered fauna is considered not significant by the applicant (i.e., applicant considers that no "take or kill" will occur);
- (b) There is no accompanying application for a s120 licence because, for example, FIS was forwarded for comment by the Service by a Consent or Determining Authority;

- (c) Application for s120 licence is withdrawn before it has been fully considered;
- (d) Application for s120 licence has been considered and s120 licence has been issued for the proposed development or activities;
- (e) Application for s120 licence has been considered and s120 licence refused;
- (f) Application for s120 licence currently under review.

To date there have been examples of almost all these situations. Several have either not required to be licensed under Section 120 of the NPW Act or have not been accompanied by an application for a s120 licence (R. Couch, NPWS, pers. comm.). Applications for s120 licences have been submitted and subsequently withdrawn in some cases, including proposed forestry operations for a number of Management Areas (for FISs see Austeco 1992; Forestry Commission of New South Wales 1992b; Kinhill Engineers 1992; Mount King Ecological Surveys 1992b; Truyard 1993b). As of 30 April 1995 Section 120 licences have been granted for 15 proposed developments or activities (Table 1). At that time a further 15 licence applications were being processed by the Service (J. Carter, NPWS, pers. comm.).

To date, no applications for s120 licences have been formally refused (though some have apparently been withdrawn after informal discussions — R. Couch, NPWS, pers. comm.). Hence it is not presently possible to consider this category of FIS.

The present paper will focus primarily on those FISs for which s120 licences have been issued, because it is only for these FISs that it is possible to consider the decision-making process whereby the FIS is evaluated. In these cases the Service is required to prepare and publish a "Decision Report" which presents the DG's "reasons for issuing a licence" (see NPW Act and see below). If, on the other hand, a licence application is refused then the "reasons" for the decision need only be provided to the applicant and anyone who made a submission regarding the FIS (see NPW Act). Furthermore, unless an application for a s120 licence is formally granted or refused, no such Report is required (see NPW Act 1974).

Section 120 licences have been issued for a range of developments, activities (*sensu* EPA Act) and other actions (Table 1). Licensed actions include construction of roads (4 cases),

Table 1. Fauna Impact Statements submitted to the NPWS in association with applications for s120 licences (as of 31 April 1995).

Proposed development/activity	Proponent	FIS prepared by	Reference	Date licence issued
(a) General licence issued				
	Roads and Traffic Authority	A. Ross (Roads and Traffic Authority of NSW) (EIS in lieu of FIS)	Ross (1991)	Nov. 92
Forestry operations in 11 compartments in Eden Management Area	NSW Forestry Commission (now State Forests)	Environmental Assessment Branch of the Forestry Commission using information supplied by J. Shields and V. Jurskis	Forestry Commission of New South Wales (1992)	Jan. 93
Mining at Saltwater, near Taree	Mineral Deposits Ltd	F. D. Fanning (Gunninah Consultants)	Fanning (1992)	Feb. 93
Construction of North Nowra-Bomaderry Link Road	Shoalhaven City Council	Mitchell McCotter and Associates	Mitchell McCotter (1992)	Jun. 93
Importation of domestic dogs on to Lord Howe Island	Lord Howe Island Board	R. Harden (NSW NPWS)	Harden (1993)	Sept. 93
Forestry operations in Wingham Management Area	NSW Forestry Commission (now State Forests)	M. Denny (Mt King Ecological Surveys)	Truyard (1992)	Feb. 94
Construction of warehouse complex at Roberts Road, Greenacre	Walker Corporation Pty Ltd	A. White (Biosphere Consultants)	White (1993)	Jun. 94
Construction of Taree Bypass Road	Roads and Traffic Authority	SWC Wetlands and Ecological Management Consultancy	SWC Wetlands and Ecological Management Consultancy (1993)	Jun. 94
Residential development at corner of Dalmeny and Kimberley Roads, Rosebery	State Superannuation Investment and Management Corporation	H. Cogger (Australian Museum)	Australian Museum (1993)	Sept. 94
Mining at Lower Bielsdown, North Dorrigo	Allegiance Mining NL	Austeco Pty Ltd	Austeco (1994)	Nov. 94
Development within Homebush Bay Brickpit	Homebush Bay Corporation (now Olympic Co-ordination Agency)	A. Greer (Australian Museum)	Greer (1994)	Nov. 94
Residential development at Cabarita on NSW north coast	David Ardwill and Associates	J. Warren (Biological and Environmental Consultant)	Warren (1994a)	Nov. 94
Construction and operation of Pacific Palms Sewerage Treatment Plant	Great Lakes Council	Austeco Pty Ltd	Manidis Roberts Consultants (1993)	Nov. 94
Construction of Brunswick Heads Bypass Road	Roads and Traffic Authority	D. Milledge and A. McKinley (David Milledge and Associates)	Roads and Traffic Authority (1993)	Nov. 94
Extension of mining at Mt Owen Mine near Hebdon	Hunter Valley Coal Corporation	Resource Planning Pty Ltd	Resource Planning (1994)	Apr. 95

Table 1 — continued

## (b) Application for s120 licence under review as of 31 April 1995

Proposed development/activity	Proponent	FIS prepared by	Reference
Construction of Lismore to Mullumbimby Electricity Transmission Line	Electricity Transmission Authority	F. D. Fanning (Gunninah Consultants)	Fanning (1994)
Construction of Fingal Bay Road	Port Stephens Council	M. Denny (Mt. King Ecological Surveys)	Sinclair Knight Merz (1994)
Construction of Coffs Harbour Eastern Distributor Road	Coffs Harbour Council	M. Murray (SWC Wetlands and Ecological Management Consultancy)	RUST PPK (1994)
Residential development at Fern Beach in Byron Shire	Ray Group	J. Warren (Biological and Environmental Consultant)	Warren (1994b)
Construction of Lyons Road—Englands Road deviation of Pacific Highway at Coffs Harbour	Coffs Harbour Council	J. Brockhoff (Connell Wagner Pty Ltd)	Connell Wagner (1994)
Development of industrial, residential, and tourist facilities in Bega Shire	Department of Conservation and Land Management	N. Graham-Higgs (Nicholas Graham-Higgs and Associates)	Nicholas Graham-Higgs (1994)
Construction of Bulahdelah—Coolongolook upgrade of Pacific Highway in Great Lakes Shire	Roads and Traffic Authority	M. Murray (SWC Wetlands and Ecological Management Consultancy)	SWC Wetlands and Ecological Management Consultancy (1994)
Construction of Fattorini Dam in Kempsey Shire	Department of Public Works	Kendall and Kendall	CMPS&F Environmental (1995)
Sand extraction mining at Fern Bay in Port Stephens Shire	Boral	N. Buchhorn and B. Crossley (ERM Resource Planning)	ERM Resource Planning (1994b)
Mining of titanium at Clybucca in Kempsey Shire	RZM	ERM Resource Planning	ERM Resource Planning (1995)
Residential development at Croudace Bay in Lake Macquarie Shire	Ifuno Pty Ltd	ERM Resource Planning	ERM Resource Planning (1994a)
Construction of Coolongolook—Possum Brush deviation of Pacific Highway in Great Lakes Shire	Roads and Traffic Authority	Austeco Pty Ltd	Mitchell McCotter (1994)
Construction of Billinudgel to Chunderah deviation of Pacific Highway in Tweed Shire	Roads and Traffic Authority	M. Denny (Mt. King Ecological Surveys)	Sinclair Knight (1994)
Residential development at Searanah in Tweed Shire	Ray Group	S. Phillips (Australian Koala Foundation)	Australian Koala Foundation (1995)
Control of vertebrate pests	NSW Department of Agriculture	Korn <i>et al.</i> (NSW Department of Agriculture)	Korn <i>et al.</i> (1998)

construction of buildings (5 cases), forestry operations (2 cases), mining (3 cases) and dog importation (1 case).

It is against this background that I have carried out the present review of the FISs submitted to the NPWS, the processes that lead to them, and the manner in which they are to be evaluated. In this paper I shall consider the following:

- (a) conditions under which an FIS is required
- (b) who decides whether or not an FIS is required and how is this decision made
- (c) relationship between FISs and EISs
- (d) requirements for an FIS
- (e) who prepares an FIS
- (f) adequacy of present FISs
- (g) evaluation of FIS
- (h) determination of applications for general licences
- (i) opportunities to view and comment on an FIS and associated documents
- (j) potential improvements in the FIS process.

In considering these things, I shall attempt to provide an ecologist's perspective and understanding, rather than those of a lawyer or judge.

#### **(a) When is an FIS required?**

There are three general situations in which an FIS is required. These arise from the *Endangered Fauna (Interim Protection) Act 1991* (EFIP Act) which amends both the *National Parks and Wildlife Act 1974* (NPW Act) and the *Environmental Planning and Assessment Act 1979* (EPA Act). The *Timber Industry (Interim Protection) Act 1992* (TIIP Act) further amends the EPA Act.

These three situations are as follows. First, the amended NPW Act states that the "taking or killing" of "endangered fauna" is not permitted without a "general licence". Such a licence is issued by the Director-General of the NSW National Parks and Wildlife Service (NPWS) and a licence application must be accompanied by an FIS. Second, the amended EPA Act now states that where an application is made in respect of a development which is "likely to significantly affect the environment of endangered fauna" this application must be accompanied by an FIS. Finally, the amended EPA Act also states that a Determining Authority must not carry out an activity, or grant an approval in relation to an activity,

being an activity which is "likely to significantly affect the environment of any endangered fauna" unless an FIS has been prepared. I shall show below that, except in regard to direct killing of endangered fauna, these situations are essentially equivalent. Direct killing or otherwise disturbing endangered fauna individuals is rarely an issue and is covered solely by the NPW Act.

It follows that in order to understand when an FIS is required, it is necessary to know what is meant by "take", "environment", "significant effect", "endangered" and "fauna". I shall consider each of these in turn and shall show that the overall requirement is that an FIS must be prepared whenever the proposed actions are likely to have a significant impact on either individuals or the habitat of a species that is listed on Schedule 12 of the NPW Act.

#### *(i) Definition of "take"*

The EFIP Act modified the definition of "take" in the *National Parks and Wildlife Act 1974* (NPW Act) to explicitly include "significant modification of the habitat of the fauna which is likely to adversely affect its essential behavioural patterns". Other activities such as hunting, shooting etc were already included in the definition. The EFIP Act thus gave explicit recognition to the definition of "take" adopted by the Land and Environment Court in the now well-known court case concerning proposed logging within three forestry compartments of the Chaelundi State Forest (Forestry Commission of New South Wales v Corkill 1991: 73 LGRA 247).

The "habitat" of a species may be defined as the "place where an animal or plant normally lives, often characterized by a dominant plant form or physical characteristic" (Ricklefs 1979).

Many proposed developments or activities would lead to some modification of the habitat of endangered fauna and are therefore potential subjects of FISs. Forestry activities, for example, clearly involve the modification of habitat and, since all State Forests probably contain "endangered" fauna, forestry activities in all Management Areas are likely to affect such species through habitat modification. Roadworks through vegetated areas will also modify wildlife habitat and, depending on the area involved, may affect endangered species.

#### *(ii) Definition of "environment"*

The "environment" and "habitat" of a species are essentially the same. The EPA Act defines "environment" only in a human context

as including "all aspects of the surroundings of man, whether affecting him as an individual or in his social groupings". If this definition is applied to a non-human animal species by simply replacing the word "man" with the words "a species" then the resulting definition is equivalent biologically to that above for "habitat".

(iii) *Significant modification to habitat*

It can be seen from the above discussion of the meanings of "take", "habitat" and "environment" that an Authority will require an FIS if it considers that the proposed actions are likely to result in significant modification of the habitat of endangered fauna.

It is not clear, however, what constitutes a "significant modification" to the habitat, whether forestry activities fall within this category, and what other activities are included. The EFIP Act lists the following seven factors (i.e., "seven point test of significance") to "be taken into account" in deciding whether there is likely to be such a significant effect:

- (a) the extent of modification or removal of habitat, in relation to the same habitat type in the locality;
- (b) the sensitivity of the species of fauna to removal or modification of its habitat;
- (c) the time required to regenerate critical habitat, namely, the whole or any part of the habitat which is essential for the survival of that species of fauna;
- (d) the effect on the ability of the fauna population to recover, including interactions between the subject land and any adjacent habitat that may influence the population beyond the area proposed for development or activities;
- (e) any proposal to ameliorate the impact;
- (f) whether the land is currently being assessed for wilderness by the Director of National Parks and Wildlife under the *Wilderness Act* 1987;
- (g) any adverse effect on the survival of that species of endangered fauna or of populations of that fauna.

However, while these factors seem most reasonable, there remains little indication of how these factors are to be evaluated and integrated to produce an assessment of "significance".

The EPA Act overcomes this problem to some extent by providing a list of "designated developments" for which an FIS must be submitted along with an application for approval of the proposed development (Schedule 3 of EPA Regulation 1980 under the EPA Act 1979). However, this list is not a complete list of developments that ultimately require consent under Part IV of the EPA Act and there is no apparent list of activities that require similar approval under Part V of the Act.

There is no explicit legislative requirement that FISs be prepared in relation to proposed forestry operations and consequently whether or not an FIS should be prepared in relation to any proposed forestry operations is apparently up to the New South Wales Forestry Commission. Firstly, the NPW Act does not necessarily require such an FIS. Though the NPWS must evaluate any FIS along with an application for a General Licence, it has no legislative obligation to require or request either a licence application or an FIS in respect of any proposed activities. It does, however, have the power to issue stop-work orders and to initiate prosecutions where it considers that actions are having or are about to have a significant impact on endangered fauna. Forestry activities are, however, covered by Part V of the EPA Act which requires that these activities are approved by a "Determining Authority" (see EPA Act). For the forest management areas included in the TIIP Act, the relevant Determining Authority is the New South Wales Minister for Planning. According to this Act, Environmental Impact Statements (EIS) are required for the listed management areas (see Schedule 4 of TIIP Act). However, neither the Minister for Planning nor the Department of Planning are apparently obliged to require or request that an FIS be prepared and submitted. This leaves the Forestry Commission to decide whether or not to submit an FIS with respect to each area listed in the TIIP Act. For forestry management areas other than those listed in the TIIP Act, the Forestry Commission is the Determining Authority for its own proposals. It is therefore also up to the Forestry Commission to decide with respect to these latter areas whether or not an FIS is required. As a Determining Authority it must consider the seven factors listed above.

The recent court case concerning logging in the Chaelundi State Forest (Forestry Commission of New South Wales *v* Corkill 1991: 73 LGRA 247) did, however, establish a precedent for the preparation and submission

of FISs in relation to proposed forestry activities. In the judgment for that case it was concluded that "taking" fauna included significantly modifying their habitat and that the proposed forestry activities would be likely to result in such habitat modification (Forestry Commission of New South Wales *v* Corkill 1991: 73 LGRA 247). Consequently, it can reasonably be expected that the Land and Environment Court would conclude that an FIS was required for any forestry activities in forest containing endangered fauna. This should apply to all State Forests, since each State Forest is expected to contain a number of species of endangered fauna (see, for example, Kinhill Engineers 1992; Austeco 1992; Mount King Ecological Surveys 1992a; 1992b; Truyard 1993b).

In order to judge whether or not a proposed forestry operation requires an FIS, the Forestry Commission (which now uses the name State Forests of NSW for its commercial activities) has apparently adopted its own definition of "significant disturbance" which is as follows (e.g., Mount King Ecological Surveys 1992):

- (i) A significant disturbance event occurs when an animal population is reduced to a level from which it cannot possibly recover. This event is significant at the species level if it effects all populations of the species simultaneously.
- (ii) A significant disturbance event occurs when an animal population is reduced to a level that it would never experience under conditions imposed by nature: fire, drought, disease, predation and competition. This disturbance event would be significant at the species level if it effects all populations of the species concerned simultaneously. A reduction of 30% of the population could be considered significant.

This definition is consistent biologically with the above "seven point test of significance". The first component addresses the fourth point of significance, while the second simultaneously considers the first and second points. This definition also provides some potential means of quantifying the impact of proposed activities and assessing their significance. It does not, however, fully address the seven points.

It is not, in any case, possible to apply the State Forests definition of significant disturbance to current proposed forestry activities because of our lack of knowledge of faunal abundances and the impacts of logging

and other forestry activities on fauna. However, it appears to have been generally accepted that there is a reasonable "probability that some endangered species may be affected by selective logging practices" (Mount King Ecological Surveys 1992) and this has resulted in the preparation of FISs for forestry activities in many areas.

Other activities that could be considered to result in "significant modification of the habitat" range in scale from the felling of one or a few trees to relatively large scale habitat destruction for extensions to agricultural land or urban development. What constitutes "significant" along this continuum needs to be discussed and clarified.

A different criterion for assessing the significance of likely impact on endangered fauna has been adopted by Austeco (e.g., Austeco 1993). They have suggested that a loss of one or more individuals of any species of endangered fauna would be significant and would therefore warrant the preparation and submission of an FIS (e.g., Austeco 1993). Given this criterion for significance, it is clear that forestry operations in any State Forest would be considered likely to have a significant impact on endangered fauna.

#### (iv) Definition of "endangered"

The EFIP Act provides only a rough idea of what the biological attributes of an "endangered" species are. It indicates that these are species that require "protection" (section 2) and so implies that "endangered" species are species that are at a relatively high risk of extinction. The Act also states that "endangered" species will be categorized as either "threatened" or "vulnerable and rare" and implies that the risk of extinction is greater for the former than for the latter.

The Act does not provide biologically precise definitions of "endangered", "threatened", "vulnerable" or "rare". It does, however, indicate that a species is to be considered "threatened" if it satisfies at least one of the following conditions (see NPW Act):

- (a) "the population of the species has been reduced to a critical level";
- (b) "the habitat of the species has been drastically reduced or modified";
- (c) the species is "in danger of extinction";
- (d) the species is "considered extinct".

It also indicates that a species will be considered vulnerable and rare if it satisfies one or more of the following:

- (a) "the population of the species is decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance";
- (b) "the population of the species has been seriously depleted and its ultimate security has not yet been assured";
- (c) "the population of the species is still abundant but is under threat from severe adverse factors throughout its range";
- (d) "the species has a small population contained in restricted areas or habitats or thinly scattered over a more extensive area".

In terms of biology, it is difficult to apply these definitions because it is not clear what is meant by such terms as "critical level", "drastically reduced", "danger of extinction", "seriously depleted", and "security assured" in the definitions. Consequently, the categorization of some species as being "endangered" is similarly difficult (see below).

The EFIP Act specifies that a "Scientific Committee" will produce a list of "endangered" fauna species and specifies that the Committee will have regard to the above criteria for judging a species to be either "threatened" or "vulnerable and rare". The Committee is not, however, restricted to these criteria but may have regard to "any other matter which the Committee considers relevant". The Act does not provide any indication of how the various factors are to be quantified and integrated to produce the categorization of each species. This is left up to the Committee.

The Scientific Committee consisted, as per the EFIP Act, of three people, "each with expertise in the assessment and conservation of threatened and vulnerable species of fauna". It included "one person nominated by the Australian Museum" (H. Cogger), "one person nominated by the Ecological Society of Australia" (C. Dickman), and "one scientific officer of the National Parks and Wildlife Service" (D. Lunney). The Committee had little time (i.e., only one month) to produce the draft list (i.e., interim Schedule 12) of endangered species.

The Scientific Committee adopted the following scheme to quantitatively evaluate the status of each species of "fauna" (i.e., mammal, bird, reptile and amphibian — see section III below) known to occur in New

South Wales (Lunney *et al.* 1995). First, a questionnaire with numerical scores assigned to each possible answer was prepared and distributed to a number of fauna "experts" for their responses (Lunney *et al.* 1995). For example, if a species was considered to have a New South Wales population of less than 100 individuals, that species received a score of 15 out of 15 for the question relating to population size. If it was estimated to have a current New South Wales distribution that covers less than 100 square kilometres then it would receive an additional score of 10. The total for the whole questionnaire of the maximum points for each question is 100. The higher the total score the more endangered the species is considered to be. In addition, any species that had not been recorded alive in the wild in New South Wales in the last 50 years was automatically listed in the most-endangered category in Schedule 12 (i.e., as "threatened").

Included in the questionnaire was also an opportunity for the respondent to "vote" for a particular categorization of each species. The respondent to the questionnaire was asked to specify which of three alternative categories (i.e., threatened, vulnerable/rare, none of the above) is most appropriate for each species. These categories were not defined but the respondent was made aware of the above listed criteria for the categorization of species as threatened or vulnerable and rare.

Replies to the questionnaire were received from 89 zoologists chosen by the Committee. The median scores were tabulated along with the results of the vote regarding species status. Both were considered by the Committee in the categorization of species and a preliminary list of endangered species was prepared in two parts (Part 1: Threatened; Part 2: Vulnerable and Rare).

The initial listing by the Committee of endangered fauna was based on the results of the questionnaire, including both the votes by the "experts" and the scoring system (Lunney *et al.* 1995; D. Lunney, NPWS, pers. comm.). This initial list was then placed on public exhibition resulting in 35 submissions which were considered in the production of the final list (Lunney *et al.* 1995; D. Lunney, NPWS, pers. comm.). The final list was then published in the *Government Gazette* on 18 December 1992. Of the State's 883 fauna species, 233 were now on the list of endangered fauna for New South Wales as a result of this process. This list has remained in place up to the present time of writing (May 1995). The



Schedule 12 list of "endangered" species can be modified by the Scientific Committee "as may be appropriate from time to time" (section 92A of amended NPW Act).

(v) *Definition of "fauna"*

"Fauna" is defined by the *National Parks and Wildlife Act 1974*, as amended by the *Endangered Fauna (Interim Protection) Act 1991*, to include any mammal, bird, reptile or amphibian. Consequently the definition now embraces amphibians for the first time. However, fish and invertebrates which would be considered "fauna" by any biologist are not included. Furthermore, by focusing only on fauna, the legislation does not consider flora, many species of which are also "endangered" (Briggs and Leigh 1988), or associations of species, some of which are considered poorly conserved (Benson 1989).

(b) *Who decides whether or not an FIS is required and how is this decision made*

Whether or not a proposed development or activity is likely to result in a "significant" effect on "the environment of endangered fauna", and hence whether or not an FIS is required, is not decided by the New South Wales NPWS but may be decided by the proponent of the proposed development or activity, or the "Consent Authority" for proposed developments, or the "Determining Authority" for proposed activities (see EPA Act, as amended by the EFIP and TIIP Acts). However, the latter two situations apply only to proposed actions that require consent or approval under the EPA Act. In all other situations the decision is made by the proponent.

The criteria to be used by a Consent or Determining Authority in deciding whether or not an FIS is required are specified in the so-called "seven-point test" presented in section 4A of the EPA Act. These are as follows (see EPA Act):

- (a) the extent of modification or removal of habitat, in relation to the same habitat type in the locality;
- (b) the sensitivity of the species of (endangered) fauna to removal or modification of its habitat;
- (c) the time required to regenerate critical habitat, namely, the whole or any part of the habitat which is essential for the survival of that species of (endangered) fauna;

- (d) the effect on the ability of the (endangered) fauna population to recover, including interactions between the subject land and adjacent habitat that may influence the population beyond the area proposed for development or activities;
- (e) any proposal to ameliorate the impact;
- (f) whether the land is currently being assessed for wilderness by the Director-General of National Parks and Wildlife under the *Wilderness Act 1987*;
- (g) any adverse effect on the survival of that species of endangered fauna or of populations of that fauna.

These criteria, though not quite as comprehensive as those required for any subsequent FIS (see below), are similar in that they amount to an assessment of the nature and extent of any impact of the proposed actions on endangered fauna and of the likely effectiveness of any ameliorative measures that have been proposed.

It is not clear, however, how either a Consent Authority or a Determining Authority obtains the necessary information to make the initial decision regarding whether or not an FIS is required. This decision must be made on the basis of information that relates to the above "seven-point test", but there is no legislative requirement regarding the nature, extent or form of this information. It is apparently, current "practice" for proponents of developments to submit a preliminary fauna assessment or EIS to the relevant Consent Authority and for proponents of activities covered by Part V of the EPA Act to submit a Review of Environmental Factors or EIS to the relevant Determining Authority (D. Lunney, NPWS, pers. comm.). In each case the decision with regard to the need for an FIS is presumably made by the Authority after informal discussion between it and the proponent.

It is also unclear how Consent and Determining Authorities make this decision after they have obtained the necessary information. The "seven-point test" provides the criteria but gives no indication of how they should be applied. It would seem to be possible, in principle, for an Authority to consider that the total extinction of a species is not "significant" with regard to application of the EPA Act.

A proponent for a development or activity might in some cases prepare and submit an FIS and seek a Section 120 licence without

direction from a Consent or Determining Authority. A proponent might, for example, do this to reduce the likelihood of either becoming subject to a stop work order issued under Section 92E of the NPW Act or of being prosecuted for taking or killing endangered fauna under the NPW Act. Successful prosecution would not be possible and a stop work order would be unlikely, if the proponent had a Section 120 licence from the Director-General of the NPWS to "take or kill endangered fauna" (see NPW Act). A proponent might also initiate an FIS in order to save time in the overall approval process.

### **(c) Relationship between FISs and Section 120 Licences**

The decision regarding whether or not a proponent of a development or activity will seek a Section 120 licence from the NPWS appears to be solely up to the proponent. There is no apparent legal requirement for such a licence except in that "taking or killing" of endangered fauna may not occur without one. Hence, by proceeding without a Section 120 licence, a proponent may be at risk of being affected by a stop-work order or of prosecution for "taking or killing" endangered fauna. Proponents may reduce these risks by seeking an appropriate Section 120 licence if they consider it likely that the proposed actions will have a significant impact on endangered fauna.

The submission of an FIS to either a Consent Authority or a Determining Authority does not in any way obviate the need for a Section 120 licence for the proposed development or activity.

### **(d) Relationship between FISs and EISs**

In many cases both an FIS and an EIS will be required. If, for example, a proposed activity is considered likely to significantly affect endangered fauna, then the Determining Authority will require an FIS. Since endangered fauna are part of the environment, then the Authority should also require an EIS. In addition, if a Consent Authority considers that a designated development is likely to have a significant effect upon endangered fauna, then it will require an FIS in addition to the mandatory EIS for such developments. Consequently, FISs and EISs will commonly be produced together or as combined documents.

However, an FIS will be required but no EIS for proposed developments that are considered likely to significantly affect

endangered fauna but are not included in the list of designated developments (see Section 77 of EPA Act as amended by EFIP and TIIP Acts and see Schedule 3 of the Environmental Planning and Assessment Regulation 1980). Examples of such proposed developments include new or enlarged roads such as the North Nowra-Bomaderry link road (Table 1) and large scale housing or tourist developments (J. Johnson, Environmental Defenders Office, pers. comm.).

### **(e) What are the requirements for an FIS?**

An FIS must satisfy several requirements explicitly stated in the EFIP Act plus other requirements as notified by the Director-General of the NPWS. In terms of fauna the Act requires that an FIS must include, "to the fullest extent reasonably practicable", the following 4 items:

- (i) a full description of the fauna to be affected by the actions and the habitat used by the fauna;
- (ii) an assessment of the regional and statewide distribution of the species and the habitat to be affected by the actions and any environmental pressures on them;
- (iii) a description of the actions and how they will modify the environment and affect the essential behavioural patterns of the fauna in the short and long term where long term encompasses the time required to regenerate essential habitat components;
- (iv) details of the measures to be taken to ameliorate the impacts."

In addition, the Act requires that an FIS "have regard to any requirements" of the Director-General of the National Parks and Wildlife Service. These requirements may vary from one situation to another but are generally similar to the following 21 which were required in the case of the FIS prepared for proposed logging operations in the Wingham Forestry Management Area (Mount King Ecological Surveys 1992):

1. A fauna survey of the area. Selection of sites should be based on sampling a range of environmental strata present, e.g., across different vegetation types, altitude and geology. Sites should be replicated and potential habitat of endangered fauna must be adequately sampled. A review of any relevant fauna studies previously undertaken in the area should be included.

2. A full description of the methodology used in the survey, including dates of survey, weather conditions, number of traps, configuration of traps, etc. Identification of reptiles, frogs and bats should be confirmed by a recognized authority (e.g., Australian Museum) for species of taxonomic uncertainty.
  3. A list of all protected fauna species known or likely to occur in the area.
  4. A description of the location of endangered fauna species recorded during the fauna survey referred to in point 1 and a discussion of potential habitat of endangered fauna known to occur in the area.
  5. Comments on the health of endangered fauna populations recorded during the fauna survey referred to in point 1.
  6. A description of the abundance of endangered fauna populations within areas to be affected by proposed forestry operations and an estimation of the local, regional and state-wide abundance of endangered fauna known to occur in the area.
  7. A description of the local, regional and state-wide distribution of endangered fauna known to occur in the area.
  8. A discussion of protected species (including endangered) species known to occur in the area which are likely to be sensitive to the proposed forestry operations and forest disturbance.
  9. Identification of the protected (including endangered) fauna species known to occur in the area, which are dependent on or utilize old growth forests.
  10. A description of the habitats or potential habitats of endangered fauna known or likely to occur in the area affected by the proposed operations and a discussion of the regional and state-wide distribution of these habitats.
  11. A discussion of the conservation status, in local, regional and state-wide context, of all species of endangered fauna known or likely to occur in areas to be affected by the proposed operations.
  12. A description of dispersal or movement areas or routes of endangered fauna species known to occur in the area and any barriers to interbreeding opportunities between populations of endangered fauna within the area.
  13. Identification and general discussion of habitat critical to the survival of endangered species known or likely to occur in the areas to be affected by the proposed operations.
  14. A discussion of the likely impact on native fauna populations from feral animals, disease, insect damage, changed fire and hydrological regimes and the potential introduction of invasive weed species.
  15. Identification of significant localities within the area where there are high fauna population densities, high diversity of fauna habitats or high fauna species diversity.
  16. A description of proposals to ameliorate the impact on endangered fauna and an assessment of the effectiveness of such proposals.
  17. A detailed description of proposed habitat restoration including the expected time taken to restore habitat and critical habitat components and food sources, and any proposals or opportunities to improve habitat. The description should include the likely impact on endangered fauna during the time the habitat is being restored.
  18. A detailed description of proposed ongoing monitoring of endangered fauna and species sensitive to forestry operations, and monitoring and audit of the effectiveness of ameliorative measures.
  19. Proposals for the recovery of endangered species known to occur in the area that are likely to be affected by the proposed operations and their critical habitat.
  20. A discussion of the ability of endangered fauna known to occur in the area to recover from serious declines in population size.
  21. Where conclusions are drawn from information cited in the FIS, either a full reference or a copy of the information must be provided.
- Taking the above 25 requirements together (i.e., 4 requirements in EFIP Act plus 21 requirements of the Director-General of the NPWS), an FIS is clearly supposed to provide a good idea of what species of "endangered" fauna are likely to be affected by the proposed activities, what should be the nature and extent of these effects and how these impacts are to be ameliorated. There are no obvious requirements that might be added to the list.

**(f) Who prepares FISs?**

So far all FISs have been prepared either by the proponent of the proposed development or activity or on behalf of the proponent by a consultant or firm of consultants contracted by the proponent (see Table 1). Consequently the FISs cannot necessarily be considered to be independent assessments of the likely impacts of the proposed actions but are understandably biased in the direction of promoting the proposal. A more balanced view should arise from the consideration by the NPWS of both the FIS and the various submissions concerning it.

**(g) How adequate are present FISs?**

The FISs that have so far been produced do not provide a good indication of the nature and extent of the impacts of the proposed activities on "endangered" fauna. There are four general reasons for this.

First, there is insufficient available information for estimating the effects of forestry and other activities on fauna. For example, most studies of the impacts of logging and associated practices on wildlife have focused on relatively high-intensity logging after which little of the initial forest canopy remains (e.g., Recher *et al.* 1980; Smith 1985; Lunney *et al.* 1987). A more selective logging regime, with relatively more of the canopy retained, is proposed in the present general licence applications and their associated FISs (e.g., Truyard 1992). It is known that a number of fauna species depend on tree hollows that only occur in very old trees (e.g., Kavanagh *et al.* 1985; Mackowski 1984) and it would be expected that the practice of retaining such so-called "habitat trees" within the logged forest would ameliorate the impacts of logging on these species (at least relative to total clearfelling). There is, however, no published information on how successful this practice is. In association with some of the present FISs there have been fauna (and flora) surveys of logged and unlogged sites which have been carried out to provide information on the effects on wildlife of past logging (e.g., York *et al.* 1991; Binns and Chapman 1992; York 1992; York and Shields 1992; Clancy 1992; Shields *et al.* 1992; Binns 1992). However, these surveys have resulted in low sample sizes, especially with respect to endangered species, and there are general differences between the logged and unlogged sites in addition to the difference in logging treatment (e.g., Binns and Chapman 1992). Consequently these surveys provide little indication of how logging may have affected wildlife.

Second, the present FISs have not included detailed and comprehensive reviews of the biology of each endangered species and known or likely effects of forestry practices upon them. A reflection of this can be seen by comparing the number of pages devoted to each species in the FISs, typically about 2 (e.g., Mount King Ecological Surveys 1992), with the sizes of the reports prepared on behalf of the NPWS on the biology and management of certain fauna species (e.g., Smith 1990; Baker-Gabb 1990; Clancy 1991; Lim *et al.* 1992; Osborne 1991; Webster and Ahern 1992). These reports range in size from 32 pages (Webster 1991) to 84 pages (Grant 1991) and provide reasonable reviews for the species considered. Of course, it is not necessarily the number of pages devoted to each species that is the issue. An FIS need only summarise and reference available biological information and treat it rationally. Unfortunately, as reflected in this comparison, this has not, for the most part, been done.

Third, it is evident from talking to people and from references to "unpublished data" and "personal communication" in FISs and elsewhere, that there is much relevant information, especially on the impacts of logging on wildlife, that remains unpublished. This makes it difficult to prepare and evaluate FISs.

Fourth, the faunal surveys, that form the basis of an FIS through providing information on the location and abundance of endangered fauna in a proposal area, are generally carried out during a restricted period of the year and consequently provide poor information regarding seasonal events that occur at other times of year. Migratory birds may, for example, be present in an area during one time of year but rare or absent during the remainder of the year. Bats are also relatively easier to detect during the warmer months because they are more active then. Faunal surveys should be carried out at certain times of the year for some species groups and over at least an entire year where seasonal patterns are important.

**(h) Evaluation of an FIS**

For the following reasons, most FISs will be evaluated (at some stage) by the Director-General of the NPWS. Firstly, the situations in which an FIS is required are, as I have argued above, essentially identical. Secondly, a copy of any FIS submitted to either a Consent Authority or a Determining Authority must be forwarded to the Director-General of the

NPWS. Thirdly, no reports on the FISs in relation to the proposed activities listed in Table 1 have so far been produced by any of the Consent or Determining Authorities involved. Finally, in considering an application for a general licence the Director-General of the NPWS must take into account "any fauna impact statement or environmental impact statement" (section 92B of the NPW Act).

In special circumstances some FISs may be evaluated by a Consent or Determining Authority and not by the Director-General of the NPWS. This might be expected if an FIS is submitted to a Consent or Determining Authority and is not also submitted to the NPWS in association with an application for a Section 120 licence. The proponent of a development or activity could choose this line of action. As argued above, however, such situations are expected to be rare.

In cases where an FIS is submitted to both the NPWS and another Authority, both Authorities would be expected to consider the document. The NPWS would consider it with regard to an application for a section 120 licence under the NPW Act. The other Authority would consider it assessing an application for a development or activity under the EPA Act.

Rather than working independently, however, the NPWS and the other Authority would be expected to collaborate and communicate with one another to a sufficient extent that the final decisions regarding the two applications are consistent. Otherwise, as the following example illustrates, implementing these decisions may be difficult. Suppose that a Consent Authority grants consent for a proposed development and that the NPWS then requires, as part of the amelioration of impacts on endangered fauna, a significant modification to the planned development. It would then be possible that the Consent Authority has to reconsider the development application. The Consent Authority might then impose new conditions on the proposal which are not satisfactory to the NPWS. Obviously, this process could, in principle, go on forever. Since it is not in the interests of either Authority or the proponent of a particular development or activity for the application processes to be prolonged in any way, all parties involved would be expected to work as closely together as possible.

In most cases when the NPWS and another Authority are working together in this way, it would be expected that, with regard to impacts on endangered fauna and the likely

effectiveness of possible ameliorative measures, the Authority would largely defer to the Service. Most Authorities would not have easy access to the necessary expertise to consider these aspects of a proposal. Furthermore, a fundamental statutory role of the Service is the "protect(ion) and care of fauna" (section 92 of the NPW Act), whereas other Authorities have other primary roles.

Guidelines for actions arising from the EFIP Act have been prepared and distributed by the Director-General of the NPWS (Gillooly 1992).

#### **(i) Determination of applications for general licences**

The general process by which applications for general licences are made and considered is as follows. Applications are submitted to the NPWS along with an FIS. This FIS is then placed on public display for at least 28 days and during that time the NPWS receives submissions concerning it. The NPW Act, as amended by the EFIP Act, requires that the Director-General of the NPWS "take into account" any such submissions, the FIS, any EIS prepared for the same proposal, plus the reasons for considering any species to be endangered. The NPWS may also commission comments on an FIS from outside of the Service.

It is not clear, however, how the Director-General of the NPWS determines whether or not to grant a general licence. There is apparently no written set of guidelines nor written description of the decision-making process.

Whether or not a general licence is granted could depend on the extent to which the proposed activities should change, in the long term, the population size, distribution or conservation status of each species. Thresholds could be adopted, with certain changes being unacceptable while smaller changes are acceptable. One such possibility would be to require that the proposed activities should not result in an increase in the regional conservation assessment score for each species based on the methodology (explained above) for considering some species as endangered. These could be possible components of guidelines for licensing by the NPWS.

#### **(j) Opportunities to view and comment upon FISs and associated documents**

After an FIS has been prepared there are several places at which a copy can be viewed and a limited period during which comments

regarding it can be forwarded to the NPWS for its consideration. When the NPWS receives an application for a general licence along with its associated FIS, it must "cause to be published in a newspaper circulating statewide a notice: (a) outlining the nature of the application; (b) stating the locations at which copies of the FIS may be inspected or purchased; and (c) inviting public submissions within a period of not less than 28 days of the date of the notice" (Section 92B of amended NPW Act). While no further details of this requirement are specified in the Act, it is the policy of the NPWS that notices as described above are placed just once in a statewide newspaper (J. Ravallion, NPWS, pers. comm.). It is also NPWS policy to arrange that the FIS document is generally available at the following places (J. Ravallion, NPWS, pers. comm.):

- (a) Head Office NPWS (Hurstville)
- (b) Office of proponent closest to development or activity
- (c) Appropriate regional, zone and local district offices of NPWS
- (d) Local Council chambers
- (e) Government Information Service (Sydney)
- (f) New South Wales Environment Centre (Sydney)
- (g) Cadmans Cottage, NPWS (Sydney).

After the period of public exhibition has ended it should still be possible to view an FIS. At the end of this period copies of the FIS must be lodged at the New South Wales State Library according to Section 5 of the *Copyright Act 1879* No. 20. Copies of all FISs submitted to the NPWS have been retained by the Service (J. Brooks, NPWS, pers. comm.) and copies of FISs related to proposed forestry operations are lodged in the Library of State Forests of New South Wales (S. Suchaar, State Forests of New South Wales, pers. comm.). Copies are also retained by some other proponents (e.g., RTA — G. Smart, RTA, pers. comm.) and by the New South Wales Environment Centre (P. Hopper, New South Wales Environment Centre, pers. comm.). Copies are not, however, retained by the Government Information Service (C. Masqualini, Government Information Service, pers. comm.).

It should also be possible to view other documents that are associated with an FIS. Following public exhibition of an FIS there is generally a number of submissions that have been made to the NPWS regarding the FIS and its proposed development or activity.

The NPWS retains these submissions after a general licence in respect of the proposal has either been granted or refused (R. Couch, NPWS, pers. comm.). Copies of these submissions may be obtained from the NPWS under provisions of the *Freedom of Information Act* (R. Couch, NPWS, pers. comm.). In addition, "all information concerning fauna supplied to the Director-General in support of a licence application is to be made freely available to the public" (see Section 92B of the NPW Act).

For each application to the NPWS for a general licence and each associated FIS, the Director-General of the Service must produce a report indicating the reasons for his/her decision regarding the application. Section 92B(9) of the NPW Act requires that the Director-General notifies the applicant and any person who made a submission on the publicly exhibited FIS of his/her decision on the licence application and the "reasons" for that decision. In addition, if a general licence is issued, the Director-General of the NPWS is required to make available for either public inspection or sale a copy of the "reasons for issuing the licence" (Section 92B(14) of amended NPW Act). These reports have been called "Decision Reports".

These Decision Reports from the NPWS Director-General have evolved reasonably quickly and are now quite detailed documents. In the case, for example, of the application to import domestic dogs onto Lord Howe Island, the Decision Report includes a summary of the proposal and the FIS, a discussion of the extent to which the FIS satisfies the requirements of the NPW Act and the requirements of the Director-General, a summary of the public submissions, an analysis of the issues raised in the submissions and a species-by-species account of how the proposed actions would affect endangered (i.e., Schedule 12) species (National Parks and Wildlife Service 1993). In all, this Decision Report is 73 pages long and, given the greater complexity of issues and the extent of public comment, the Decision Reports regarding the Forestry applications should often be considerably larger documents.

From the above it can be seen that it should be possible to follow the entire process, beginning with the original proposal with its associated impact statements, through the submissions made in relation to the proposal and its impacts, through the evaluation of all the arguments in relation to the proposal, to the final decision concerning whether or not

a general licence is granted, and, if a licence is granted, to the conditions applied. If to all of this were added a reasonably detailed account of what levels of impacts on endangered fauna are considered acceptable to the NPWS Director-General (see above), it should also be possible to fully understand the process. In the present absence of such an account it should be possible to infer these maximum acceptable levels of impacts by comparing the reports of the NPWS Director-General in cases where general licences have been granted with cases where they have been refused. To date, however, there are only a small number of Decision Reports available and no licences have apparently been refused by the Director-General of the NPWS.

### **(k) Potential improvements in FIS process**

It can be seen, from the above discussion, that, while the goals of fauna impact statements are clear and reasonable, it is not clear when an FIS is required, FISs do not achieve their goals, and it is not clear what the criteria are for the granting of a general licence to "take" endangered fauna. To remedy these problems, I make the following three general suggestions:

#### *(a) More research results*

There needs to be more research on the biology of our wildlife and on the impacts of forestry practices and other activities upon it. This research should include studies of endangered species but should also include broader impacts on wildlife. Researchers should also be encouraged to publish the large amounts of presently unpublished but very relevant material.

Until such research is carried out, decisions will have to be made regarding proposed forestry activities. These decisions will have to rely on the extent and quality of existing information.

#### *(b) Reviews of available information*

There needs to be comprehensive reviews of all available information concerning "endangered" species and other species of special interest, of the impacts of forestry and other activities upon them, and of the success or otherwise of ameliorative measures. A series of such reviews could be organized, edited and published collaboratively by staff from Government Agencies such as State Forests of New South Wales, National Parks and Wildlife Service, Australian Museum, non-government organizations such as the

Royal Australian Ornithologists Union, and the various Universities. Such a collaborative effort should ensure that any conclusions reached in the reviews are reasonably widely accepted. These documents would then become important references for any FIS and should help to ensure that FISs are of reasonably high quality.

Until such reviews have been produced and are kept updated, FISs are likely to contain substantially incomplete accounts of the biology of endangered fauna and of the known and likely impacts of various human activities upon them.

#### *(c) Clear and transparent decision-making*

As described above, it is not clear how decisions are made concerning whether or not an FIS or other kind of impact assessment is required or concerning whether or not a general licence is granted. It would seem that only when these decision-making processes are clear and transparent will there be a reasonably high degree of consensus among interested parties. By comparison, the present situation seems to fuel conflict.

It would help in this regard, if Government Authorities published descriptions of their guidelines and procedures for making decisions with respect to proposed activities and published reports explaining the reasons why each proposal was either approved or rejected.

State Forests of New South Wales (formerly the New South Wales Forestry Commission) is expected to prepare and publish many more FISs in respect of forestry activities throughout the State. Under the TIIP Act (as amended by the TIIP Amendment Act 1994), State Forests is required to prepare Environmental Impact Statements for 22 of its Management Areas (see Schedule 4 of EFIP Act 1992 and EFIP Amendment Act 1994). Given the above discussion, it can be expected that Fauna Impact Statements will also be necessary for these areas and that they will be prepared and displayed at the same time as the EISs. Such combined EISs and FISs have so far been prepared and published for 8 of these Management Areas (Mt. Royal: see Kinhill Engineers 1992; Wingham: see Truyard 1992; Dorrigo: see Mount King Ecological Surveys 1992b; Sinclair Knight 1992; Glen Innes: see Austeco 1992; Manidis Roberts Consultants 1992; Kempsey and Wauchope: see Truyard 1993a,b; Grafton: see Margules Groome Poyry 1994a,b; Eden: see Drielsma 1994a,b; Tanton 1994).

I therefore make the following additional recommendations regarding the procedures adopted by the Commission in preparing the FISs for forestry activities.

(a) *Survey design*

If it were possible, the initial surveys should be treated as pilot studies leading to an optimal design for future surveys. Such an optimal design would probably involve comprehensive assessment of impacts of forestry activities on wildlife in a few representative locations rather than the present inadequate assessments in each forestry management area. However, the present survey programme is now so far advanced that there is little opportunity to modify it.

Alternatively, the results from the surveys so far carried out could be combined and analysed collectively. This would greatly increase sample sizes and might permit statistically sound conclusions to be reached. This would seem to be the best approach.

(b) *Detailed studies on the biology of each species of "endangered" fauna and on the impacts of forestry activities upon them*

Because some endangered species are so rarely encountered, even combining the results from surveys in many Management Areas may not yield enough data to enable any impacts of forestry activities to be discerned. Detailed studies targeted at individual species or groups of species (e.g., owls) are therefore required.

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### REFERENCES

- Austeco, 1992. Proposed forestry operations in the Glen Innes Forest Management Area. Fauna Impact Statement. Forestry Commission of New South Wales: Sydney.
- Austeco, 1993. The Proposed Pacific Palms Sewage Treatment Plant. Fauna Impact Statement. In: Manidis Roberts Consultants. Forster and Pacific Palms Sewerage Scheme Environmental Impact Statement. Prepared on behalf of Great Lakes Council and New South Wales Public Works Department.
- Austeco, 1994. The proposed Lower Bielsdown Antimony Mine. Fauna Impact Statement.
- Australian Koala Foundation, 1995. Fauna Impact Statement. Proposed Searanck Residential Development. Prepared for RDC Pty Ltd.
- Australian Museum, 1993. Faunal Impact Statement. Green and Golden Bell Frog (*Litoria aurea*) occurring on property at the corner of Dalmeny Street and Kimberley Grove, Rosebery. Prepared for State Authorities Superannuation Board.
- Baker-Gabb, D. J., 1990. The biology and management of the Plains-wanderer (*Pedionomus torquatus*) in New South Wales. Species management report number 3. NSW National Parks and Wildlife Service: Sydney.
- Benson, J., 1989. Establishing priorities for the conservation of rare or threatened plants and plant associations in New South Wales. In *The Conservation of Threatened Species and their Habitats*. Australian Committee for IUCN: Canberra.
- Binns, D., 1992. Flora survey, Glen Innes Management Area, Northern Region. Forest Resource Series No. 23. Forestry Commission of New South Wales: Sydney.
- Binns, D. and Chapman, W., 1992. Flora survey, Wingham Management Area, Port Macquarie Region. Forest Resources Series No. 18. Forestry Commission of New South Wales: Sydney.
- Briggs, J. D. and Leigh, J. H., 1988. *Rare or Threatened Australian Plants*. ANPWS: Canberra.
- Clancy, G. P., 1991. The biology and management of the Osprey (*Pandion haliaetus cristatus*) in New South Wales. Species management report number 6. NSW National Parks and Wildlife Service: Sydney.
- Clancy, G. P., 1992. Fauna survey, Wingham Management Area, Port Macquarie Region. Part 3. Reptiles and amphibians. Forest Resources Series No. 21. Forestry Commission of New South Wales: Sydney.
- CMPS&F Environmental, 1995. Construction of Fattorini/Frenchmans Creek Dam. Environmental Impact Statement. Prepared for Kempsey Council.
- Connell Wagner, 1994. Pacific Highway Reconstruction. Lyons Road to Englands Road Coffs Harbour. Main Volume and Appendices. Environmental Impact Statement incorporating a Fauna Impact Statement. Prepared for Roads and Traffic Authority.
- Drielsma, J. H., 1994a. Eden Management Area Proposed Forestry Operations. Environmental Impact Statement. Volume A — Main Report. Prepared for State Forests of New South Wales.
- Drielsma, J. H., 1994b. Eden Management Area Proposed Forestry Operations. Environmental Impact Statement. Volume C — Appendices 2–25. Prepared for State Forests of New South Wales.
- ERM Resource Planning, 1994a. Croudace Bay Road Belmont. Fauna Impact Statement. Prepared for Ifuno Pty Ltd and Lake Macquarie City Council.
- ERM Resource Planning, 1994b. Sand extraction operations on Boral Resources freehold property at Fern Bay, Newcastle Bight. Fauna Impact Statement. Prepared for Boral Resources (Country) Pty Ltd.
- ERM Resource Planning, 1995. Fauna Impact Statement for proposed Titanium minerals mining near Clybucca, New South Wales. Prepared for RZM Pty Ltd.
- Fanning, F. D., 1992. Saltwater Heavy Minerals Project. Mineral Deposits Ltd. Revised Mine Area. Fauna Impact Statement. Prepared on behalf of Mineral Deposits Ltd.



- Fanning, F. D., 1994. Lismore to Mullumbimby Transmission Line. Fauna Impact Statement. Prepared for Electricity Transmission Authority.
- Forestry Commission of New South Wales, 1992a. Proposed forestry operations in Eden Management Area. Supplementary Environmental Impact Statement. Prepared by the Forestry Commission of New South Wales.
- Forestry Commission of New South Wales, 1992b. Forestry Operations in Mistake State Forest. Environmental Impact Statement. Assessment Report and Determination. Prepared by Forestry Commission of New South Wales.
- Gillooly, W. J., 1992. *Endangered Fauna (Interim Protection) Act 1991*. Guidelines for applicants, consent authorities and determining authorities. NSW National Parks and Wildlife Service: Sydney.
- Grant, T. R., 1991. The biology and management of the Platypus (*Ornithorhynchus anatinus*) in New South Wales. Species management report number 5. NSW National Parks and Wildlife Service: Sydney.
- Greer, A. E., 1994. Faunal Impact Statement for Proposed Development Works at the Homebush Bay Brick Pit. Prepared for Property Services Group.
- Harden, R. H., 1993. Fauna impact statement. The impact of domestic dogs on protected and endangered fauna on Lord Howe Island. Prepared Lord Howe Island Board.
- Kavanagh, R. P., Shields, J. M., Recher, H. F. and Rohan-Jones, W. G., 1985. Bird populations of a logged and unlogged forest mosaic at Eden, New South Wales. In *Birds of Eucalypti Forests and Woodlands: Ecology, Conservation, Management* ed by A. Keast, H. F. Recher, H. Ford and D. Saunders. Royal Australasian Ornithologists Union and Surrey Beatty & Sons: Sydney.
- Kinhill Engineers, 1992. Proposed forestry operations in the Mount Royal management Area. Environmental Impact Statement. Prepared for the Forestry Commission of New South Wales: Sydney.
- Korn, T., Croft, D., Fosdick, M., Lukins, B., Wiseman, G., Meany, J., Barnes, T. and Kay, B., 1993. Fauna Impact Statement. *Endangered Fauna (Interim Protection) Act 1991*. The impact of vertebrate pest control on endangered fauna in New South Wales. Prepared for New South Wales Department of Agriculture.
- Lim, L., Sheppard, N., Smith, P. and Smith, J., 1992. The biology and management of the Yellow-footed Rock-wallaby (*Petrogale xanthopus*) in New South Wales. Species management report number 10. NSW National Parks and Wildlife Service: Sydney.
- Lunney, D., Cullis, B. and Eby, P., 1987. Effects of logging and fire on small mammals in Mumbulla State Forest, near Bega, New South Wales. *Aust. Wildl. Res.* 14: 163–81.
- Lunney, D., Curtin, A., Ayers, D., Cogger, H. G. and Dickman, C. R., 1995. An ecological approach to identifying the endangered fauna of New South Wales. *Pac. Conserv. Biol.* In press.
- Mackowski, C., 1984. The ontogeny of hollows in blackbutt (*Eucalyptus pilularis*) and its relevance to the management of forests for possums, gliders and timber. In *Possums and Gliders* ed by A. P. Smith and I. D. Hume. Australian Mammal Society: Sydney.
- Manidis Roberts Consultants, 1992. Environmental Impact Statement. Glen Innes Forest Management Area. October 1992. Forestry Commission of New South Wales: Sydney.
- Manidis Roberts Consultants, 1993. Forster and Pacific Palms Sewerage Scheme. Environmental Impact Statement with specialist consultants reports. Prepared on behalf of Great Lakes Council and New South Wales Public Works Department.
- Margules Groome Popyry, 1994a. Grafton Management Area Proposed Forestry Operations. Environmental Impact Statement. Volume A — Main Report. Prepared on behalf of State Forests of New South Wales.
- Margules Groome Popyry, 1994b. Grafton Management Area Proposed Forestry Operations. Environmental Impact Statement. Volume B — Appendix I. Prepared on behalf of State Forests of New South Wales.
- Mitchell McCotter, 1992. Fauna Impact Statement. North Nowra-Bomaderry Link Road. Prepared for Shoalhaven City Council.
- Mitchell McCotter, 1994. Proposed Toll Road Coolongook to Possum Brush. Environmental Impact Statement. Volumes 1 and 2. Prepared for New South Wales Roads and Traffic Authority.
- Mount King Ecological Surveys, 1992a. Wingham Management Area. Fauna impact statement for proposed forestry operations. Prepared on behalf of the Forestry Commission of New South Wales: Sydney.
- Mount King Ecological Surveys, 1992b. Proposed forestry operations — Dorrigo Management Area. Fauna Impact Statement. October 1992. Forestry Commission of New South Wales: Sydney.
- Mount King Ecological Surveys, 1993. Fauna survey of the Kempsey and Wauchope Forestry Management Areas. A report to the Forestry Commission of New South Wales: Sydney.
- National Parks and Wildlife Service, 1993. General (section 120) licence application for the Lord Howe Island Board to import domestic dogs. Section 92B(6) Decision Report. NSW National Parks and Wildlife Service: Sydney.
- Nicholas Graham-Higgs, 1994. Fauna Impact Statement for proposed development of: Industrial, Residential and Tourist Facilities at Pambula and Pambula Beach. Prepared for the Department of Conservation and Land Management.
- Osborne, W. S., 1991. The biology and management of the Corroboree Frog (*Pseudophryne corroboree*) in New South Wales. Species management report number 8. NSW National Parks and Wildlife Service: Sydney.
- Recher, H., Rohan-Jones, W. and Smith, P., 1980. Effects of the Eden woodchip industry on terrestrial vertebrates with recommendations for management. Research Note 42. Forestry Commission of New South Wales: Sydney.
- Resource Planning, 1994. Fauna Impact Statement. Proposed extension of Mt Owen Colliery near Ravensworth, New South Wales. Prepared for Hunter Valley Coal Corporation Pty Ltd.
- Ricklefs, R. E., 1979. Ecology. Second edition. Chiron Press: New York.
- Roads and Traffic Authority, 1993. Pacific Highway—State Highway No. 10 Brunswick Heads Bypass. Environmental Impact Statement. Volume 2. Fauna Impact Statement. Prepared for New South Wales Roads and Traffic Authority.
- Ross, A., 1991. Pacific Highway Raymond Terrace Traffic Relief Route. Environmental Impact Statement. Prepared for New South Wales Roads and Traffic Authority.

RUST PPK, 1994. Coffs Harbour Eastern Distributor. Environmental Impact Statement Volume 2 — Appendices. Prepared for Coffs Harbour City Council.

Shields, J. M., York, A. and Binns, D., 1992. Flora and fauna survey, Mt Royal Management Area, Newcastle region. Forest Resources Series No. 16. Forestry Commission of New South Wales: Sydney.

Sinclair Knight, 1992. Proposed forestry operations — Dorriggo Management Area. Environmental Impact Statement. October 1992. Forestry Commission of New South Wales: Sydney.

Sinclair Knight, 1994. Proposed Motorway Billinudgel to Chinderah. Environmental Impact Statement. Flora and Fauna Working Paper including Fauna Impact Statement. Prepared for the Roads and Traffic Authority New South Wales.

Sinclair Knight Merz, 1994. Proposed Fingal Bay Road. Environmental Impact Statement. Prepared for Port Stephens Council.

Smith, P., 1985. Effects of intensive logging on birds in eucalypt forest near Bega, New South Wales. *Emu* 85: 15–21.

Smith, P., 1990. The biology and management of the Little Tern (*Sterna albifrons*) in New South Wales. Species management report number 1. NSW National Parks and Wildlife Service: Sydney.

SWC Wetlands and Ecological Management Consultancy, 1993. State Highway No. 10 — Pacific Highway Taree Traffic Relief Route. Fauna Impact Statement. Report to New South Wales Roads and Traffic Authority.

SWC Wetlands and Ecological Management Consultancy, 1994. State Highway 10 — Pacific Highway Bulahdelah–Coolongolook Tollroad. Fauna Impact Statement. Report to Roads and Traffic Authority of New South Wales.

Tanton, M. T., 1994. Eden Management Area Proposed Forestry Operations. Environmental Impact Statement. Volume B. Appendix 1 — Fauna Impact Statement. Prepared for State Forests of New South Wales.

Truyard, 1992. *Environmental Impact Statement*. Wingham Management Area. Proposed forest management. Prepared on behalf of the Forestry Commission of New South Wales: Sydney.

Truyard, 1993a. *Environmental Impact Statement*. Vol 1 — Report. Kempsey/Wauchope Management Areas. Proposed forest management. Prepared on behalf of the Forestry Commission of New South Wales: Sydney.

Truyard, 1993b. *Environmental Impact Statement*. Vol 2 — Appendices (including FIS). Kempsey/Wauchope Management Areas. Proposed forest management. Prepared on behalf of the Forestry Commission of New South Wales: Sydney.

Warren, J., 1994a. Proposal to develop a 60 lot residential subdivision in “Cabarita Seaside Estate” south of the village of Bogangar. Prepared for David Ardill and Associates Pty Ltd on behalf of Ardel Pty Ltd.

Warren, J., 1994b. Proposal to develop a 150 lot residential subdivision in “Fern Beach Estate” South Golden Beach. Fauna Impact Statement. Prepared for Ray Development Corporation Pty Ltd.

Webster, R. and Ahern, L., 1992. Management for conservation of the Superb Parrot (*Polytelis swainsonii*) in New South Wales and Victoria. Dept. of Conservation and Natural Resources: Melbourne.

White, A. W., 1993. Fauna Impact Statement for proposed development of Telecom site at Robert's Rd., Greenacre. Prepared for Walker Corporation Pty Ltd.

York, A., 1992. Fauna survey, Wingham Management Area, Port Macquarie Region. Part 1. Mammals. Forest Resources Series No. 19. Forestry Commission of New South Wales: Sydney.

York, A. and Shields, J., 1992. Fauna survey, Wingham Management Area, Port Macquarie Region. Part 2. Birds. Forest Resources Series No. 20. Forestry Commission of New South Wales: Sydney.

York, A., Binns, D. and Shields, J., 1991. Flora and fauna assessment in New South Wales State forests. Survey guidelines. Procedures for sampling flora and fauna for Environmental Impact Statements. Version 1.1. Forestry Commission of New South Wales: Sydney.

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## Addendum to “The mammals of Kinchega National Park, western New South Wales”

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In Ellis and Henle (1988) and Dickman (1993) reference was made to a specimen of *Pseudomys hermannsburgensis* (Australian Museum specimen M11225) collected in Kinchega National Park by Peter Bayliss in 1978. This specimen has been examined by Linda Gibson (Australian Museum) and has been re-assigned to the House Mouse *Mus domesticus*. The nearest record this century of *Pseudomys hermannsburgensis* to the Kinchega National Park is from Fowlers Gap which is over 150 km to the north. This means that there is currently no physical evidence for which species of native rodents occurred within the boundaries of Kinchega National Park and any estimates would have to interpolate from other records.

This episode also highlights the value of being able to lodge voucher specimens with a reputable collection for future workers to study and reassess.

## REFERENCES

- Dickman, C. R., 1993. *The Biology and Management of Native Rodents of the Arid Zone in New South Wales*. NSW National Parks and Wildlife Service: Hurstville.
- Ellis, M. and Henle, K., 1988. The mammals of Kinchega National Park, western New South Wales. *Aust. Zool.* 25: 1–5.