RESPONSE TO DISTURBANCE OF FOREST SPECIES IN CRA REGIONS IN NSW - EDEN REGION

NSW CRA/RFA
STEERING COMMITTEE

RESPONSE TO DISTURBANCE OF FOREST SPECIES IN CRA REGIONS IN NSW - EDEN REGION

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1. EXECUTIVE SUMMARY

This report has been prepared for the joint Commonwealth/State Steering Committee which oversees the comprehensive regional assessments of forests in New South Wales.

The comprehensive regional assessments (CRAs) provide the scientific basis on which the State and Commonwealth governments will sign regional forest agreements (RFAs) for the major forests of New South Wales. These agreements will determine the future of the State's forests, providing a balance between conservation and ecologically sustainable use of forest resources.

This project was undertaken to identify the conservation needs of flora and fauna species in the Eden region. It was managed jointly by the NSW National Parks and Wildlife Service, State Forests of NSW and Environment Australia (Commonwealth), the lead agency.

Flora and fauna were treated in separate but similar assessments. The work began with the government agencies compiling lists of forest dependent fauna and flora in the region. Expert ecologists were asked to provide information on the habitat and critical resource requirements, ecological attributes and the disturbances affecting the listed species. Some simple formulae were used to estimate the area of land needed for the conservation of species which were rated as the highest priority.

Experts also provided information to help apply the targets in an ecologically meaningful way. This included recommendations on the minimum size for reserved patches of habitat, dispersal distances and barriers as well as priority areas for reservation.

The main chapters of this report cover the methods and results of the project. Appendices provide lists of species, lists of experts, rule sets, management recommendations, research and monitoring recommendations and detailed tables of results.

The outcomes of this project will be used, firstly, to guide the allocation of forested land in the Eden region so that the habitat of the most threatened species is protected. Secondly the results are intended to help the management of forested land over the entire region.

1. INTRODUCTION

The National Forest Policy Statement (NFPS) signed in 1992, included, amongst other things, an undertaking to manage Australia's forests to conserve biological diversity (Commonwealth of Australia 1992). In order to achieve this objective it was agreed that a comprehensive, adequate and representative (CAR) reserve system be created. One of the aims of developing such a reserve system is to maintain viable populations of native forest species throughout their natural range (Commonwealth of Australia 1997). These reserve systems are to be incorporated into a Regional Forest Agreement (RFA) to be signed by the State and Commonwealth governments which will outline the long term management and use of forests in a particular region. The information needed to draw up these agreements will be collected during the Comprehensive Regional Assessments (CRA).

The Response to Disturbance Project was undertaken to identify and synthesise forest species conservation requirements. This information will assist in ensuring the reserve system meets the JANIS criteria pertaining to the conservation of forest species. The most relevant of these being:

- The reserve system should seek to maximise the area of high quality habitat for all known elements of biodiversity…(criterion 5)., and
- Reserves should be large enough to sustain the viability, quality and integrity of populations (criterion 6) (Commonwealth of Australia 1997).

The Response to Disturbance Project provides key information about forest dependent species that is needed to create a reserve system and outlines other management actions that will fulfil these JANIS criteria. It has been divided into two sections, one examining the requirements of fauna species, and the other, the requirements of flora species.

Throughout the world wildlife managers recognise that it is immensely difficult and expensive to collect sufficient data to confidently describe the conservation requirements of any species. In most cases managers have to rely on the opinions or best guesses of the researchers who know most about the species. With this in mind, Environment Australia has sought to advance the development of methods which would improve the transparency and objectivity of this kind of expert advice. Some of the foremost thinkers on these methods, including Professor Hugh Possingham of University of Adelaide, Dr Mark Burgmann of Melbourne University, and Dr Mike McCarthy of the Australian National University have been closely involved. The Response to Disturbance project, and its equivalents in other States, has provided an opportunity to test and refine these new approaches to the conservation of species.

2. METHODS

2.1 INTRODUCTION

The methods used in this project aimed to answer the following questions for the Eden CRA region:

Which species of flora and fauna are at a high risk of extinction?

What are their habitat requirements?

What disturbances affect their populations?

How big an area should be reserved or managed for priority species?

How should these species be managed?

Should their habitat be placed in dedicated reserves?

The answers to these questions were used, in conjunction with information on where the priority species and their habitats occur, to guide the design of a reserve system. These spatial data came from the Eden Fauna Modelling Project which was conducted by NSW National Parks and Wildlife Service and from the Service's flora databases.

2.2 FAUNA

There were six steps or assessments for fauna species.

2.2.1 Species list

The objective of this step was to ensure that species of conservation concern were given high priority and that statutory and policy responsibilities of the two governments for protecting species were met.

A comprehensive list of forest dependent species for the Eden CRA region was drawn up by agency staff.

A forest dependent species is defined as a species which is dependent on forested ecosystems for any component of its life cycle.

The list was refined by agency staff to give priority to those species which are likely to go extinct, decline further or start to decline in the absence of management action. For Eden the list included species listed on schedules to the *Threatened Species Conservation Act 1995* (NSW) and the *Endangered Species Protection Act 1992* (Commonwealth), as well as a few species considered by experts to be of concern in the region.

The list was reviewed by experts at the Eden Expert Workshop held in August 1997 (Anon 1997a).

2.2.2 Risk of extinction

The Intrinsic Risk of Extinction Assessment involved compiling and analysing a number of attributes about each species on the priority list to enable them to be ranked according to their risk of extinction. The attributes relate to the rarity and population dynamics of the species.

These attributes were obtained by asking expert ecologists, who were familiar with the relevant literature, to complete proformas. The information sought was: the geographic range, percentage of the range occupied, density, relative abundance, habitat specificity, and changes in population size. The proformas were designed to distinguish between opinion, unpublished data and published data. Experts were asked to provide references for published data.

Using the information in the proformas, species were ranked according to their rarity in the region. Rabinowitz (1981) describes the rarity of a species as depending on three factors; its geographic range, its relative abundance, and its habitat specificity. Some combinations of these three factors are likely to make a species more prone to extinction than others. For example a species with a small geographic range, low relative abundance and narrow habitat specificity is more likely to become extinct than one that has a large range, high abundance and a wide habitat specificity, all other things being equal.

Once the risk of extinction due to rarity was determined, information about population trends, the magnitude and direction of these trends and the need for management intervention, was used to increase, decrease or confirm individual rankings. This ensured that species which are naturally rare and do not appear to be declining are given lower priority than rare species which were known to have been more common in the past. It also allows species that may not be rare at present but are declining to be given increased priority.

Using the rule sets shown in Appendix 2 species were placed into groups. Group 1 being the species with the greatest risk of extinction and group 3 being that with the lowest risk. A fourth group contains species for which there was inadequate information to be able to do the assessment (poorly understood species). Group five were species considered to be secure in the region and were not considered further.

Summarised information from all the proformas and the risk of extinction groupings were reviewed by experts at the Eden Expert Workshop held in August 1997 (Dwight 1997).

2.2.3 Habitat requirements and disturbances

Information was collected to describe the habitat requirements of species and the disturbances that adversely affect their populations. Again, proformas were seen as the most efficient means for obtaining this information from experts. The proformas asked about the macro and micro-habitat, topography, floristic elements, and whether the species occurs in discrete patches or is widespread. Experts provided a list of disturbances and described the likely scale at which disturbances occurred, their intensity, their frequency, how they were ranked against each other and the time a species would require to recover from these events (if recovery occurs).

This information was used in three ways:

1. To identify the habitat requirements of the species so that these can be spatially located in the region. This tied in with the Fauna Habitat Modeling Project. Knowledge of habitat requirements also allows better understanding of the impact of disturbances and can guide management.

2. To identify disturbances which have an adverse impact on each species. Disturbances identified were ranked according to land tenure because not all disturbances occur across all land tenures. For example clearing for agriculture or urban development is not an issue in reserves or state owned commercial forests.

The interaction of different types of disturbances were examined where the information was available. Some disturbances may have a particularly deleterious effect in combination with other disturbances. For example fox predation alone may not cause a population to decline except following a fire which removes shelter.

3. To allow an assessment of current management practices to ensure that these adequately meet the needs of each species with respect to the disturbances that affect their populations. For example if predation was identified as the primary disturbance for a species but the management prescription for that species only excluded logging around breeding sites, predator control would be recommended as an additional practice. If the species is not affected by logging then this prescription could be removed.

2.2.4 Minimum viable habitat area

The aim of this assessment was to estimate the minimum area of habitat needed to maintain a viable population. The preferred approach to estimating such an area is a formal Population Viability Analysis for each species (Possingham *et al.* 1993, Lindenmayer and Possingham 1994). A great deal of information on the biology of a species is needed to run this type of analysis. Since many of the species living in forests are poorly understood this approach is not possible.

As an alternative, Professor Hugh Possingham has developed a simple formula, using a minimum set of life history parameters that influence the area a species needs. The formula takes an arbitrary number of 1000 adult females multiplied by the average home range area of a female and adjusts that figure according to trophic level and breeding lifespan.

$$Area = \frac{1000\left(H/I\right)T}{\sqrt{L}}$$

Where: H = size of adult female home range; I = average number of breeding females per home range; T = trophic level; L = average reproductive lifespan of an adult female.

Trophic level is an index of population variability. Species at higher trophic levels (predators) experience less variation than herbivores or granivores. A species with lower population variation has a lower risk of extinction and therefore can persist with fewer individuals. T was

set at 1 for a predator of vertebrates, 2 for insectivores, sap-feeders and other categories, 3 for a herbivore or frugivore, and 8 for a granivore.

Lifespan is included because longer lived animals are better able to persist at lower population sizes than short lived animals.

The intent of this formulae is to rank species according to their need for space and to provide 'ball park' figures to aim for when creating reserves. In evaluating a reserve system for a species Possingham suggests that areas of suitable habitat should be counted only if they are contiguous and represent at least 10% of the minimum viable habitat area.

The parameters for each species were provided by experts on proformas. These data were reviewed by experts at the Eden Expert Workshop held in August 1997 (Anon 1997a). The agreed figures were then used to calculate minimum viable habitat areas for each priority species. The results were presented as a range of values to indicate the reliability of the data.

2.2.5 Evaluation of existing management

Ideally prescriptions should be formulated on clear logical links between the results of well designed studies and concise management objectives. Well designed studies were not available for most species in the Eden region so participants at the Eden Expert Workshop held in August 1997 were asked to advise on existing management and suggest improvements. Experts were asked to recommend management actions that related directly to the disturbances identified in earlier assessments.

Research, survey and/or monitoring should be put in place to assess the adequacy of all management prescriptions and provide the scope for altering the prescriptions should they prove inadequate.

2.2.6 Selection of areas to be reserved or managed

This step was undertaken at a second workshop held in September 1997 (Anon 1997b). In accordance with advice from the Environment and Heritage Technical Committee, experts were asked to specify where and how the minimum viable habitat areas for each species should be applied in the region.

Selection of an appropriate distribution model for the species

A number of distribution models were produced for each species in the Eden Fauna Modelling Project conducted by NSW National Parks and Wildlife Service. Experts viewed the models on screen and were asked to select the most appropriate model. They adjusted the boundaries delineating high, medium and low quality habitat by indicating what the probability of occurrence would be in each of these habitats.

In some cases models were further adjusted by overlaying spatial layers such as logging history. In other cases a new model was constructed by using spatial layers (eg vegetation types) that represent the habitat requirements of the species.

Target area, patch size and relative carrying capacities of habitat

Experts were asked to review the range of target areas calculated for each species following the Eden Expert Workshop held in August 1997 and select a single, most appropriate value for use in the integration software.

A minimum patch size was also agreed upon and this was generally set at no less than 10% of the total target area, as recommended by Possingham.

Patch carrying capacities were set for medium and low quality habitat, assuming that high quality habitat had an arbitrary carrying capacity of one. This was done so that target areas could be scaled up if only lower quality habitats were available for selection during integration.

Distribution of patches across the region

Experts advised on how patches of reserved or managed habitat should be distributed to maintain a geographic spread of the species across the Eden CRA region.

Further information was provided by the experts to ensure that land selected to make up the target area was suitable. This included:

1. A description of possible barriers to movement to ensure that local populations are not isolated from the regional population.

2. A description of features that areas selected should or should not be placed near, eg. major roads.

3. Identification of exceptional areas that represent particularly good habitat or contain a local population in habitat different from the habitat occupied by most of the regional population.

4. Identification of refuge areas where the species may retreat to in the event of disturbances such as wildfire or drought.

Management needs

In order to maintain the habitat requirements of each species two types of management recommendations were identified.

1. Management that will enhance the quality of species habitat outside formal reserves.

2. Management that is needed to maintain habitat across all land tenures. These management recommendations are incorporated into Appendix 6.

There were a number of species for which targets could be neither derived nor applied.

The most common reasons for this were:

1. There wasn't a reliable distribution model available for the species.

2. There were no data available to calculate the target areas

3. The species is nomadic making it difficult to reliably identify suitable areas for management.

These species are listed in Table 3.3 along with the reason why targets were not calculated or applied. This means formal reserves can not be created for these species and their conservation needs can only be dealt with through appropriate management.

Reservation rank

During integration a need arose to prioritise species in terms of their need for formal reservation. A meeting was called to allocate a rank to each of the priority species being considered for reservation. This rank was derived by considering the risk of extinction category allocated to the species, as well as its susceptibility to disturbances such as logging, land clearing, fire and predation.

2.3 FLORA

There were four steps or assessments for determining the conservation requirements of flora species.

2.3.1 Species list

This step began with a review of forest dependent flora to determine the priority species. Keith and Ashby (1992) was the starting point and expert botanists added other species that were on the list of Rare or Threatened Australian Plants (ROTAP) (Briggs and Leigh, 1988), or were known to be endemic, disjunct, regionally uncommon, or at the edge of their range in Eden.

2.3.2 Risk of extinction

As with fauna, the best way to assess the risk of extinction for flora is to conduct full population viability analyses for each species. There was not the time, the resources or in most cases the scientific knowledge to approach the assessment in this way so a simplified method was developed.

Comparative studies using population viability analyses have shown that classifying plant taxa according to their ecological characteristics will generally differentiate groups with a similar risk of extinction. At the first flora workshop held in July 1997 (Dwight, 1997), experts agreed on the list of priority species and assigned them to groups based in the vital attributes scheme devised by Noble and Slatyer (1981). Each functional group was assigned a pair of code letters; the first letter indicates how the plant persists through, or arrives after, a disturbance such as fire or logging; the second letter refers to the conditions a plant requires to establish (see Table 2.1).

TABLE 2.1: FUNCTIONAL GROUP CODES

Code 1	Description
D	obligate seeder, wide dispersal, recovers as juveniles after disturbance
Δ	resprouter, wide dispersal, recovers as mature and juvenile phases after disturbance
σ	obligate seeder, short lived adult, long lived seed bank not exhausted by disturbance, propagules only tend to be present
S	obligate seeder, long lived seed bank not exhausted by disturbance, recovers as juveniles after disturbance
Σ	resprouter, long lived seed bank not exhausted by disturbance, recovers as mature and juvenile phases after disturbance
G	obligate seeder, long lived seed bank exhausted by disturbance
T	resprouter, long lived seed bank exhausted by disturbance
V	vegetative resprouter, no seed bank, mature plants destroyed by disturbance, recovers as juveniles after disturbance
U	vegetative resprouter, no seed bank, mature plants unaffected by disturbance, recovers as mature and juvenile phases after disturbance
ρ	vegetative resprouter, no seed bank, regeneration exclusively from root suckers
C	obligate seeder, short lived seed bank, mature phase only tends to be present
W	resprouter, short lived seed bank, mature phase only tends to be present
N	no known mechanism for recovery after disturbance

Code 2	Description
T	tolerant - can establish at any time following a disturbance
I	intolerant - can establish only during a short period following disturbance
R	dependent - cannot establish immediately after a distrubance

The resulting classification was intended to place plants into groups which require similar forms of management to ensure their persistence.

2.3.3 Management requirements

The expert panel provided generic management guidance for each of the functional groups. This advice was reviewed at a second workshop held in August 1997 (Dwight 1997) to ensure that the exceptional needs of species which were atypical of their functional group were recorded.

2.3.4 Area required to manage a species

The purpose of this assessment was to determine how much area should be reserved or managed for each priority species of plant. In the fauna assessments a simple formula was developed to give a guide to how much space a population would require to remain viable. A similar approach was taken for flora.

Professor Possingham proposed a formula to calculate how much area (R_i) needs to be reserved or managed so that a plant species has no more than 0.1% per annum chance of becoming extinct in the region.

$$R_i = \frac{3A_i}{\log_{10}\left(1/e_i\right)}$$

Where: A_i = typical areal extent of threat i;

e_i = annual probability of threat i.

The "Equity of Persistence" formula rests upon identifying the main threats to the taxon (i) and estimating the annual probability and the typical areal extent of each of these threats.

If the threats overlap spatially, an area should be reserved or managed equal to the biggest R_i where i is considered the dominant threat. If the threats are spatially independent, an area equal to the sum of the R_i values should be reserved or managed.

The risk of extinction from the dominant threat(s) should be spread by distributing the reserves or prescribed management across the taxon's range.

This formula was used in the first and second expert flora workshops to explore the range of R_i for each functional group.

3. RESULTS

3.1 FAUNA

3.1.1 Species list

The initial group of 47 priority species for Eden fauna is listed in Appendix 3. The list was refined through subsequent assessments to the final group of 27 species listed in Table 3.1.

3.1.2 Risk of extinction

Appendix 3 contains the data collected for the Risk of Extinction assessment and the resulting allocation of species into categories. Category one contains the species at the greatest risk of extinction and category four contains those at the lowest risk. For many species data were provided by two or more experts resulting in different rankings.

A fifth category contained species for which there was inadequate information to be able to do the assessment (poorly understood species). Three species in the Eden region fell into this category, the Squirrel Glider, the Brush-tailed Phascogale and the Eastern Cave Bat

3.1.3 Habitat requirements and disturbances

Appendix 4 lists all the disturbances nominated by experts as affecting the priority species. The land tenures on which these disturbances occur is also listed because not all disturbances occur everywhere. All other data collected about disturbances is stored in the Conservation Database in Environment Australia.

Much of the information provided describing disturbances was based on opinion or observation. In many cases experts made recommendations for further research. Appendix 5 presents a table of all the fauna research recommendations made during the project.

3.1.4 Minimum viable habitat area

Table 3.2 sets out the minimum viable habitat area for the species which had a reliable distribution map. There were a number of species for which Minimum Viable Habitat Areas could be neither derived nor applied.

These species are listed in Table 3.3 along with the reason why targets were not calculated or applied. Formal reserves cannot be created for these species and their conservation needs can only be dealt with through appropriate management.

3.1.5 Evaluation of existing management

Appendix 6 contains a description of management prescriptions recommended during the workshops and the species to which these applied.

3.1.6 Selection of areas to be reserved or managed

Table 3.2 summarises the minimum patch size and the number of subregions where the minimum viable habitat area should be applied. The subregions were delineated for each species on their distribution maps produced by the Eden Fauna Modelling Project (see reports entitled ‘Eden Fauna Modelling Project’ and ‘JANIS and National Estate Conservation Requirements for the Eden Region’).

Reservation Rank

The rank given to each species are listed in Table 3.1. Those ranked 1 have the greatest need for their habitat to be protected in dedicated reserves.

TABLE 3.1: FAUNA SPECIES RESERVATION RANKS

Species Common Name	Reservation Rank
Greater Glider	1
Long-footed Potoroo	1
Stuttering Barred Frog	1
Koala	2
Yellow-bellied Glider	2
Barking Owl	2
Powerful Owl	2
Sooty Owl	2
Southern Brown Bandicoot	2
Masked Owl	3
Smoky Mouse	3
Tiger Quoll	3
Glossy Black Cockatoo	3
Red-browed Treecreeper	3
Giant Burrowing Frog	3
Grey-headed Flying Fox	3
Long-nosed Bandicoot	4
Long-nosed Potoroo	4
White-footed Dunnart	4
Crested Shrike-tit	4
Olive Whistler	4
Pink Robin	4
Yellow-tailed Black Cockatoo	4
Common Death Adder	4
Common Bentwing Bat	4
Eastern Horseshoe Bat	4
Varied Sittella	5

TABLE 3.2: A SUMMARY OF THE AGREED TARGET AREAS, MINIMUM PATCH SIZES AND NUMBER OF AREAS IDENTIFIED IN THE REGION WHERE THE TARGETS ARE TO BE APPLIED

SPECIES	Target Area (ha)	Minimum Patch Size (ha)	No. of Areas
Greater Glider	2,600	500	4
Koala	53,000	5,300	9
Yellow-bellied Glider	53,000	5,300	7
Masked Owl	308,000	3,000	8
Powerful Owl	260,000	5,000	8
Sooty Owl	204,000	5,000	7
Long Nosed Bandicoot	3,412	341	8
Long Nosed Potoroo	3,750	375	7
Smoky Mouse	4,800	1920	2
Southern Brown Bandicoot	5,000	500	8
Tiger Quoll	375,000	37,500	5
White Footed Dunnart	1,429	140	7
Crested Shrike-tit	9,333	200	9
Glossy Black Cockatoo	126,491	1,000	6
Olive Whistler	4,667	100	11
Pink Robin	1,167	50	8
Red-browed Tree-creeper	2,600	200	12
Varied Sitella	13,333	200	8
Grey-headed Flying Fox	1200	400	3
Yellow-tailed Black Cockatoo	114,416	1,000	7
Common Death Adder	6,000	100	6
Giant Burrowing Frog	7,000	1,000	* 7
Stuttering Barred Frog	6,000	1,000	6

* For the giant burrowing frog a mimimum of seven areas were allocated with one additional possible area to be negotiated.

TABLE 3.3: A LIST OF SPECIES FOR WHICH TARGETS WERE NOT APPLIED AND THE REASONS WHY THIS WAS NOT DONE

Species	Reason for not applying a target
Barking Owl	No distribution model
Australasian Bittern	No distribution model
Bush Stone-curlew	Nomadic species
Emerald Dove	No distribution model
Regent Honeyeater	Nomadic species
Square-tailed Kite	No distribution model
Turquoise Parrot	No distribution model
Swift Parrot	Nomadic species and does not breed in Eden
Common Scaly-foot	No distribution model
Diamond Python	No distribution model
Lace Monitor	No time, lowest priority in reptile group
Booroolong Frog	No distribution model
Highlands Tree Frog	No distribution model
Long-footed Potoroo	Use current management area
Common Bentwing-bat	No data to estimate a target area
Eastern Horseshoe Bat	No data to estimate a target area
Eastern Little Mastiff-bat	No data to estimate a target area
Golden-tipped Bat	No data to estimate a target area
Great Pipistrelle	No data to estimate a target area
Greater Broad-nosed Bat	No data to estimate a target area
Large-footed Myotis	No data to estimate a target area
Large Forest Bat	No data to estimate a target area
Little-red Flying Fox	No data to estimate a target area
Yellow-bellied Sheathtail Bat	No data to estimate a target area

3.2 FLORA

3.2.1 Species list

The final list of 189 priority flora species is provided in Appendix 7.

3.2.2 Risk of extinction

Appendix 7 lists all the priority plant species with their functional groups. The functional groups of most concern, because of the greater risk of extinction are:

N no known mechanism for recovery after disturbance.

C short lived seed bank.

R require undisturbed habitat for recruitment.

In addition, species with a small area of occupancy, fragmented habitat or a distribution restricted to less than 10 km^2 were considered to be at a high risk of extinction.

3.2.3 Management requirements

Appendix 8 sets out the expert advice on management requirements for each species. The management requirements for most species in a functional group were the same. There were some species which had atypical requirements and some which required further research.

At the second flora workshop (Dwight 1997), experts agreed that a minimum of five populations of each plant species should be protected. For species where less than five populations were known all should be protected. A nominal 5 ha was recommended as the area to be protected for a plant population unless the area occupied by the population is accurately known.

This "global" protection target was adjusted for some species and functional groups based on their susceptibility to disturbances. Details of these adjustments are set out in Appendix 8.

3.2.4 Area required to manage a species

Equity of Persistence calculations were made for a set of species from each functional group (see Table 3.4).

TABLE 3.4: RESULTS FROM EQUITY OF PERSISTENCE CALCULATIONS

Species	Functional Group	Target Area (ha)
Banksia spinulosa var. *cunninghamii*	CI	3870
Eucalyptus badjensis	VI	845
Dendrobium aemulum	DR	2519
Pimelea curviflora spp. *gracilis* var. *sericea*	∑I	1637
Acacia subporosa	SI	1,140
Correa baeuerlenii	SI	815
Pomaderris costata	SI	861
Pseudanthus divaricatissimus	SI	141
Pultenaea villifera	SI	136
Westringia davidii	SI	141
Hibbertia hermanniifolia	SI	361
Santalum obtusifolium	DR	∞
Xanthorrhoea concava	UI	7509
Caladenia sp. aff *reticulata*	UT	∞
Deyeuxia accedens	CT	9415
Eucalyptus tereticornis	VT	4375
Eucalyptus sieberi	VI	20,460
Psychotria loniceroides	DT	2,014

4. DISCUSSION

4.1 FAUNA

4.1.1 Species list

The fauna species, assessed as part of the Response to Disturbance project, included all those terrestrial vertebrates that were forest dependent and were scheduled in either the *ESP Act* 1992 or the *TSC Act* 1995, as well as several other species that agency staff and experts felt were of concern. Ideally the species list should also have considered invertebrates and fish.

4.1.2 Risk of extinction

The Risk of Extinction Assessment was not used as intended in Eden due to time constraints. Ideally this assessment should have been conducted for a much larger group of species. Species identified as being at a high risk of extinction in the region would then have made up the priority species list for further assessments. This would ensure that species that are at risk only in the region would be identified. The species list used in the Eden region focussed on species at risk in NSW (those listed in the *TSC Act 1995)* or all of Australia (those list in the *ESP Act 1992*) potentially excluding those species only at risk within the region.

4.1.3 Habitat requirements and disturbances

While there was a very good understanding of the habitat requirements of many species in Eden there was little knowledge on the disturbances affecting them. Information describing the impact of disturbances at different intensities and scales was sought but proved difficult to obtain. The only information experts were willing to provide was the identification of disturbances affecting species, how these were ranked relative to each other within the three land tenures (National Park, State Forest and Private land) and the components of critical habitat they affected. This made it impossible to quantify the impacts of disturbances and therefore compare the relative threat to each species.

4.1.4 Minimum viable habitat area

The target setting method used was well received by the experts. The method appeared to work well for most arboreal mammals, ground dwelling mammals, nocturnal birds, reptiles, frogs and diurnal birds. It was not a suitable method for bats and those species where the information needed to run the model was not available.

4.1.5 Evaluation of existing management

During the workshops, where disturbances were identified for each species, experts were asked to identify shortcomings in current management prescriptions. Management actions were recommended that related directly to each of the disturbances identified. Some species were quite poorly understood and the experts had trouble identifying their habitat requirements let alone disturbances and management needs.

Experts had varying levels of experience with the development of management prescriptions. The workshops were directed to disregard economic factors and give recommendations to conserve species. This resulted in recommendations that may have been impracticable to apply in normal forestry operations.

4.1.6 Selection of areas to be reserved or managed

The last workshop sought to collect information that would allow the species distribution models to be refined and indicate areas suitable for selection for inclusion in C-Plan. Unfortunately the nature of C-Plan was poorly understood by the project managers and so some information may have been provided that was innappropriate for inclusion in the software.

4.2 FLORA

4.2.1 Species list

The species list comprehensively documents the rare and threatened plants in the Eden region.

4.2.2 Risk of extinction

The use of functional groups was an efficient way of assessing the extinction risk of such a large list of species, many of which are poorly studied.

4.2.3 Management requirements

The structure of the project enabled the management requirements of a large number of rare plant species to be covered within the time and resource constraints of this project.

4.2.4 Area required to manage a species

The results of the Equity of Persistence calculations have been discussed by the expert panel and with Prof Possingham and Dr Burgman. The applicability of the results to management of the species in the field is still being clarified.

5. REFERENCES

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