Department of Sustainability and Environment

Action Statement

Flora and Fauna Guarantee Act 1988 No. 92

Powerful Owl

Ninox strenua

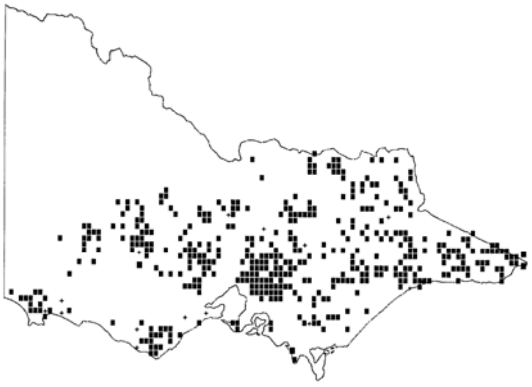
Description and Distribution

The Powerful Owl *Ninox strenua* (Gould), belongs to the family Strigidae (or Hawk owls) which are characterised by bright-yellow, large, forward-directed eyes. It is the largest owl found in Australia, with an overall head-tail length of 60-65cm. The male is larger than the female. Adults are mottled dark grey-brown above and white below with bold grey-brown chevrons (chest barrings); legs are feathered to the tarsus (shins), with dull yellow feet. Immature birds (owlets) are whiter, having paler back and wings, a whiter face with dark eye-patches and sparse fine dark streaks and faint barring on the flanks. The Powerful Owl has a characteristic double-note 'whooooo-hooooo', occasionally only a single 'whoooo', which is used to signal territory, identify its position and to maintain contact with its mate. For a full description refer to Schodde & Mason (1980) and Hollands (1991).

The Powerful Owl is restricted to mainland Australia, being generally concentrated along the forested coastal ranges of the eastern seaboard between Rockhampton in Queensland (Eyre & Schulz 1996) south to the Victorian/South Australian border (Mt Burr area). It also occurs on the western slopes of the Great Dividing Range and in the drier box-ironbark forests and woodlands (Blakers *et al.* 1984, *Emison et al.* 1987,

Hollands 1991, Debus & Chafer 1994).
In Victoria, the Powerful Owl has been recorded from most of the State with the exception of the drier north-west and most riverine Red Gum forests (NRE 1998a), although recent surveys have recorded Powerful Owls occurring in Red Gum plains along the Ovens River (R. Loyn *pers. comm.*). In the wetter mountain forest habitats it appears to

Powerful Owl *Ninox strenua*
(from a transparency by Alan Webster)



Distribution in Victoria
+ before 1970, ■ since 1970
[Source: *Atlas of Victorian Wildlife, NRE 1998a].*

Victoria
The Place To Be

be replaced by the Sooty Owl (Milledge *et al.* 1993). Dispersing juveniles have been recorded inhabiting woodland plains. There are also records of birds roosting in softwood plantations. The Powerful Owl has re-occupied suburban Brisbane (Pavey 1993), and resident breeding populations are known in the outer suburbs of Sydney (Debus & Chafer 1994) and Melbourne (Webster unpubl. data). Throughout its range, the Powerful Owl generally favours dense gullies for roosting and breeding sites. It prefers older forests where large tree hollows provide nesting sites and arboreal prey items are plentiful.

Records from Victoria indicate that nesting takes place during winter. Usually, two eggs are laid in a large hollow lined with wood debris between June and July. The eggs hatch after 35-38 days and the owlets are fledged at approximately 10 weeks of age. The young remain dependent for up to eight months of age. During February and March they disperse and establish new territories (McNabb 1996). The Powerful Owl reaches sexual maturity at two years of age. Each pair mates for the life of a partner (Schodde & Mason 1980, Debus & Chafer 1994).

The Powerful Owl is an opportunistic, nocturnal hunter that preys mainly on arboreal or semi-arboreal marsupials. Prey items vary from place to place depending on seasonal availability. The Common Ringtail Possum *Pseudocheirus peregrinus* and Sugar Glider *Petaurus breviceps* are the predominant prey items in southern Victoria (Seebeck 1976, Tilley 1982, Lavazanian *et al.* 1994) whilst Greater Gliders *Petauroides volans* are a common prey item in wetter forest habitats (James 1980, Kavanagh 1988, Pavey 1992, Debus & Chafer 1994). Birds, insects and some terrestrial mammals are also taken opportunistically, with some prey species being characteristic of open country, indicating that Powerful Owls may forage on forest margins.

Conservation Status

Current status

Garnett (1992a, b).....Rare (Aust.)

NRE (1998b).....Endangered (Vic.)

SAC (1994).....Threatened (Vic.)

The Powerful Owl has been listed as a threatened taxon in Schedule 2 of the **Flora and Fauna Guarantee Act 1988**.

Reasons for conservation status

Since European settlement, 65% of Victoria's forest cover has been cleared (Woodgate & Black 1988). Only 5% of freehold land remains forested. This past permanent loss of habitat has likely led to an overall reduction in owl numbers and fragmentation of the original continuous population into a series of small residual populations, each of which is at risk of becoming locally extinct.

It is estimated that hollows suitable for owls do not form, even in the fastest-growing eucalypts, until they are at least 150-200 years of age (Parnaby 1995). Of 21 nest trees observed by McNabb (1996) in southern Victoria, about 50% were senescent and all ranged between 350-500 years of age, based on data collected by Ambrose (1982). Over much of its range, the lack of suitably large hollows is considered to be a limiting factor to successful breeding and population recruitment. The Powerful Owl is, therefore, vulnerable to land management practices that reduce the availability of these tree hollows now or in the future. The loss of hollow-bearing trees has been listed as a potentially threatening process under the Flora and Fauna Guarantee Act (SAC 1991). In addition, prey density may be an important determinant in territory size and breeding success, particularly considering that only the male hunts during the breeding season. Seebeck (1976) estimated that about 250 possums (or their equivalent) would be required per year by a family group and recent studies have estimated around 300 prey items for a breeding pair rearing two young (Webster unpubl. data.). Key prey are also dependent on hollow trees.

In its final recommendation the Scientific Advisory Committee (SAC 1994) has determined that the Powerful Owl is:

- significantly prone to future threats which are likely to result in extinction, and
- very rare in terms of abundance or distribution.

Major Conservation Objective

The short-term conservation objective is to prevent further decline by ensuring that good quality habitat for at least a population target of 500 breeding pairs of Powerful Owl is maintained on public land in Victoria. The long-term objective is to increase population numbers in potentially suitable areas, where owls are now scarce, by maintaining and restoring habitat for the species across all land tenures to return it to a secure conservation status in the wild. These objectives will be achieved by:

Short-term (<10 years):

- identifying and protecting sufficient habitat on public land in designated Powerful Owl Management Areas (POMAs) for 500 breeding pairs across the Victorian range. Five hundred breeding pairs is an interim target, based on a population size that is likely to persist in the short to medium term (Shaffer 1981, Soul 1987) and is supported by a preliminary Population Viability Analysis (PVA);
- improving the estimation of the size and distribution of Victoria's Powerful Owl population, especially the breeding population, by the year 2000;
- implementing management prescriptions for designated habitat areas within State forest and conservation reserves;
- monitoring population size to determine if management prescriptions are effective and to assess if viable populations have been achieved.
- Long-term (10+ years):
- generating community awareness and promoting restoration of owl habitat on private land and emphasising the need to protect sites occupied by the Powerful Owl wherever possible;
- determining the effects of habitat fragmentation on owl populations;
- review Population Viability Analysis as more detailed biological information is obtained and parameters can be refined;
- determining habitat quality indices and Powerful Owl densities in different habitats.

Management Issues

Ecological issues specific to the taxon

Apart from diet, general behaviour, broad habitat types and general distribution, little is known about the Powerful Owl. It is sedentary and lives alone or in pairs which occupy a permanent territory containing a number of roost sites and one or more nesting sites. Tilley (1982) recorded 25 roost sites of a non-breeding pair near Healesville over a nine-month period. Although no birds have been individually marked, there appears to be high fidelity to nesting areas and adult pairs appear to remain within one large home range all their lives (Garnett 1992a, Webster unpubl. data). Traill (1993) reported one female in Chiltern State Park using the same nest tree for at least three consecutive years. In contrast, Webster (unpubl. data) has observed a breeding pair use three different hollows in consecutive years within the same home range, utilising over 70 roost trees in that period. The protection of known and active nesting areas is considered crucial for recruitment and thus persistence of local populations.

The Powerful Owl occupies a large permanent home range. Estimates of home range size have been based largely on the spacing of calling birds (not on radio-telemetry work) and appear to vary in size from 400-1 500ha (Davey 1993). Home range calculations based on estimated dietary requirements in western Victoria put this figure at over 1 000ha (Seebeck 1976). Schodde and Mason (1980) report that pairs appear to be well spaced, often at intervals of five to 20km, depending on habitat type and availability. Quinn (1993) recorded two breeding pairs in separate gullies about 400m apart. Clearly, home range sizes vary, being dependent upon density of prey items, adequate breeding hollows and tolerance to disturbance. Home range is likely to be smaller in forests supporting higher densities of prey.

Intensive forestry activities leading to a reduction in the abundance of hollows suitable for nest sites or prey species poses a threat to the Powerful Owl over much of its range (Brouwer & Garnett 1990, SAC 1994). From studies in New South Wales which investigated owl tolerance to disturbance, the degree of impact may depend on whether important owl areas are logged and to what extent the logged forest is prime Greater Glider habitat, this species being the main prey item of the Powerful Owl in wetter upland forests. In the drier lowland forests where the Common Ringtail Possum is the major prey item, Powerful Owls occur and breed in heavily-logged forests when the important riparian forest area used for nesting and roosting are protected in wide streamside corridors (Kavanagh & Peake 1993, Kavanagh & Bamkin 1995, Kavanagh *et al.* 1995). These studies demonstrate that the Powerful Owl will persist in mosaics of logged-unlogged forests in NSW.

The existing parks and reserve system may not provide sufficient suitable habitat to meet the management objectives of this Action Statement. Accordingly, management actions within State forest which complement the protection provided by the formal reserve system are required to conserve owl populations.

There are no reliable data on population size or densities of the Powerful Owl in Victoria or Australia. Expert opinion provided to the Scientific Advisory Committee (SAC 1994) considered that fewer than 500 pairs may exist throughout Victoria. This estimate may be conservative, because recent surveys in the forests of south-eastern Australia suggest that the apparent scarcity of owls may reflect lack of survey effort rather than lack of birds (Debus & Chafer 1994). The majority of Powerful Owl records have come

from surveys in areas designated for hardwood production. The status of owls in conservation reserves is generally unknown as these areas have not been systematically assessed to the same extent as State forest areas. Population modelling work for the East Gippsland Forest Management Area (FMA), based on known owl records followed by a stratified habitat survey of likely preferred habitat, gave an estimate of between 102-182 pairs within the one million hectares of forested land in the FMA (McIntyre and Henry *in prep.*).

The Powerful Owl has been recorded dispersing across open country, suggesting that populations are unlikely to be genetically isolated (Garnett 1992a, Humphries unpubl. data) although it is not known what distances birds are capable of travelling.

To manage the Powerful Owl effectively, it is necessary to quantify population size, (especially breeding population size) and understand impacts of habitat fragmentation/disturbance on breeding success and dispersal capabilities. Detailed investigations (e.g. radio-telemetry studies) are needed to determine densities, home range and dispersal accurately before long-term management prescriptions can be prepared.

Wider conservation issues

Actions implemented to conserve and protect the Powerful Owl throughout its range will benefit other threatened species that are dependent on similar habitat requirements. These include the FFG-listed Leadbeaters Possum *Gymnobelideus leadbeateri* and the Sooty Owl *Tyto tenebricosa* in wetter forests, and the Barking Owl *Ninox connivens,* Squirrel Glider *Petaurus norfolcensis,* Brush-tailed Phascogale *Phascogale tapoatafa* and Masked Owl *Tyto novaehollandiae* in drier forest habitats.

The loss of hollow-bearing trees has been listed as a potentially threatening process under the Flora and Fauna Guarantee Act (SAC 1991) and an Action Statement is in preparation. The development of management actions across both public and private land necessary to address ongoing hollow decline will benefit Powerful Owl conservation. Furthermore, actions already being undertaken to protect vegetation communities (eg. old-growth forest) are beneficial to Powerful Owl conservation.

The Powerful Owl also has the potential to affect other threatened species. In some instances this may be significant. Traill (1993) reported that Squirrel Gliders, a vulnerable species in Victoria, represented 30% of the vertebrate prey items in regurgitated pellets in north-eastern Victoria. Van Dyck and Gibbons (1980) found that Brush-tailed Phascogales, a rare species in Victoria, were highly preferred prey at Mt Alexander in central Victoria. Brush-tailed Phascogales have also been recorded in the diet of the Powerful Owl near Beaufort by Tilley (1982) and at Chiltern State Park by Traill (1993).

Social and economic issues

Currently about 28% of public native forest is available for hardwood timber production and associated forestry activities (Government of Victoria 1986), subject to the *Code of Forest Practices for Timber Production* (NRE 1996a) and the approval of annual wood utilisation plans. About 0.3% of this area is harvested each year to supply sawlog licence commitments.

The key socio-economic issue in relation to protection of the Powerful Owl is that protection of its habitat will reduce the area of State forest available for timber production. However, much of the area required to satisfy the Action Statement is already protected in steep slopes, stream buffers, old-growth and National Parks and reserves (eg. of the 52 POMAs proposed in the Central Highlands, 38 are allocated to conservation reserves and 14 within State forest). Additionally, the area required for owl conservation is also required to satisfy other flora and fauna conservation objectives. Such forest has many values for people - timber products, water harvesting, recreation, and also the knowledge that its biodiversity is being maintained. These values and how to reconcile them have been the subject of several enquires and much policy debate in recent years. The Timber Industry Inquiry (Ferguson 1985) and the Land Conservation Council (1986) provide detailed reports on the social and economic values of the forest industry. At a regional scale, Lugg *et al.* (1993) discussed the implications for management of East Gippsland forests, and the presence of wood processing industries that require access to the timber resource combined with the State government's legislative commitment to supply harvesting quotas to sawmills.

The economic value foregone will vary greatly from one POMA to another across the state, depending on the volumes of timber available, the yield and quality, timber harvesting costs, and price. Employment and local communities may be affected to varying extents. Although not likely to be as important as timber harvesting values, the value of any changes in recreational opportunities and water yield are likely to also vary greatly from site to site. Where there are choices to be made in regional forest management planning about the levels of protection to be given to Powerful Owl habitat, and local social and economic impacts to consider, economic assessment may give useful guidance.

The development of a systematic approach to forest owl conservation across Victoria, taking into account local economic factors, forest management practices and owl ecology as developed for the East Gippsland forest area (CNR 1995a), will provide a balanced outcome for conservation and timber production. The Action Statement acknowledges that large forest owls may be difficult to conserve in production forest because they require extensive areas of forest supporting hollow trees for nesting and substantial populations of possums as prey.

Previous Management Action

Distribution

The *Atlas of Victorian Wildlife* (NRE 1998a) currently includes over 800 Powerful Owl records. Cautious interpretation of this information is necessary to filter out replicate sightings and anomalies with breeding pairs using different hollows over consecutive seasons.

Birds Australia *Nest Record Scheme* information for Powerful Owls has been reviewed to find additional breeding localities within Victoria.

Ballarat, Bendigo, Melbourne and Orbost NRE offices have begun mapping owl records to determine the location of breeding pairs, home range size and breeding requirements in relation to land tenure and land-use.

Survey

The Powerful Owl has been recorded as part of general flora and fauna surveys and pre-logging surveys across Victoria.

Surveys for large forest owls have been undertaken in East Gippsland, Bendigo FMA (13 records from 150 surveyed sites), North-east Victoria and mid-Gippsland Tambo area (95 records from 679 surveyed sites);Central Gippsland (25 records from 273 surveyed sites) and Midlands (Lerderderg State Park - 12 records from 46 surveyed sites) (McIntyre and Bramwell in prep., Gibbons 1995, Loyn pers. comm., Morcom unpubl. data).

Habitat protection

Powerful Owl records have been included in Sites of Biological Significance as part of the pre-logging surveys commenced in 1983 (eg. Chesterfield *et al.* 1983). These sites have now been reviewed and adopted by the FMA planning process.

Specific prescriptions and targets to protect the Powerful Owl in State forests have been developed by McIntyre and Henry (*in prep.*) and incorporated within the East Gippsland FMA Plan (CNR 1995a), Midlands FMA (NRE 1996b) and in the Central Highlands Plan (NRE 1998c).

The Plans include conservation guidelines for old-growth forest and large forest owls within a network of conservation areas, encompassing designated parks and reserves and [1]Special Protection Zones (SPZ) and [2]Special Management Zones (SMZ) within State forest. The measures taken to protect Powerful Owl populations vary between plans according to regional circumstances:

- In the East Gippsland FMA (regional target population 100 pairs), up to 800ha of SPZ or SMZ is established in State forest for each pair of owls.
- In the Midlands FMA (regional target population 25 pairs), 500ha of SPZ is established in State forest within a radius of 3.5km from known records and a further 500ha of forest within the 3.5km radius is maintained at greater than 30 years old.
- In the Central Highlands planning area (regional target population 50 pairs), at least 500ha of suitable habitat is protected in SPZ for each owl, which must comprise patches of at least 100ha within a 3km radius.
- In the Otway FMA, specific protection is limited to nest sites and the contribution made by habitat in the existing parks and reserves network.
- In the North East planning area (regional target population 125 pairs), it is proposed that at least 500ha of suitable habitat is protected in SPZ for each owl, which must comprise patches of at least 100ha within a 3.5km radius [NRE (*in prep*)].

Research

Monitoring of selected breeding populations north-east of Melbourne has been continuing since 1991, by Port Phillip Region. Recently, similar monitoring commenced in the Midlands and Bendigo FMAs.

Banding of owlets under the Australian Bird and Bat Banding Scheme began in 1982. A total of 40 owlets have been banded, with no returns of bands to date (Ed McNabb *pers. comm.*).

A preliminary Population Viability Analysis (PVA) (McCarthy *et al., in press*) based on available quantitative data on the species, revealed that age-specific mortality of adults may have a major effect on extinction rates and that extinction rates appear relatively insensitive to population density. It showed that the population targets for the State and for individual regions of the State identified in the Intended Management Section of this

[1] SPZ-areas managed for conservation with timber harvesting being excluded.

[2] SMZ-areas managed to maintain conservation values whilst catering for timber production under certain conditions.

document are in the appropriate range for this species. Another key finding of the analysis was that collection of further ecological data to improve the reliability of the model would be prohibitively expensive and that population monitoring would be a more realistic method of assessing the population targets. Because of the limited data available for the PVA, its findings should be interpreted cautiously.

Intended Management Action

At the time of listing the Powerful Owl as a threatened species under the **Flora and Fauna Guarantee Act 1988**, the SAC considered that because the estimated population was less than 500 pairs, with no specific habitat protection outside of conservation reserves and threatening processes continuing across most of their range, the species was at risk of extinction.

The following actions are specific to meeting the short-term objective of protecting habitat for at least 500 Powerful Owl pairs in Victoria on public land within designated Powerful Owl Management Areas (POMAs). Additional owl breeding areas occurring in forests in excess of the target number will also be subject to specific management prescriptions. The strategy is based on the assumption that owls will continue to successfully utilise forest areas outside of the formally designated POMAs.

1. Identification of owl sites

Identify at least 500 POMAs on public land across the known Victorian range. The emphasis should be on identifying/locating nest sites or probable breeding areas based on the occurrence of owlets or adult roosting pairs. A notional breakdown of the number of POMAs to be protected within each FMA to meet designated targets is shown in Table 1. Regional targets will be set in the context of Geographic Representation Units (GRU) and be spread across the state to reflect the distribution of suitable habitat. POMA selection criteria will ensure a mixed allocation of sites across National Parks and State forest, with preference given to the protection of suitable habitat within the conservation reserves. Priority will be given to allocations in large parks where home range is protected within the conservation reserve. Priority for inclusion in the 500 pair target is as follows (in descending order):-

- confirm Identification of owl sites ed nesting tree utilised during the past 5 years.
- confirmed roost tree utilised during the past five years.
- repeated sighting or vocalisation during the past five years.
- incidental sighting or vocalisation during the past five years.
- historic record not reconfirmed in past five years.
- potential habitat area (preferably based on formal analysis and modelling).

Once regional targets are met, new POMAs will be established only on the basis of records of a higher priority.

Whilst the Powerful Owl has been recorded in Red Gum habitat along the Ovens River, it is unknown if they occur in the extensive riverine Red Gum forests along the Murray River. It is uncertain whether this forest type is good quality Powerful Owl habitat, and until survey work is undertaken no POMA target is allocated within the 500 designated as per Table 1.

Table 1: Target number of Powerful Owl Management Areas (POMAs) by Forest Management Areas.

FMA	Potential Habitat Area (ha)*	Proportion of State Target (%)	Target No. of POMAs
Mildura	0	0	0
Horsham	140,258	3	15
Portland	225,717	5	25
Mid-Murray	20,000#	1	3
Bendigo	252,545	6	28
Midlands	264,351	6	25
Otways	138,084	3	15
Central	238,118	5	25
Dandenong	88,402	2	10
Benalla-Mansfield	217,795	5	25
Central-Gippsland	770,117	16	85
Wangaratta	412,460	9	45
Wodonga	474,217	10	52
Tambo	417,918	9	47
East Gippsland	893,251	20	100
TOTAL	**4,533,233**	**100**	**500**

* Potential habitat areas calculated from known area of preferred habitat.
# not including 65 000 ha of riverine Red Gum Forest

2. Register

Develop a Powerful Owl Management Area register to record the locality and status of all sites in the target group and additional sites for review as necessary. The Register will initially include known owl localities and incorporate POMAs allocated across the FMAs as forest management plans are completed. NRE will maintain the register through the Forests Service and Flora and Fauna Program in consultation with Parks Victoria.

3. Protection in State forest

Protection in State forest will generally follow two protocols: where clear-fell harvesting is used, areas of SPZ and/or SMZ will be designated for owl protection; and where selective harvesting is used areas of SMZ will be designated. In State forests, the requirements of this Action Statement will be implemented through the development of forest management plans to ensure effective integration of owl conservation measures with other forest values and uses. The Powerful Owl conservation strategies established in existing plans are generally consistent with this Action Statement and will be maintained until the plans are reviewed.

Where clear-fell harvesting (NRE 1996a) is used, delineate and protect a core area of suitable habitat of at least 500ha (dependent on habitat type) as SPZ within a 3.5km radius (approx area of 3 800ha) for each POMA. Suitable habitat is areas dominated by old trees and areas likely to support high densities of prey species. Where forest stand characteristics may limit the adequacy of the core SPZ, additional habitat of up to 500ha of SPZ and/or SMZ should be maintained within the same 3.5km radius. The size of the core SPZ and any additional habitat requirements will be determined by assessment of the suitability of both existing forest habitat and regrowth forest in relation to prey densities.

Where selective harvesting (NRE 1996a) is used, POMAs will comprise SMZs of about 1 000 ha which will be managed to maintain habitat capable of supporting adequate populations of arboreal prey mammals to support breeding owls, allowing for modified timber harvesting practices which retain high levels of habitat trees. The retention rates will take into account research currently being conducted for the West Region Comprehensive Regional Assessment on home range and habitat characteristics. In some areas, where selective harvesting occurs, the approach described under Action 3 may be used.

Unless otherwise protected, all confirmed nesting and roosting sites will be protected by a 3ha SPZ around the site and a 250-300m radius (or equivalent linear area) SMZ buffers around identified localities. Outside of POMAs, habitat for foraging is provided in areas excluded from timber harvesting by general prescription including wildlife corridors, steep areas and unmerchantable areas and areas protected for other management purposes.

4. Protection in Conservation Reserves

Locate, monitor and protect all known Powerful Owl habitat sites within the parks and reserves system as a contribution to regional targets. In larger Parks and Reserves identify POMAs of at least 500ha of continuous suitable habitat which can be managed to be free of significant disturbance factors. In smaller sites, take account of the provisions applying to State forest owl protection measures and endeavour to obtain co-operative management from adjoining landowners as appropriate.

Avoid the development of intensive recreational facilities near known nesting and roosting trees and discourage access to breeding areas.

5. Protection on other Crown Land

Parcels of other Crown land having owl conservation values and suitable habitat should be identified as part of the assessment process and exempted from disposal, or sold with a caveat that includes site protection measures equivalent to those in Point 6 above as a minimum, dependent upon land size, location, viability and reservation status. Planning permit applications [Native Vegetation Retention (NVR) planning amendment referrals, mining applications, etc.] will be assessed in line with the major conservation objectives to protect a target number of sites across the species' range. This may include areas of Crown Land for protection and hence withholding approval of some applications.

6. Protection on Private Land

Encourage and assist Municipal Councils to develop conservation mapping and GIS overlay systems within planning schemes to improve information on owl habitat and breeding sites across private land.

Using provisions of local planning schemes, the **Flora and Fauna Guarantee Act 1988** and the **Planning and Environment Act 1987**, seek to ensure that Municipal Councils meet objectives and obligations to protect owl habitat on private land when considering land-use change.

Encourage private landowners to enter into voluntary agreements (e.g. *Trust for Nature* covenants, *Land for Wildlife Scheme*) to protect owl sites on private land across the species known range (covenanted private land sites may be used to attain the targets specified in Table 1). Planning permit applications (subdivision, native vegetation

clearing, mining) will be assessed in line with the major conservation objectives to protect breeding sites on private land (target number of sites across the species range which may include some areas of private land for protection).

7. Community involvement and extension

Prepare and distribute an information pamphlet and record card to reach potential observers through established networks such as Birds Australia, Bird Observers Club of Australia, Field Naturalists Club of Victoria, *Land for Wildlife* scheme, Victorian National Parks Association and the *Trust for Nature*, to encourage the community to report known nest sites, roosting sites and general sightings of the Powerful Owl.

8. Research

Encourage universities, Birds Australia and research institutes (eg. Arthur Rylah Institute) to conduct research into the density of owl populations, impacts of current forest management practices on nest site availability, prey density, recruitment, home range requirements and dispersal capabilities in all habitat types occupied in Victoria.

9. Survey and Monitoring

Monitor, on a tenure blind basis, at least 10% (i.e. 50 sites throughout Victoria) of POMAs regularly to determine persistence of owls and breeding success. The most efficient means of this monitoring will be determined to provide statistically valid analysis of management actions and program evaluation and should consider monitoring of unprotected owl sites as a control.

Undertake owl surveys as part of the West Regional Forest Agreement to improve estimation of population size and the location of breeding population.

Other Desirable Management Action

It is unknown if the Powerful Owl occurs in the extensive riverine Red Gum forests along the Murray River. Conduct survey work to determine if this forest type is good quality Powerful Owl habitat.

Repeat Population Viability Analysis modelling for the Powerful Owl when sufficient new data are available. Protection targets may be revised accordingly.

Review and apply the results of research findings to management prescriptions determined above especially in relation to home range and population viability.

Diet studies should be completed for all major habitat types occupied by the Powerful Owl. Densities and population dynamics of main prey items in each habitat would be used to refine territory size estimates based on dietary requirements as calculated by Seebeck (1976) and Kavanagh (1988) in the absence of suitable techniques to calculate territory use by telemetry studies of individual birds.

Undertake telemetry studies to determine dispersal and recruitment of young birds into the established population and movements and home range size of breeding adults.

Use economic evaluation, where appropriate, to assist decisions which are likely to have significant effect on Powerful Owl habitat, timber harvesting, water yields, and recreational opportunities or which may have significant local social and economic impact.

Legislative Powers Operating

Legislation

Catchment and Land Protection Act 1994 – provides for the integrated management and protection of catchments and the control of noxious weeds and pest animals.

Conservation Forests and Lands Act 1987 – provides for the management of public land under the Act, the co-ordination of legislation administered by NRE and for the preparation of codes of practice.

Crown Land (Reserves) Act 1978 – provides for reserving areas as public land and for making a specific reservation status for existing public land.

Flora and Fauna Guarantee Act 1988 – provides for the protection of flora and fauna in Victoria through a range of mechanisms including controls over the handling of protected flora and listed fish.

Forests Act 1958 – provides for the management of forests, and includes controls over the taking of forest produce.

Local Government Act 1958 – provides for local council by-laws and conservation regulations (e.g. permit requirement for land clearing).

Mineral Resources Development Act 1990 – provides for the management of mineral resources and includes controls over exploration and mining activities to minimise impacts on the environment.

National Parks Act 1975 – provides for the preservation, protection and management of natural areas and inlcudes controls over taking native flora and fauna from parks.

Planning and Environment Act 1987 – provides for the protection of native vegetation through the State section, and for regional planning controls in all planning schemes.

Victorian Conservation Trust Act 1972 – provides for the establishment of conservation covenants on land titles.

Wildlife Act 1975 – provides for the management of wildlife (vertebrate animals other than fish, and Flora and Fauna Guarantee-listed invertebrates) and includes controls over the handling of protected wildlife. The status of the Powerful Owl as protected wildlife makes the taking of it an offence under the Act unless an appropriate permit has been obtained.

Licence / permit conditions

The Powerful Owl is protected wildlife and can only be held under licence or permit in the case of injured animals or for rehabilitation and release. Healesville Sanctuary currently holds two birds in captivity.

Consultation and Community Participation

Consultation during public land management planning (Catchment Management Authorities, National Parks, Environment and Conservation Council, Forest Management) continues to provide for public participation in decisions about management of Powerful Owl sites.

The development of FMA planning proposals is guided by Forest Management Area Advisory Committees, consisting of about 12 members representing local municipal, commercial, and community organisations (eg. CNR 1995a). Moreover, upon release for public comment, the Proposed FMA Plans are accompanied by colour brochures (eg. CNR 1995b) designed to promote public awareness of the document and to maximise community response.

Consistent with this approach, wildlife biologists and land-use planners were consulted during the development of the management strategies identified and used to compile this Action Statement. The successful implementation of this Action Statement will rely on the contribution of reliable records of the Powerful Owl in Victoria and the successful protection of sites to meet specified targets.

Implementation, Evaluation and Review

The Regional Managers in all areas where the Powerful Owl occurs will coordinate the implementation of this action statement. Primary responsibility for implementation and assessment of the effectiveness of the management actions lies with the Flora and Fauna Planning Officers and Forest Officers.

In line with the major conservation objectives, the results of attaining and protecting specified targets will be assessed and the Action Statement will be reviewed five years after publication.

Contacts

Management

Flora and Fauna Officers, NRE Regions.

Wildlife Biologists, Parks Flora and Fauna Division.

Forest Service Officers.

Environmental Rangers, Parks Victoria.

Biology

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Many staff from Forests Service, Flora and Fauna Branch and regional NRE officers have provided valuable contributions and comments on earlier drafts.

Charlie Silveira (consultant biologist).

Rod Kavanagh (State Forests of NSW).

Ed McNabb (Ninox Pursuits) also provided information on aspects of owl ecology and management.

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Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

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