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Otway Forest Management Plan

June 1992

Section 6, part 1: Conservation of resources and values

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6.1 - Forest conservation and biodiversity

The maintenance of biodiversity of the natural environment is recognised by the Victorian Government as a major responsibility. Many of the state's forest conservation measures already in place and proposed for the Otway FMA in this plan reflect the objectives

described in the *Flora and Fauna Guarantee Act 1988*.

A parks and reserves system, which provides a sound basis for the regional forest flora and fauna conservation strategy, is outlined in the Statement of Resources, Uses and Values (Brinkman & Farrell 1990). The value and resilience of this system is enhanced by neighbouring State forest, especially when complemented with a system of retained habitat. Within State forest, biodiversity is influenced by the incidence of fire, by setting aside areas for conservation purposes and by manipulating forest age, structure and condition through harvesting and regeneration.

Forest conservation and biodiversity may also be influenced in the long term by climatic changes resulting from the greenhouse effect. Forest management strategies can play a part in preventing potential adverse effects of climatic change on the environment.

Objectives

Conserve Victoria's forest communities of flora and fauna and ensure their survival and retention of potential for evolutionary development.

Manage vegetation to suit the range of dependent flora and fauna species in both the short and long term.

Identify information deficiencies and set priorities for further research.

Adequate representation and protection of the various types of vegetation will ensure the conservation of long-term forest flora and fauna values. Determining the extent of representation and protection necessary is not easy. The simplest approach, setting aside minimum proportions of all land as reserves for nature conservation, raises the questions of not just what minimum proportion is adequate but to what areas of land is the figure applied? And then, are reserved areas spatially distributed to best achieve the desired objectives?

The answers are influenced by factors such as the land's biological significance and vulnerability, and by the demands placed on the land for its non-environmental values. The criteria commonly used to assess biological significance include ecological integrity and viability, species richness and diversity, rarity, representativeness of type and scientific and educational value.

Another influence which must be considered is the potential impact of the greenhouse effect. Major forest types', communities' and species' ranges may shift with a change in climate. New plant and animal associations and competitive interactions are possible. Some species may benefit and have an expanded range while others may be adversely affected. Species considered to be most at risk include those with genetically impoverished or localised populations, poor dispersers and/or some coastal, montane and alpine species (Mansergh & Bennett 1989).

Strategies for risk reduction are built on sound conservation measures. Their main thrusts should be to increase the resilience of the reserve system, avoid fragmentation of native vegetation and faunal communities and increase levels of reforestation.

In examining the levels of forest diversity it is important to distinguish between small scale or local diversity and broadscale regional diversity. It is possible, for instance, to increase local diversity by the creation of ecotones between communities and habitats of different age or conditions and at the same time reduce regional diversity through the loss of forest species susceptible to habitat fragmentation and manipulation. Emphasis should be given to regional forest diversity especially to enhance the conservation of specialist and sensitive forest-dependent species.

Within the Otway FMA, the adequacy of representation of public forested land in conservation areas has been examined by analysing the percentage of areas managed for conservation purposes in three ways:

- total forested area across land management units;
- major floristic communities; and
- major forest types and age classes.

Distribution of vegetation types and age classes has been considered at the regional level to some extent in the design of the regional system of retained habitat, which includes the existing parks and reserves system (see Section 6.3.2), and in coupe location and design. With further surveys and research and the development of geographic information systems and resource models, the influence of scale and pattern of disturbance and habitat requirements can be given greater consideration.

6.1.1 - Reservation of Forested Areas Across Land Management Units

The Otway FMA has been subdivided into Land Management Units based on catchment or subcatchment boundaries. These units represent areas of distinct physical and biological characteristics.

The nine units considered in this proposed plan each encompass, on average, approximately 20 000 ha of forested public land. They allow for assessment of management on a local as well as a regional level and may be suitable for other planning and management purposes. Land Management Units within the Otway FMA are shown in Figure 1. The reservation of areas within Land Management Units is described in Figure 2.

Action

- Establish a sufficient area of State forest within the Conservation Zone so that a suitable proportion of each Land Management Unit, including parks and reserves, is managed for conservation (refer to Figure 2) *High Priority*

6.1.2 - Reservation of Major Floristic Communities

Cool Temperate Rainforest, Heathy Woodland, Wet Heath and Coastal Complex communities are of high value for flora and fauna conservation and either unavailable or of little or no value for timber production, including green firewood harvesting. No sawlog harvesting is undertaken in these communities. The floristic communities in which hardwood timber harvesting does occur are Wet Sclerophyll Forest, Damp Sclerophyll Forest, Foothill Forest, Grassy Forest and Dry Sclerophyll Forest.

The percentage of these major native floristic communities in the various land use categories and management zones are described in Figure 3. Note that additional survey work is required to determine the major floristic communities represented in the Myrtle Beech/Blackwood species class. Areas identified as rainforest will be added to the Conservation Zone. Some non-rainforest areas may be suitable for reforestation and added to the Production Zone.

Actions

- Include all Cool Temperate Rainforest, Heathy Woodland, Wet Heath and Coastal Complex within State forest in the Conservation Zone *High Priority*
- Adequately represent each floristic community within the Conservation Zone *High Priority*
- Conduct additional flora survey work within the Myrtle Beech/Blackwood class and include any areas identified as Cool Temperate Rainforest in the Conservation Zone *High Priority*

Timber harvesting occurs in five floristic communities. The minimum area managed exclusively or primarily for conservation varies from 26% (Grassy Forest) to 90% (Dry Sclerophyll Forest). In the case of Grassy Forest, which does not occur within the parks and reserves system, the community has been represented and protected in the Conservation Zone by positioning part of the wildlife corridor network across major occurrences and by incorporating two of the larger occurrences (north of Pennyroyal Track and east of Seaview Road) in the Conservation Zone. Furthermore, most of this community occurs as low foothill forest which is unsuitable for sawlog production.

The five communities in which timber harvesting may take place are composed of 23 subcommunities. These have been defined floristically but have not yet been fully described nor mapped so that objective analysis of subcommunity representation within conservation areas is not possible.

Action

- Encourage further floristic surveys (see Section 6.2.2) to enable better subcommunity definition and mapping and facilitate future management *Medium Priority*

Figure 1 Otway Forest Management Area - Land Management Units

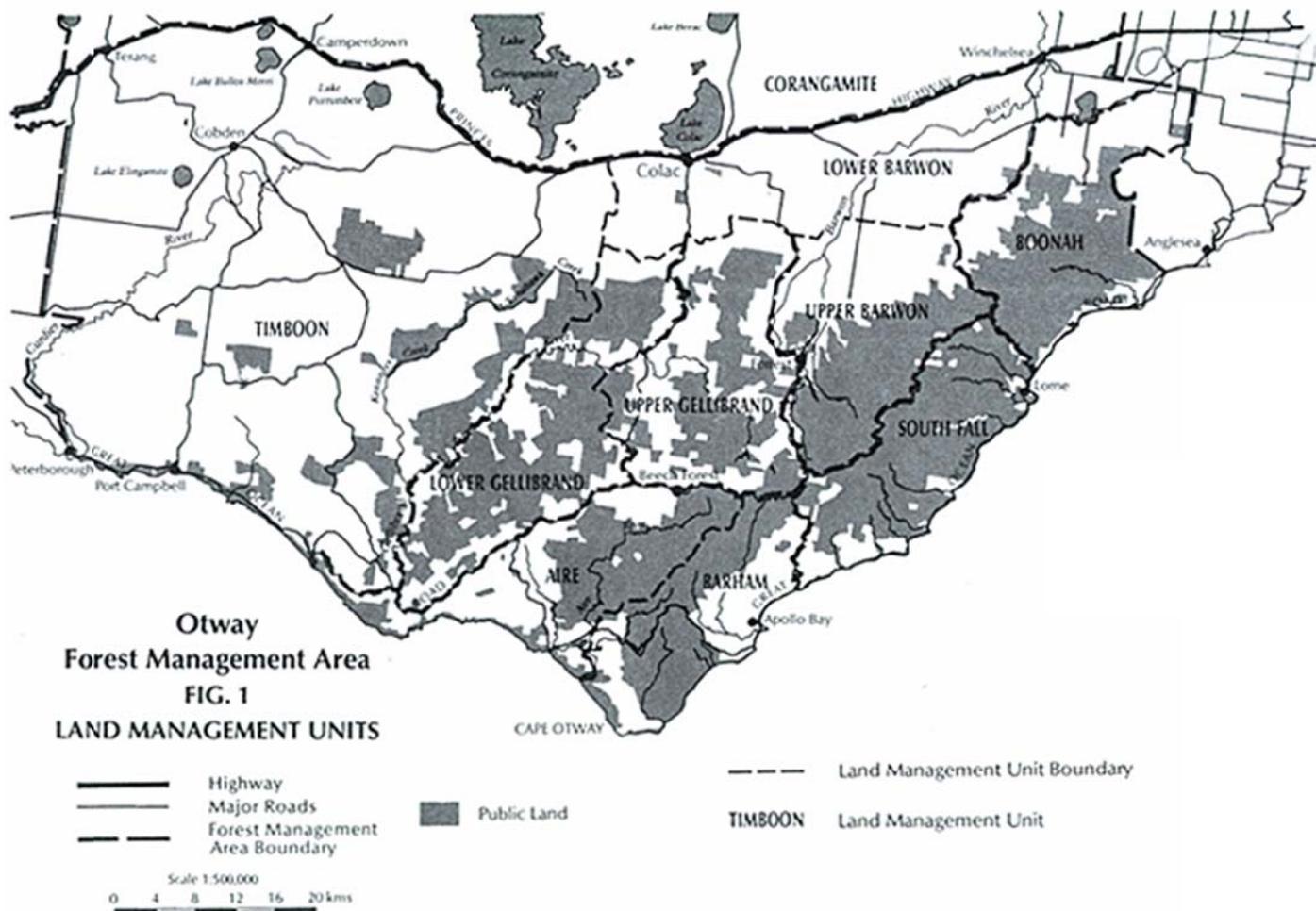


Figure 2 Percentage of Land Management Units managed primarily for conservation

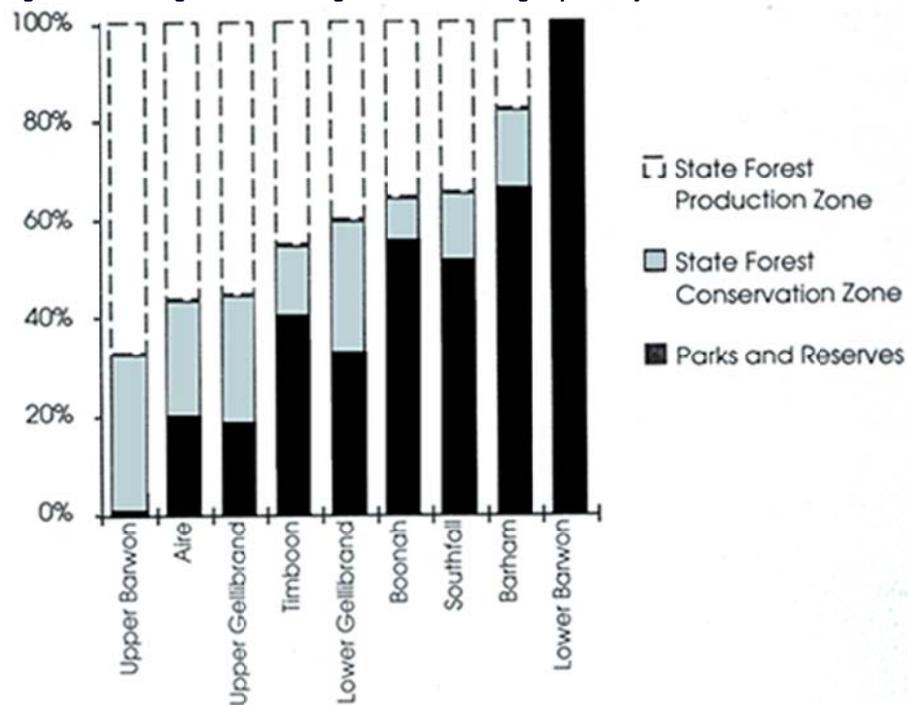
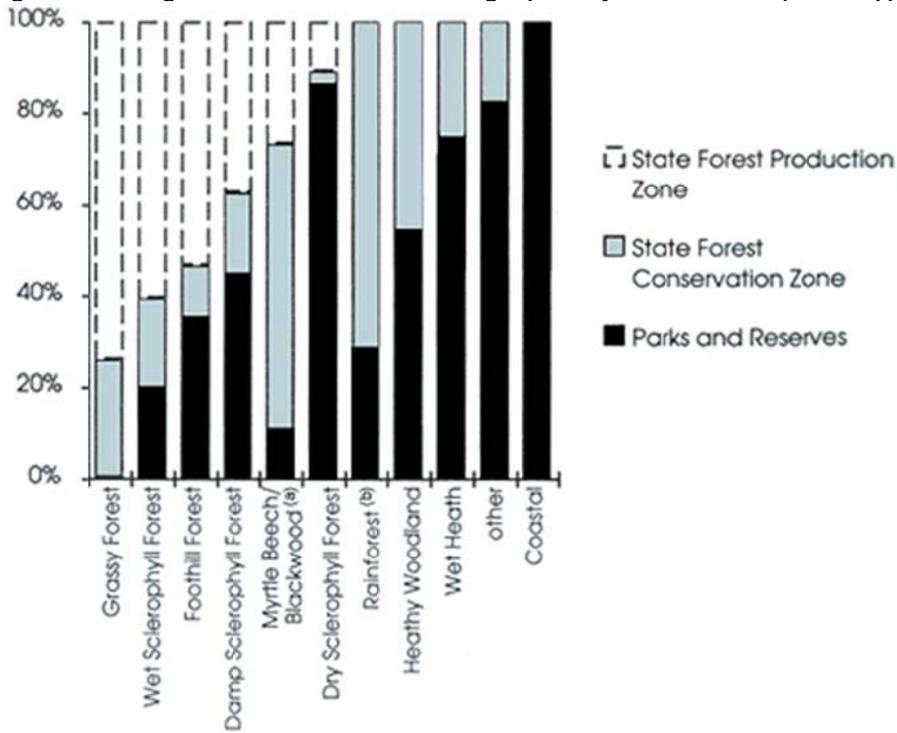


Figure 3 Percentage of Floristic Communities managed primarily for conservation (refer to Appendix D for precise areas)



(a) refers to stands of Myrtle Beech and tree fern only

(b) further floristic sampling is required to determine the extent of rainforest in this community

6.1.3 - Management of Forest Types

A mosaic of forest structural types and age classes should promote forest biodiversity. Although mixed-age stands do occur within the Wet Sclerophyll Forest and Damp Sclerophyll Forest floristic communities, many forest stands have originated from severe fires or past logging and are largely even-aged.

The present age composition of mountain forest and even-aged foothill forest is described generally in terms of stand classes. Detailed information on these stand classes does exist for State forest but not for all parks and reserves.

It is possible to monitor and, in fact, manipulate future forest age class composition by means of reservation and varying harvesting and regeneration rates. While it is important to maintain a full range of age classes, the wildlife conservation and aesthetic value of old growth forest is well recognised and requires special consideration (see Section 6.3.2).

Action

- Maintain a range of forest age classes within mountain and foothill forests*High Priority*

Table 5 details the areas of each forest age class within the State forest Production and Conservation Zones. The projected long-term forest age class distribution is shown in Figure 4. No attempt has been made to include possible effects of wildfire.

Table 5 Forest stand types by Forest Management Zone

Stand Class (stratum)	Total area	State forest	Conservation Zone		Production Zone		Parks and Reserves^(a)		Total Conservation	
	ha	ha	ha	%	ha	ha	ha	%	ha	%
<i>Mountain (greater than 40 m)</i>										
Old Growth	27 970	11 890	4 240	15	7 660	27	16 080	57	20 320	73
1890s Regrowth	1740	1360	410	24	950	55	380	22	790	45
1919/26 Regrowth Ash & Ash Mix	5390	3680	980	18	2700	50	1710	32	2690	50
1919/26 Regrowth Mixed Species	4280	4280	880	21	3400	79	n/a	n/a	880	21
1939 Regrowth	5650	2910	610	11	2300	41	2740	48	3350	59
1970s Regrowth	2350	2350	300	13	2050	87	n/a	n/a	300	13
1980s Regrowth	4630	2210	270	6	1930	42	2420	52	2690	58
<i>Non-eucalypt</i>										
Myrtle Beech/Blackwood ^(b)	3080	2760	1940	63	820	27	320	10	2260	73
Rainforest ^(c)	1270	910	910	72	0	0	360	28	1270	100
Other	11960	8360	3400	28	4960	41	3600	30	7000	59
<i>Sub-total</i>	<i>68320</i>	<i>40710</i>	<i>13940</i>	<i>20</i>	<i>26770</i>	<i>39</i>	<i>27610</i>	<i>40</i>	<i>41550</i>	<i>61</i>
<i>Foothill (28 -- 40 m)</i>										
Old Growth	14840	11240	3110	21	8130	55	3600	24	6710	45
Old Growth (with regrowth)	17100	10070	2290	13	7790	46	7030	41	9320	55

	Total area	State forest	Conservation Zone		Production Zone		Parks and Reserves^(a)		Total Conservation	
Stand Class (stratum)	ha	ha	ha	%	ha	ha	ha	%	ha	%
1939 Regrowth	650	650	110	17	540	83	n/a	n/a	110	17
1950s Regrowth	3500	3240	600	17	2640	75	260	7	860	25
1980s Regrowth	2540	1140	260	10	870	34	1400	55	1660	65
1983 Regrowth (with mature/overmature)	1490	1490	380	25	1110	75	n/a	n/a	380	25
1983 Regrowth (with mature/overmature & regrowth)	1820	1820	410	23	1410	77	n/a	n/a	410	23
<i>Foothill (less than 28 m)</i>										
Old Growth	6870	6870	1640	24	5230	76	n/a	n/a	1640	24
Old Growth (with regrowth)	20470	3510	620	3	2890	14	16960	83	17580	86
Other (>15m)	12770	12770	6750	53	6020	47	n/a	n/a	6750	53
<i>Sub-total</i>	82050	52800	16170	20	36630	45	29250	36	45420	55
<i>Softwood</i>	6220	6220	1220	20	5000	80	0	0	1220	20
Total	156590	99730	31330	20	68400	44	56860	36	88190	56

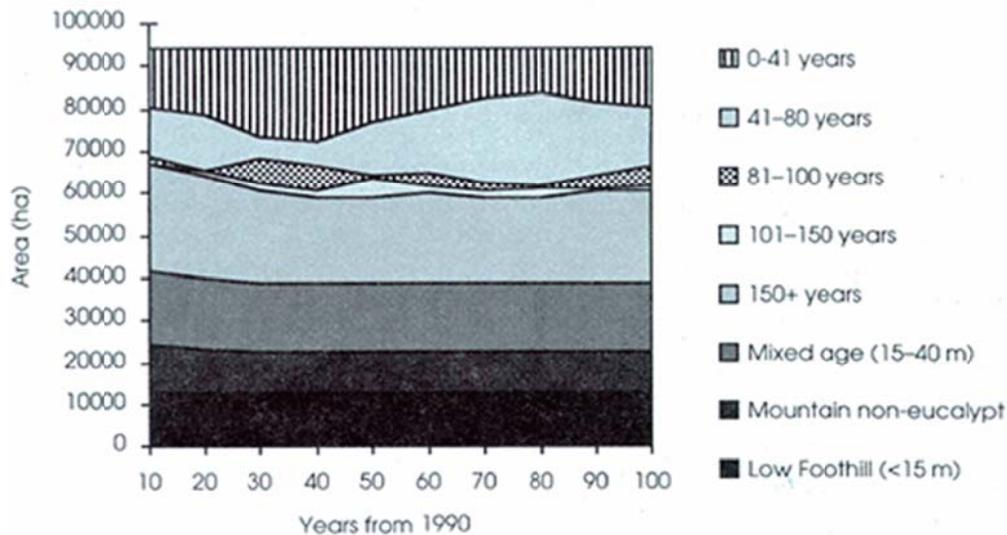
(a) Parks and Reserves figures are approximations only

(b) Further floristic sampling is required to determine the presence of rainforest in this stand class

(c) Refers to Myrtle Beech and tree fern stands only

n/a The figure has not been assessed. These stands have been aggregated into other stand types for park and reserve estimates

Figure 4 Age distribution of Otway FMA State forest (1990–2090)



Local forest diversity can be enhanced by varying the size and location of logging coupes. Small coupes which do not abut similarly aged areas enhance the amount of 'edge' habitat in the forest. A higher diversity of annuals is usually found at the boundary between two habitat types (ABRG 1984). However, the effects of coupe size and distribution on flora and fauna values is quite complex. For example, if coupes are too small they may not support specialist fauna species. Recher *et al.* (1980) reported that small coupes (10 ha) at Eden supported fewer bird species per unit area than larger coupes. Large coupe size should also reduce the need for temporary roads with less potential effects on values. Topographic and operational factors contribute to a relatively small coupe size in the Otways (average size of clearfelled coupes has been 9 ha since 1981/82).

Under the Code of Forest Practices, coupe size is limited to 40 ha with adjacent fellings in not more than three successive years or a combined area of generally less than 120 ha. Other methods of enhancing diversity, such as retaining habitat trees, are discussed in Section 6.2.

Action

- Increase average size of clearfelled coupes to between 10 and 20 ha by increasing the area of smaller coupes *Low Priority*

6.1.4 - Further Research

There are several notable gaps in our knowledge and understanding of the flora and fauna of the Otway region. The greatest deficiency (and a major weakness of the Otway fauna indicator species abundance model) is related to species' spatial distribution and ecological processes.

Questions raised include the minimum viable populations and habitat and the scale and pattern of natural and man-made disturbances in order to manage effectively for species richness. In the short-term, efforts should be directed to the biological requirements of threatened species, especially those at the top of the food chain (e.g. owls) and those with specialised habitats (e.g. skinks in small swamps) (Bennett in press).

Information used in the Otways fauna model is adapted from a limited number of Victorian studies. Consistent quantitative measurements of relative abundance associated with specific locations would enable, with the use of geographic information systems, predictions and more accurate models of the temporal dynamics of flora and fauna patterns. Further research should reflect the potential value of these methods.

Actions

- Promote research into management of threatened species *Medium Priority*
- Promote research into ecological processes at the broad-scale, regional level*Medium Priority*
- Promote flora and fauna surveys which provide information on quantitative abundance levels and spatial/temporal distributions for GIS-based predictive modelling *Low Priority*

6.2 - Native flora

The Otway FMA supports diverse native plant communities ranging from Cool Temperate Rainforest to Heathy Woodlands. Lunt (1989) described 19 floristic communities (comprising 55 subcommunities) in the Otway FMA. Further work may define other subcommunities. Native vegetation has been mapped into one of nine major communities (refer to Section 6.1). Cool Temperate Rainforest, Heathy Woodland, Wet Heath and Coastal Complex floristic communities within State forest have been zoned for conservation. In State forest, the five floristic communities within the production zone are Wet Sclerophyll Forest, Foothill Forest, Damp Sclerophyll Forest, Grassy Forest and Dry Sclerophyll Forest.

More than 30 plant species classified by Gullan *et al.* (1990) to be rare, vulnerable or endangered in Victoria are found within State forest in the Otways FMA. Most of these species are found within Cool Temperate Rainforest, or occupy either riparian or poorly drained sites. A significant number are ferns or fern allies.

Objectives

- Conserve and protect floristic communities, subcommunities and plant species recognised to be of special significance.
- Maintain the genetic diversity of natural plant communities and subcommunities.
- Control non-indigenous native and other introduced species.
- Improve knowledge of the ecology of plant species and communities through continued research and floristic surveys.

6.2.1 - Rainforest

A definition of rainforest was prepared with public involvement and incorporated into the Code of Forest Practices. This definition has provided the basis for the identification and management of rainforest in Victoria. The Code of Forest Practices defines rainforest as:

closed broadleaved forest vegetation with a more or less continuous rainforest tree canopy of variable height, and with a characteristic composition of species and life forms. Rainforest canopy species are defined as shade tolerant tree species which are able to regenerate below an undisturbed canopy, or in small canopy gaps resulting from locally recurring minor disturbances, such as isolated windthrow or lightning strike, which are part of the rainforest ecosystem. Such species are not dependent on fire for their regeneration.

There are concerns about the adequacy of this definition with regard to proper reflection of the ecological processes of rainforest and practical field interpretations of the definition. Further refinement of rainforest policy and management will be conducted within DCE.

A summary of the proposed position developed by the Rainforest Project Team and further refined by Flora and Fauna Division, which is relevant to the Otways, describes rainforest as a combination of ecological, floristic and structural attributes. Ecological attributes are given priority over floristic attributes, which are given priority over structural attributes. Ecologically, a rainforest is a fire-sensitive forest, composed of or dominated by primary or secondary rainforest species which, once established, is intrinsically capable of maintaining an internal environment that resists destruction of the canopy by running crown fire. It can include transitional and seral forest communities once they have developed a recognisable canopy of rainforest species below an overstorey of sclerophyll emergents. Primary Cool Temperate Rainforest species include *Nothofagus cunninghamii* and *Dicksonia antarctica*. Secondary species include *Acacia melanoxylon*, *Eucalyptus regnans* and *Phebalium squameum*. Rainforest may be recognised floristically with a field key which uses a range of differential species. Rainforest is defined structurally as having a more or less continuous closed canopy composed of primary or secondary rainforest species which provides the habitat for a characteristic diversity of dependent life forms (DCE 1991).

The distribution of rainforest communities in the Otway Ranges has been mapped from aerial photos into four vegetation types that have floristic or structural characteristics consistent with, or similar to, that of rainforest. Otway rainforest canopy species are Myrtle Beech (*Nothofagus cunninghamii*) and Blackwood (*Acacia melanoxylon*) where the balance of the foliage cover is composed of Myrtle Beech (CFL 1987). The four mapped vegetation types predominantly have an overstorey of either:

- Tree Fern (*Dicksonia antarctica*) and other ferns or;
- Myrtle Beech (*Nothofagus cunninghamii*) or;
- Myrtle Beech and Blackwood (*Acacia melanoxylon*) mixture; or
- Blackwood.

The first category does not fit into the Code's definition of rainforest since it is characterised as having a dense closed layer of Tree Fern with no overstorey. Nevertheless, for the purposes of management, this is included within the areas shown on Map 11 as Cool Temperate Rainforest. The Myrtle Beech category is clearly Cool Temperate Rainforest and is also shown on Map 11. The Code and working definitions recognise Myrtle Beech/Blackwood to be rainforest. However, the variability of this vegetation type, and the difficulty in accurately determining from broadscale air photo interpretation the boundary of rainforest in and around these mapped stands (and similarly in the Blackwood vegetation type) means that more detailed sampling is needed. Further floristic field sampling is required in the Myrtle Beech/Blackwood mixture and pure Blackwood categories to determine the area of these two vegetation types that constitutes Cool Temperate Rainforest and prior to scheduling forest operations within these areas. The two latter categories are not shown on Map 11.

As part of the rainforest survey work conducted in the Otways, a floristic field identification key is being developed to enable field personnel to effectively and consistently identify and map rainforest. Different characteristics of rainforest throughout the state require different keys for each rainforest type. The Otway key is substantially advanced but not complete. It uses a range of differential species like 'filmy ferns' and *Blechnum* and *Asplenium* species that inhabit the lower stratum of rainforest, in addition to overstorey species. It should be noted that with the application of the field key, the area classified as rainforest in the Otway FMA is not expected to alter substantially if either definition is applied.

DCE is likely to further refine the definition. The current method of identifying rainforest in the field in the Otway FMA is based on the combination of structural and floristic criteria, as shown in Figure 5.

Determining the precise boundary of the rainforest community in the field is done by assessing the extent and composition of the canopy cover and using the floristic field identification key. Areas with a more or less continuously closed canopy of Myrtle Beech, Blackwood or both that contain characteristic Otway Cool Temperate Rainforest differential species are managed as rainforest. Some areas of Wet Sclerophyll Forest contain rainforest differential species but their presence alone does not necessarily mean that these areas are, or ever will be, rainforest. Conversely some areas of rainforest contain Wet Sclerophyll differential species.

Actions

- Further develop the Otway Cool Temperate Rainforest/mixed forest field identification keys *High Priority*
- Map the extent of rainforest in the Otway FMA. *High Priority*

Cool Temperate Rainforest in the Otway FMA usually occurs as narrow strips along sheltered streams on the southern slopes of the ranges though scattered stands also occur in sheltered sites on the upper northern slopes. Ten rainforest sites within the Otway FMA have been proposed by Cameron (1990) as being of national, state or regional significance. These ten sites (listed in Table 6) were generally delineated by including all native forested land in the catchments within which the significant rainforest occurs. All other occurrences of rainforest in the Otway FMA are rated to be at least of local significance. The criteria used to determine a site's significance include the level of ecological integrity and viability, richness and diversity, rarity, representation, evolutionary development and scientific reference and educational values (Cameron 1990).

Figure 5 Profile of Otway Cool Temperate Rainforest.

This diagram shows the gradation from wet sclerophyll forest to rainforest. The boundaries of these communities is best determined in the field using a combination of ecological, floristic and structural characteristics.

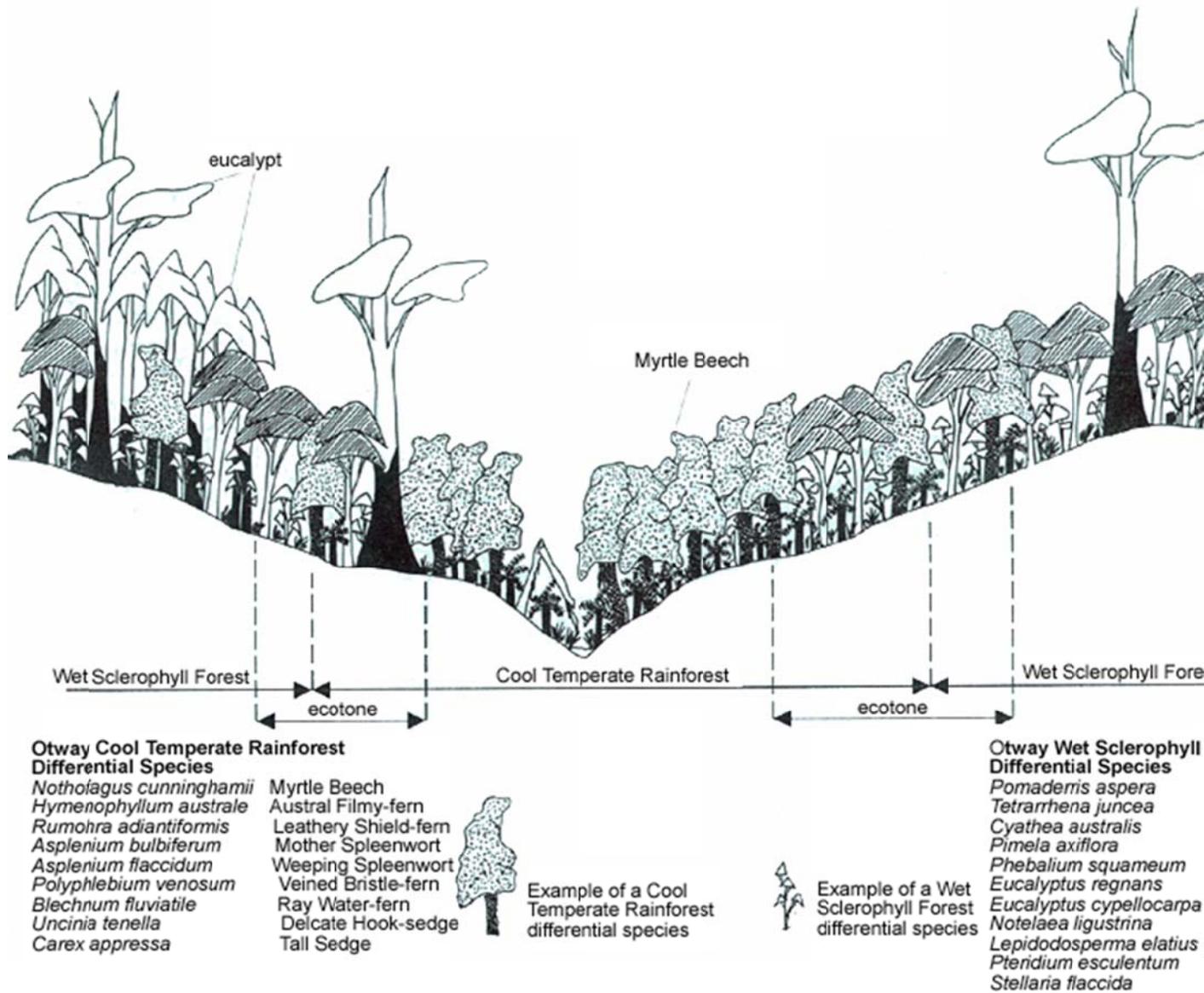


Table 6 Proposed Otway Rainforest Sites of Significance

Site Name	Significance	Location
Olangolah Creek	National	Olangolah Flora and Fauna Reserve
Youngs Creek-Aire River	National	State forest--Aire Unit
Calder River	State	Otway National Park
Clearwater Creek	State	State forest--Aire Unit
Parker River-Elliot River	State	Otway National Park

Site Name	Significance	Location
Gellibrand River	Regional	Colac District Water Board
Johanna River	Regional	Melba Gully State Park (& private land)
Redwater Creek	Regional	Redwater Flora and Fauna Reserve
West Barham River	Regional	State forest--Barham Unit
East Barham River/Wild Dog Creek	Regional	State forest--Barham Unit

The Code of Forest Practices requires buffers to be a minimum 20 m wide on linear shaped rainforest, such as along gullies and streams, and 40 m elsewhere. This procedure has been applied to delineated rainforest areas. Two larger rainforest conservation areas within the Youngs Creek and Clearwater Creek sites of significance have been delineated as shown on Map 11. These areas represent the practical application of the Code of Forest Practices' provisions and consideration of the environmental, social and economic and operational factors. The establishment of these areas recognises the range of values that led to the classification of the sites and their protection and the effect on all other forest values applicable to the Otway FMA, including timber production. These two State forest conservation areas provide representation of the dynamic ecological balance between the stands of rainforest and their surrounding eucalypt forests, and complement the significant rainforest sites within the parks and reserves system.

The encroachment of sclerophyll species following fire is considered to be a threat to rainforest ecosystems. Excessive or uncontrolled recreational usage may also have adverse effects on rainforest areas.

Actions

- Establish two rainforest conservation areas within the Youngs Creek and Clearwater Creek catchments of 690 ha and 350 ha respectively, and incorporate into the Conservation Zone *High Priority*
- Incorporate into the Conservation Zone all other rainforest, including appropriately managed buffer zones *High Priority*
- Minimise the risk of wildfire entering rainforest. (The Regional Fire Protection Plan recognises the high conservation value and sensitive nature of this community) *High Priority*
- Limit access and introduce controls to protect rainforest and associated buffer vegetation from recreational activities *Medium Priority*

- Manage visitor use by appropriate location of tracks, camping sites, and closing, relocating or surfacing roads *Medium Priority*

6.2.2 - Flora Surveys

The Otway FMA flora database used to describe floristic vegetation and prepare the floristic map is based on 815 quadrats sampled between 1982 and 1988. While this number of quadrats offers a good coverage, floristic sampling intensity of one quadrat per square kilometre in State forest and one quadrat per 5--10 km² in parks and reserves spread evenly throughout the FMA is preferable to best determine community and subcommunity definition and distribution and to properly identify areas of high conservation significance. Nearly all surveyed quadrats were located on the main Otway Range with relatively few on the foothills and outlying areas of public land.

Four areas in particular require additional floristic data:

- blocks of public land west of a line between Princetown, Kennedys Creek and Irewillipe East;
- public land north of a line between Simpson, Gellibrand and Forrest;
- area east of a line between Bamba and Fairhaven; and
- a band between Muroon and Benwerrin and Forrest and Wye River.

Sampling intensity varies considerably between communities and subcommunities. Further sampling would be beneficial in: closed forests dominated by *Acacia melanoxylon* (Blackwood) to assist in rainforest identification; Riparian Damp Sclerophyll Forest to enhance definition of subcommunities; Foothill Forest to cover all mapped areas and account for extreme variability; Dry Sclerophyll Forest which is poorly defined; Wet Heath in Eastern Otways to establish any differences from occurrences further west; and Riparian Fern Scrub and Riparian Scrub for adequate community and subcommunity definition (Lunt 1989).

Action

- Conduct additional flora surveys of poorly represented geographic areas and floristic communities *Medium Priority*

6.2.3 - Significant Plant Species

Thirty-one Victorian Rare or Threatened Species (VROTS) occur in State forest within the FMA. Some of these will be listed and then managed in accordance with the provisions of the Flora and Fauna Guarantee. Management for the conservation of rare, vulnerable and significant species is often difficult because of the lack of information on distribution, ecology and threats. In particular, there is a

need for more information about the reproductive biology of key indicator species. Species vulnerable to change, such as the epiphytic ferns, or species which are important for fauna, such as winter-flowering plants, should be a high priority for further research.

Conservation of significant plant species is usually achieved by protecting, within conservation areas, replicated examples of communities or ecosystems in which rare or threatened species or taxa occur. This ensures that sufficient individuals in a sufficient number of populations are protected from potentially threatening processes to ensure their long-term survival and maintain genetic variation. Some species, like *Leptorhynchogatesii* (Wrinkled Buttons), depend on periodic fire for their continued survival. Where such requirements are known, specific sites may be manipulated by ecological burns to ensure the conservation of the species.

Many VROTS in State forest are found in floristic communities or areas which are generally not subject to or available for timber harvesting. Entire occurrences of these species which generally fall into the Conservation Zone are listed in Table 7. Other VROTS, which may be well represented in parks and reserves, may also be relatively common in some areas of the Production Zone of the Otway FMA. The conservation status of these species (Table 8) calls for careful management though this does not necessarily entail automatic exclusion of timber harvesting or other intensive management practices.

Table 7 Rare or threatened plant species generally found within the State forest Conservation Zone.

Species	Conservation Status^(a)	Floristic Community
<i>Astelia australiana</i> Tall Astelia	Vv	Cool Temperate Rainforest
<i>Cyathea cunninghamii</i> Slender Tree-fern	Rr	Cool Temperate Rainforest (P)
<i>Cyathea X marcescens</i> Skirted Tree-fern	r	Cool Temperate Rainforest (P)
<i>Grammitis magellanica</i> Finger-fern	v	Cool Temperate Rainforest or Riparian zone in Wet Sclerophyll Forest
<i>Grammitis meridionalis</i> Finger-fern	v	Cool Temperate Rainforest & Wet Sclerophyll Forest
<i>Lastreopsis hispida</i> Bristly Shield-fern	r	Cool Temperate Rainforest (P)

Species	Conservation Status^(a)	Floristic Community
<i>Lycopodium varium</i> Long Clubmoss	v ^(b)	Cool Temperate Rainforest, Wet Sclerophyll Forest & Wet Heath (P)
<i>Oxalis magellanica</i> Snowdrop Wood-sorrel	r	Cool Temperate Rainforest
<i>Pteris comans</i> Netted Brake	r	Cool Temperate Rainforest
<i>Tmesipteris elongata</i> Elongate Fork-fern	Rv	Cool Temperate Rainforest (P)
<i>Thelymita epipactoides</i> Metallic Sun Orchid	Ee	Wet Sclerophyll Forest
<i>Burnettia cuneata</i> Burnettia	Rr	Wet Heath
<i>Lycopodium serpentinum</i> Bog Clubmoss	r	Wet Heath
<i>Thelymitra resecta</i> Bog Sun-orchid	v	Wet Heath
<i>Caladenia patersonii</i> Common Caladenia	r	Heathy Woodland (P)
<i>Grevillea infecunda</i> Anglesea Grevillea	Vv	Foothill Forest and Heathy Woodland
<i>Helichrysum rogersianum</i> Nunniong Everlasting	r	Heathy Woodland
<i>Prasophyllum frenchii</i> Slaty Leek-orchid	r	Heathy Woodland (P)
<i>Prasophyllum patens</i> Broad-lip Leek-orchid	r	Heathy Woodland (P)
<i>Thelymitra mucida</i> Hoary Sun-orchid	v	
<i>Eucalyptus yarraensis</i> Yarra Gum	Rr	Grassy Woodland
<i>Blechnum</i> sp. (King Island) King Island Water-fern	r	Riparian Damp & Sclerophyll Forest
<i>Callitriche brachycarpa</i> Short Water Starwort	P ^(c) r	Wet habitats & Riparian Scrub (P)

Species	Conservation Status^(a)	Floristic Community
<i>Calorophus elongatus</i> Long Rope-rush	v	Riparian Scrub
<i>Deyeuxia decipiens</i> Devious Bent-grass	v	specific habitat unknown
<i>Euphrasia collina</i> ssp. <i>muelleri</i> Purple Eyebright	e ^(b)	specific habitat unknown

Table 8 Rare or threatened plant species which can be found within the State forest Production Zone

Species	Conservation Status^(a)	Floristic Community
<i>Epilobium pallidiflorum</i> Showy Willow-herb	depl.	Wet Sclerophyll Forest
<i>Eucalyptus brookeriana</i> Brooker's Gum	r	Wet Sclerophyll Forest (P)
<i>Isolepis wakefieldiana</i> Tufted Club-sedge	r	Wet Sclerophyll Forest
<i>Zieria</i> sp. (Grampians) Zieria	r	We Sclerophyll Forest
<i>Leptorhynchos gatesii</i> Wrinkled Buttons	Vv	Foothill Forest (P)
<i>Pratia</i> sp. aff. <i>purpurascens</i> Showy Pratia	r	Wet habitats (P)

Key to Tables 7 and 8

(a) Conservation status is designated on a National and State basis as follows:	
R -- rare (National)	r -- rare (State)
V -- vulnerable (National)	v -- vulnerable (State)
P -- Poorly Known (National)	
depl. -- Depleted	
(b) Possibly extinct	
(c) Possibly threatened	
(P) indicates species also occurs in parks and/or reserves	

Actions

- Develop and maintain a flora database using the GIS giving the location of species of National, State and Regional significance *High Priority*
- Train all regional field staff in the identification, occurrence and ecology of species of National and State significance *Medium Priority*
- Promote research into the ecology, and particularly the reproductive biology, of significant plant species to determine the most appropriate management for their protection*High Priority*
- Manage flora listed under Schedule 2 of the *Flora and Fauna Guarantee Act* 1988 in accordance with approved Action Statements and Flora and Fauna Management Plans *Medium Priority*
- Investigate all known VROT occurrences, including sites of significance *Low Priority*
- Incorporate VROT occurrences into the Conservation Zone, as appropriate*High Priority*
- Manage occurrences of VROTS outside the Conservation Zone in consultation with departmental botanists *High Priority*
- Monitor known populations of vulnerable species occurring on sites within the Production Zone prior to and following forest operations which may affect them*Medium Priority*
- Develop (but not publicise) a location map for all VROTS *Low Priority*

***Leptorhynchos gatesii* (Wrinkled Buttons)**

This species is a fire dependent coloniser that, after not being detected in the region for many years, was found at a large number of sites after the 1983 Ash Wednesday fires. It is now much less conspicuous, with lower numbers occurring on fewer sites. The species has a conservation status of vulnerable at both the National and Victorian level (Vv).

Actions

- Monitor all sites where *L. gatesii* has been recorded, especially those harvested or burnt by wildfire, to determine the conditions required to stimulate the germination of soil-stored seed and regeneration of this species *Medium Priority*

- Develop special management prescriptions for areas where *L. gatesii* has been recorded in accordance with the conditions required to stimulate the germination of soil-stored seed and regeneration of this species*Low Priority*

***Eucalyptus brookeriana* (Brooker's Gum)**

Brooker's Gum, previously thought to be a form of Swamp Gum (*E. ovata*), was recognised as a new eucalypt species in 1979. It occurs principally in Tasmania but also in the Otways, near Daylesford, and in some areas east of Melbourne. It is reasonably common in suitable habitats across the eastern Otways and is well represented in both the Otway National Park and Angahook--Lorne State Park, by both pure stands and as a component of mixed forests. It is also represented on private forested land and as remnants in both the eastern and western Otways.

Actions

- Survey known and likely occurrences of *E. brookeriana*, especially in Angahook--Lorne State Park and Otway National Park, to determine the full distribution of this species in the Otways, and use this information as the basis for determining the need for, and possible location of, special flora reserves for this species *Medium Priority*
- Where possible, reseed or replant all logging coupes that contained *E. brookeriana* with seed collected from the coupe to ensure re-establishment of this species on the site in a similar proportion to that found prior to harvesting as shown on the coupe plan *High Priority*

***Grevillea infecunda* (Anglesea Grevillea)**

This species, previously known as a form of *G. aquifolium*, was known to occur in the Sandringham--Brighton area but is now only found in the heathy woodlands to the north and northwest of Anglesea. It grows on sandy soils overlying coarse gravels or clays which are prone to waterlogging in winter and excessive drying out in summer.

The species spreads by suckering to form dense low colonies and is believed by some to never set seed due to infertile pollen. Its ability to strike easily from stem and root cuttings and coppice freely in harsh sites would appear to secure its survival, as long as known sites are not cleared for agriculture or mined.

Firewood production operations carried out through summer and fuel reduction burns carried out in autumn should not have any adverse effect on known populations.

Actions

- Undertake surveys to determine the full distribution of this species in the Otways and use this information as the basis for determining suitable locations of special flora reserves for this species*Low Priority*
- Permit limited minor forest produce operations in areas within the production zone where this species occurs, provided a majority of existing plants are shown not to be adversely affected and there is clear evidence of adequate regeneration *Medium Priority*
- Monitor all known occurrences of this species and encourage research into its ecology *Medium Priority*
- Ensure hygiene measures outlined in Section 8.4 are undertaken to minimise the spread of diseases such as *Phytophthora cinnamomi* *High Priority*

Epilobium pallidifolium (Showy Willow-herb)

Isolepis wakefieldiana (Tufted Club-sedge)

Zieria sp. (Grampians) (Zieria)

Pratia sp. aff. purpurascens (Showy Pratia) , and

Thelymitra epipactoides (Metallic Sun Orchid)

Little is known of the habitats, abundance and occurrence of these VROTS. Further surveys and monitoring are required.

Actions

- Monitor all known occurrences of these species and encourage research into their ecology and distribution*Medium Priority*

6.2.4 - Regionally Significant Sites

Many of the regionally significant species and sites identified by Beaglehole (1980) within State forest fall into the Heath/Heathy Woodland Conservation Zone. However, there is one block of foothill forest adjoining the Alcoa lease area east of Danger Lane which contains a relatively high percentage of species not represented in existing reserves. This block (Beaglehole's sub-block 47e) is in an area subject to very heavy demand for firewood. Other sites considered to be of regional floristic significance occur on Paddy Swamp Road, where a good example of *Eucalyptus yarraensis* (Yarra Gum) is found, and on Westwoods Road, where isolated stands of *Allocasuarina littoralis* (Black She-Oak) occur.

Action

- Manage the regionally significant Danger Lane, Paddy Swamp Road and Westwoods Road sites for flora conservation purposes and exclude harvesting, intensive fuel reduction burning and extractive material operations *High Priority*

6.3 - Native fauna

Forest wildlife management is primarily concerned with maintaining species richness, viable populations of all species, and intact communities of fauna in all forest types. The long-term conservation of all species and the sustained abundance of individual species is best achieved firstly by ensuring the presence of a range of suitable habitat conditions which will benefit all fauna groups (see Section 6.1) and secondly by ensuring the presence of particular habitat requirements of featured species, especially all sensitive forest-dependent species and any rare, threatened or endangered species.

Objectives

Conserve the long-term richness of native wildlife and habitats.

Maintain viable populations of all forest species.

- Maintain intact assemblages or communities of fauna in all forest.
- Provide viable and particular habitat requirements for featured wildlife.
- Control problem native wildlife that cause unacceptable environmental or economic damage, using the most humane methods possible and with minimum effect on non-target species.
- Control pest animals and plants which adversely affect native wildlife and habitats.

In considering management strategies it must be remembered that forest habitats and their associated wildlife populations are dynamic. Changes in vegetation structure or floristics, whether natural or artificial, will produce changes in the number of species of wildlife and their respective populations.

In State forest, almost any management operation, but particularly harvesting and regeneration, will influence the presence and abundance of most species. In multiple-use forest management, that influence can be effectively directed towards meeting wildlife management objectives--not necessarily on an individual coupe basis, but certainly across the entire Forest Management Area. Wildlife management strategies are generally directed towards mammals, birds, fish and, to a lesser extent,

reptiles and amphibians. The current lack of information on most invertebrate fauna limits the extent to which their habitat requirements can be defined.

6.3.1 - Species Richness

The long-term maintenance of species richness entails sustaining levels of faunal diversity and species abundance. Faunal diversity is closely related to forest diversity (Section 6.1) and, again, management should give emphasis to regional species diversity which covers all species, including sensitive forest-dependent species.

6.3.2 - Regional System of Retained Habitat

It is desirable to maintain a full range of age classes for fauna conservation. The value can be enhanced if the distribution is designed to include viable units of particular age classes, especially old growth forest.

National and State Parks and Flora and Fauna Reserves within the Otway FMA have been set aside primarily for their nature conservation values. Within State forests, areas reserved specifically for the protection of values other than timber, such as flora conservation, water quality and geological features, also provide habitat for some wildlife species. With the benefit of continuing research, areas reserved for conservation purposes can be effectively built into this system. It is established as a dynamic system which may be moved over time to ensure habitat values are maximised and flexible enough to accommodate changes in wildlife management thinking. Such a system will aid those species known to be sensitive to timber harvesting activities. A feature of the system is the linking of legislated reserves and rainforest conservation areas, including continuous links from the coast to the top of the main ridge in many areas but particularly via Otway National Park, Redwater Flora Reserve, a 200 m wildlife corridor, the Aire River Native Fish Stream Reserve and Youngs Creek Rainforest Conservation Area.

Action

Incorporate into the Conservation Zone a regional system of retained habitat which includes the following:

- significant habitats and habitat trees;
- wildlife habitat corridors;
- steep and other areas unsuitable for timber harvesting;
- streamside reserves; and

- areas reserved primarily for other values *High Priority*

Two habitat types considered to be significant because of the diversity of fauna they support and their importance to less common fauna are the old growth forests and the heath (Wet Heath and Heathy Woodland) communities.

Heath Communities

Heath communities have significant habitat values. Rare or restricted species such as the Ground Parrot (*Pezoporus wallicus*) and vulnerable species such as the New Holland Mouse (*Pseudomys noveahollande*) occur mainly in these communities. Actions to protect these values are specified in Section 6.1.2.

Old Growth Forest

The term 'old growth' has gained widespread usage in recent years even though a precise definition as it applies to Victorian forests is yet to be satisfactorily constructed. Many people associate the term with pristine or aesthetic qualities of forests largely unmodified since European settlement. The Otway forests have been extensively disturbed during this period by partial clearing or selective logging with little or no regeneration. The only forest areas remaining in the Otways which are virtually undisturbed are contained within the Olangolah Flora and Fauna Reserve (1490 ha) and the West Barham Big Trees Flora Reserve (220 ha).

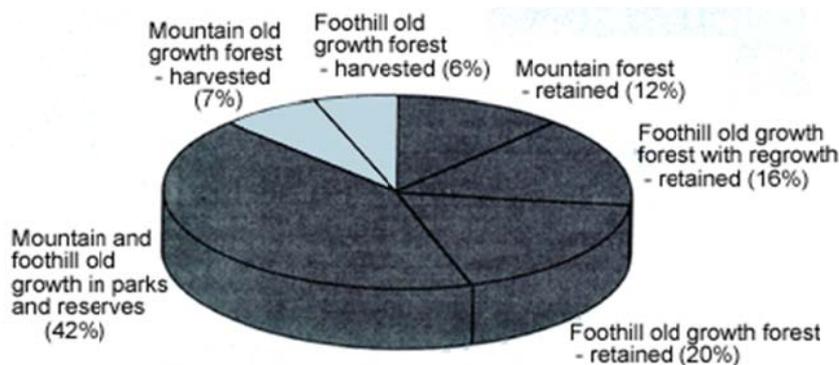
For the purposes of this document, 'old growth forest' refers to forests in the Otways that contain eucalypt trees that are pre 1890 in origin. Large and extensive areas in the Otways carry stands which contain 'old' eucalypts (aged 150 years or more), which provide valuable resources essential to a range of forest-dependent fauna. Even previously disturbed 'old growth' forest can have high wildlife habitat values which must be recognised and considered in management.

The nature of old growth forest can vary greatly across forest types and floristic communities. Its value to wildlife derives largely from its high structural diversity, manifest in the presence of multiple eucalypt age-classes or stratum levels; the presence of large living trees, large stags, and large logs; and often the presence of large inter-canopy gaps. Associated with this structural diversity and the age of 'old' trees is high availability of nest and den sites and foraging substrates that make the habitat critical for a distinct group of forest vertebrate species dependent on such resources. These include the Yellow-bellied Glider, several forest bat species, large owls and cockatoos, certain insectivorous birds, lizards that depend on large logs and stags for nesting, basking and foraging and frogs that depend on the damp conditions in and under large logs. The conservation of these specialised fauna species of old growth forest requires sensitive management of their habitat.

Figure 6

Otway Old Growth Forest Management. This chart shows the proposed maximum harvests of 'old

growth' areas in the Otway FMA. Long term forest age composition is given in Figure 4. Total area of Old Growth Forest (height greater than 28 m) = 63 220 ha



At present, forest stands classed as old growth (with a mature stand height of more than 28 m) cover 40% (63 220 ha of 156 590 ha) of public forested land within the FMA. Of this area, 57% (36 350 ha out of 63 220 ha) is in parks and reserves or the Conservation Zone.

Under this plan's 100-year strategy, only 7% of existing mountain 'old growth' forest and 6% of foothill old growth forest across the FMA (including parks and reserves) will be harvested. The retention of old growth trees within these stands will provide habitat within the regenerated stand.

The plan proposes to harvest 150 ha/yr for 30 years of mountain old growth forest.

These areas will be a mix of high and low sawlog yielding sites and will be harvested as sawlog-driven operations only.

The planned 30 year program of mountain old growth logging and regeneration will total no more than 4500 ha. This represents about 37% of all available mountain old growth stands. Figure 4 (page 25) shows the long term effects of this on forest age composition.

These percentages are calculated using only approximate estimates of the extent of old growth forest within the parks and reserves system. Detailed age-class mapping of all parks and reserves should be undertaken to at least the same standard as the State forest areas.

Furthermore, fauna survey data for this forest type in the Otways is very limited. A systematic survey identifying fauna values across all age classes and particularly within areas of old growth should be undertaken to improve the basis of management for specialist forest dependent species.

The fauna values of old growth forests require interim protection measures until the systematic fauna survey is completed.

Actions

- Limit mountain 'old growth' forest harvesting to a maximum of 150 ha/yr High Priority
- Manage forest age classes in accordance with Figure 4 (page 25) to ensure adequate areas of old growth forest are retained High Priority
- Survey the extent and distribution of structural types and age classes within parks and reserves to complement existing State forest information Medium Priority
- Conduct fauna surveys of major forest types and age classes (particularly old growth) across all public forested land within the Otway FMA to identify areas of high conservation value High Priority
- Conduct Regional assessments of proposed old growth coupes to identify any significant fauna values as an integral part of the Wood Utilisation Plan approval process Medium Priority
- Schedule harvesting of old growth forest to ensure that a range of high and low yielding sawlog stands are utilised Medium Priority

Wildlife Habitat Corridors

Wildlife habitat corridors form an integral part of the regional system of retained habitat. Although the way in which animals, particularly sensitive forest-dependent species, use habitat corridors requires further research, studies indicate that a network linking larger reserves increases the effectiveness and viability of the reserve system by providing an increased foraging area for wide-ranging species such as owls and the Tiger Quoll, and alternative refuge from disturbances such as wildfire.

The proposed primary habitat corridor network within State forest is shown in Map 11. Rather than being seen as a 'route for movement' between larger reserves, habitat corridors will provide habitat for resident populations in their own right and act as a source for recolonisation of adjacent regenerated areas. The system may also enhance the development of a gene pool, allowing gradual gene flow and preventing genetic isolation (Harris 1984, Noss 1987).

The system generally follows rivers and streams where possible. Gully vegetation is preferred for the basis of a linear reserve system because a number of native forest dependent species are usually associated with the larger trees found in gullies (Loyn 1985, Recher *et al.* 1987, Henry *et al.* 1988). Ridgetop and mid-slope corridors are also provided to cater for the wildlife species that prefer this habitat and to cater for movement in these zones (CFL 1988a).

The minimum width of 200 m is considered to be a suitable primary corridor width for one of the most sensitive mature forest inhabitants, *Petaurus australis* (Yellow-bellied Glider) (Recher *et al.* 1987). The habitat corridors shown in Map 11 total 170 km in length and cover 3400 ha. The network crosses each land management unit and includes substantial areas of each major floristic community.

A secondary corridor network will be developed and integrated with coupe plans. The total network will maximise continuity of habitat and will be flexible so as to accommodate new information and thinking on wildlife management.

Actions

- Establish and incorporate into the Conservation Zone a primary network of 200 m wide wildlife habitat corridors linking existing reserves High Priority
- Establish a network of secondary (40-100 m wide) wildlife habitat corridors based on the existing streamside reserve network and other elements of the regional system of retained habitat as individual coupe plans are developed High Priority

Habitat Trees

Habitat trees are retained to provide food and shelter to wildlife. The most valuable habitat trees are generally live, hollow-bearing eucalypts growing on highly productive sites. In terms of hollow formation or nectar production, some eucalypts are more valuable than others. For example, most gum barked species form hollows more readily than many stringybarks; peppermints often offer more favourable foraging substrates than other species. However, efforts should be made to retain a natural mix of species on coupes. Dead trees (stags) and large logs also provide valuable resources (hollows and foraging substrates for birds and reptiles) and should be retained where safety considerations permit.

Recent work by Lindenmayer (1989) in the montane ash forests of the Victorian Central Highlands, which is broadly applicable to the Otways, suggests that a minimum of five and preferably up to ten habitat trees per hectare of logged forest should be retained. Many fire origin regrowth stands in the Otways, particularly those on ridge tops and upper slopes, are entirely even-aged and do not yet support hollow-bearing trees. In such cases, some young regrowth trees should be retained to ensure a future supply of potential nest trees. These trees would supplement any existing hollow-bearing trees within the coupe or adjoining streamside reserves. Trees should be retained in clusters in order to reduce losses through exposure after completion of timber harvesting operations. These clusters should be in a regular configuration, with no more than 200 m between areas of retained habitat. Extensive areas of regrowth greater than this may not be readily recolonised by some forest-dependent fauna that may not travel further than 200 m from retained habitat to forage. Lindenmayer *et al.* (1990) also advocates the practice, already in common use in the Otways, of mechanical disturbance in preference to broadscale high intensity burning as a means of site preparation for regeneration. Where high intensity burning is used, habitat trees should be protected by clearing around their base if necessary or by retaining trees mainly along coupe edges. Existing and potential habitat trees should be large enough to survive exposure following logging (i.e. generally greater than

50 cm DBHOB).

Action

- Retain a minimum of five habitat trees per hectare net logged, preferably in regularly configured clusters or on the edges of coupes to ensure a minimum retention of 100 existing and potential hollow-bearing trees per 10 ha of area logged High Priority
- Minimise fire damage to retained habitat trees by mechanically removing logging debris or retaining trees in areas which would be subject to a low fire intensity High Priority
- Design coupe boundaries and habitat tree clusters such that there is no more than 200 m between areas of retained habitat High Priority

Steep and Unsuitable Timber Areas

Steep slopes and areas carrying trees that are unmerchantable or uneconomic for logging provide supplementary habitat for wildlife conservation. Although steep slopes may not carry the densities of large hollow-bearing trees required by many species, they can complement other habitats. The very characteristics of certain areas of mountain and foothill forests that make them unsuitable for sawlog harvesting, such as poor form and developed hollows, may make them attractive to wildlife.

Action

- Incorporate steep slopes and areas unsuitable for logging into the regional system of retained habitat High Priority

Streamside Reserves

Streamside reserves retained for water quality protection serve the additional purpose of providing food and refuge for forest-dependent wildlife and aquatic species. Section 6.3.6 describes important native fish streams with additionally wide reserves. Standard streamside reserves are generally too narrow to provide habitat for sensitive and specialised forest wildlife. Nevertheless, their usefulness can be enhanced by the provision of a continuous canopy of eucalypts adjacent to riparian habitat. The continuous eucalypt cover provides structural diversity which enhance habitat values for forest wildlife.

Action

- Increase streamside reserves where practical to maintain a continuous canopy of eucalypt tree cover Medium Priority

6.3.3 - Road Clearings (see also Section 11)

Wide road clearings help dry unsealed roads which are easily damaged when wet. However, even narrow road clearings may isolate small mammal, reptile, amphibian and small bird populations. Roads may also be dispersal corridors for introduced predators, such as Cats, Dogs, and foxes, and may increase the potential for human disturbance (ABRG 1984). Canopy closure across roads is desirable for arboreal mammals and, where possible, sections of road with minimum clearing widths should be incorporated into the regional system of retained habitat. All roads and tracks within the Hardwood and Softwood permanent road network are Class II or Class III roads, and temporary roads are generally Class IV (see Section 11.1). Departmental road standards are consistent with the Code of Forest Practices and adopted from Road Construction Authority's Road Design Manual (1985).

Action

- Restrict road clearing to maximum widths of 30, 24 and 13 m for Class II, III and IV roads respectively High Priority

6.3.4 - Featured Mammal and Bird Species

Featured species are those regarded as being significant due to their known low number or restricted habitats, or species sensitive to timber harvesting activities due to their dependence on resources that become limited after timber harvesting activities (e.g. tree hollows required for nesting, suitable foraging substrates). The 10 mammal, 15 bird and one reptile featured species within the Otway forests are described in the Statement of Resources, Uses and Values and classified according to Ahern (1986). Other species have been included in a list by Baker-Gabb (1990).

Five of these species--New Holland Mouse (*Pseudomys novaehollandiae*), Swamp Antechinus (*Antechinus minimus*), Broad-toothed Rat (*Mastacomys fuscus*), Ground Parrot (*Pezoporus wallicus*) and Swamp Skink (*Egernia coventryi*)--are generally restricted to habitats that are not affected by timber harvesting. These habitats are coastal and inland heaths and the dense, sedgy undergrowth of riparian scrub communities (usually associated with streamside reserves) which are included in the Conservation Zone. The Broad-toothed Rat is also found in Grassy forest. (John Seebeck pers. comm.) The inclusion of 26% of this community in the State forest Conservation Zone will enhance the preservation of Broad-toothed Rat habitat.

The Common Bent-wing Bat (*Miniopterus schreibersii*), which requires caves for maternity colonies and winter hibernation, is also unlikely to be affected by timber harvesting. The habitats of these particular species may, however, be affected by other activities such as fuel reduction burning, grazing, and recreational activities. The effect of these activities on these sensitive species should be

identified and reduced where possible.

Other significant or sensitive species are restricted to the mature mountain and foothill forests which may be subject to timber harvesting. These species are of particular concern because their habitats can be drastically altered and fragmented and resources depleted if their requirements are not considered in forest planning.

Unfortunately, the precise habitat requirements of many such sensitive species are still unknown. The areas with least available faunal information within the forest are the western end at the Otway Ranges, the northern foothills and remnant vegetation on the coastal plains (Bennett in press). Current research is addressing some of the requirements and future research needs have been identified. The survival of many featured species appears to be best served by implementation of general wildlife conservation measures such as the establishment of the 'regional system of retained habitat', control of weeds and introduced predators, control of fire and judicious use in fire management, control of visitor activities and care with other management practices.

Action plans will be produced for each rare or threatened species listed under the Flora and Fauna Guarantee. Some specific measures to conserve featured species are given below.

Tiger Quoll (*Dasyurus maculatus*) R/R

This rare and/or restricted (R/R) species is known to range widely. The mountain and foothill forests of the Otways are regarded as a stronghold. However, the populations are of low density with few known sites of occurrence. Lack of information makes management difficult. The linking of legislated reserves and implementation of the regional system of retained habitat should help conserve this species.

Action

- Exclude harvesting and burning operations from known denning and latrine sites *High Priority*
- Conduct fuel reduction burning in the vicinity of known sites of occurrence in autumn rather than spring when young are not mobile. (Incorporate into Regional Fire Protection Plan) *High Priority*
- Avoid the use of persistent poisons or chemicals to kill problem wildlife in areas where the Tiger Quoll is known to exist *High Priority*
- Encourage surveys on distribution and specific habitat requirements *Medium Priority*

Yellow-bellied Glider (*Petaurus australis*) Mon

The Yellow-bellied Glider appears to have a large home range and is dependent on mature, tall

eucalypt forest. Its presence is often indicated by the characteristic 'V notch' markings it makes on the trunks of trees upon which it feeds. The species has a conservation status of requiring careful monitoring (Mon). Work by Loyn & MacFarlane (1985) suggests that in the Otway Ranges the species particularly favours Blue Gum (*Eucalyptus globulus*) forest, which, within the Otway FMA, is largely reserved within the Otway National Park and Lorne--Angahook State Park. The retention of mature forest linked to the regional system of retained habitat and minimising habitat fragmentation should help conserve this species.

Actions

- Retain known nest trees and 'V-notch' feed-trees on individual logging coupes High Priority

Koala (*Phascolarctos cinereus*) Mon

Action

- Continue the current program of reintroduction to the northern foothill forests as determined by the Draft Koala Management Plan Low Priority

Smoky Mouse (*Pseudomys fumeus*) R/R

The Smoky Mouse probably occurs in more vegetation types than originally documented in the Statement of Resources, Uses and Values (J. Seebeck pers. comm.)

Action

- Encourage research to determine its range in the Otways, habitat requirements and suitable habitat management practices High Priority

Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) Ind; and Great Pipistrelle (*Falsistrellus tasmaniensis*) Mon

Little is known of these species' ecological requirements, though both species roost in tree hollows and prey over large territories. The retention of habitat trees and the provision of continuous foraging areas of mature eucalypt forest within the regional system of retained habitat are considered to be appropriate conservation measures for these and other bats.

Other mammal species known to be sensitive to intensive timber harvesting

Besides the above species, there are other mammals dependent on hollows within mature forest for nesting and roosting. These are: Common Brushtail Possum (*Trichosurus vulpecula*), Sugar Glider (*Petaurus breviceps*), Feathertail Glider (*Acrobates pygmaeus*), and most forest bats. The ecology of forest bats is an area requiring research to answer questions regarding their habitat requirements. Also the conservation requirements of bandicoots and potoroos require special consideration. Such

research is currently being undertaken at the Arthur Rylah Institute. In the meantime it is anticipated that the regional system of retained habitat to be developed for the Otway FMA will help to provide habitat for these sensitive species.

Ground Parrot (*Pezoporus wallicus*) R/R; and Blue-winged Parrot (*Neophema chrysostoma*) Rd/h

The Ground Parrot has a rare and/or restricted (R/R) conservation status and the Blue-winged Parrot has a restricted distribution or habitat (Rd/h) (Ahern *et al.* 1985). Reservation and inclusion of heathy habitats in the Conservation Zone should assist in the conservation of these species. However, the Ground Parrot, which has specialised requirements, is also dependent on particular fire regimes to maintain suitable habitat. Meredith (1984) has developed habitat burning prescriptions for the Carlisle heathlands comprising areas of State forest, Carlisle State Park and Crinoline Creek Flora and Fauna Reserve. This involves burning 12.5% (about 200 ha) of the total area of suitable habitat every two years.

Actions

- Prepare a Ground Parrot Management Plan including details on heath distribution, years since last fire, areas to be burnt, and frequency of burning. (Incorporate into Regional Fire Protection Plan)*Low Priority*
- Protect critical heath habitat (aged 3 to 7 years) against fire by use of slashed breaks (where appropriate) *High Priority*
- Revise heath age structure map each year on the basis of new areas burnt and refine areas to be burnt and protected on this basis *Medium Priority*
- Manage visitor use of Ground Parrot habitat by appropriate location of visitor tracks, camping sites, and closing or relocating roads *Low Priority*

Rufous Bristlebird (*Dasyornis broadbenti*) R/R; Beautiful Firetail (*Emblema bella*) Rd/h; and Pink Robin (*Petroica rodinogaster*) Rd/h

These three species inhabit areas of thick undergrowth; common in wet gullies, riparian zones, rainforest areas and heath communities within the Conservation Zone.

Masked Owl (*Tyto novahollandiae*) R/R; and Powerful Owl (*Ninox strenua*) Rd/h

Both these owls require large hollows within dense forest for nesting. The regional system of retained habitat should provide additional areas suitable for nesting and foraging which it is hoped will assist in maintaining viable populations. However, further research is required.

Action

- Encourage further research into the requirements and distribution of large owls High Priority

Peregrine Falcon (*Falco peregrinus*) Mon; Grey Goshawk (*Accipiter novaebollandiae*) Rd/h; and Australian Hobby (*Falco longipennis*) Rd/h

Action

- Exclude management activities within 100 m of all known raptor nests High Priority

Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus*) Rd/h; Gang-gang Cockatoo (*Callocephalon fimbriatum*) Rd/h; and Australian King Parrot (*Alisterus scapularis*) Rd/h

The reservation of hollow-bearing habitat trees, suitable streamside reserves and linear reserves in the regional system of retained habitat and the maintenance of a suitable forest age class distribution should ensure the survival of these species within the Production Zone.

6.3.5 - Reptiles and Amphibians

Twenty reptile and ten amphibian species have been recorded in the Otway forests. Reptiles are a faunal group which has received little attention and further knowledge is required (Bennett 1990). Unlike the mammal and bird fauna of the Otways, the reptile and amphibian species are similar to those found in the Eastern Victorian Uplands. The only species occurring in the Otway FMA that has a conservation status is the Swamp Skink (*Egernia coventryi*). This species is regarded as restricted or rare or both in Victoria.

Action

- Encourage further research into the ecology of reptiles and amphibians, particularly the Swamp Skink, occurring within forested areas in the Otway FMA Medium Priority

6.3.6 - Native fish

Conservation of native (and recreational) fish species depends on the adequate protection of fish habitat. Fish species occurring within the Otway FMA occupy a variety of stream habitats but all share the common requirements of:

- an adequate supply of clean, well oxygenated water;
- sections of streams with clean gravel substrates;

- water temperature variations within biological tolerance limits; and
- adequate streamside vegetation.

Minimum environmental flows have been estimated for the Gellibrand, Barwon and Aire Rivers, primarily to assist in the regulation of major diversions (Tunbridge 1988). Forest harvesting is not considered to be a limiting factor (see Section 6.5).

Management of road construction in forest areas is of major importance for its potential effect on fish populations. The most potentially damaging factors are siltation, loss or damage to streamside vegetation, pollution and physical barriers. In forest areas, these causes of stream degradation are generally addressed in the Code of Forest Practices and more specifically in the Land Degradation (Section 6.4) and Roding (Section 11) sections of this plan.

However, the conservation of streams containing vulnerable species or a significant population of threatened native species (Category 1 Streams) warrants additional streamside protection measures primarily to ensure the adequate abundance and diversity of terrestrial and aquatic invertebrates and minimum water temperature variations. Streams classified as Category 1 (Smith 1990) are:

Aire River	Grassy Creek (P)	Barham River
Kennett River (P)	Carisbrook Creek	Parker River (P)
Carlisle River	Skenes Creek	Cumberland River (P)
Wild Dog Creek	Erskine River (P)	Wye River (P)
Gellibrand River		
(P) indicates that part of the catchment is in a park or reserve		

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