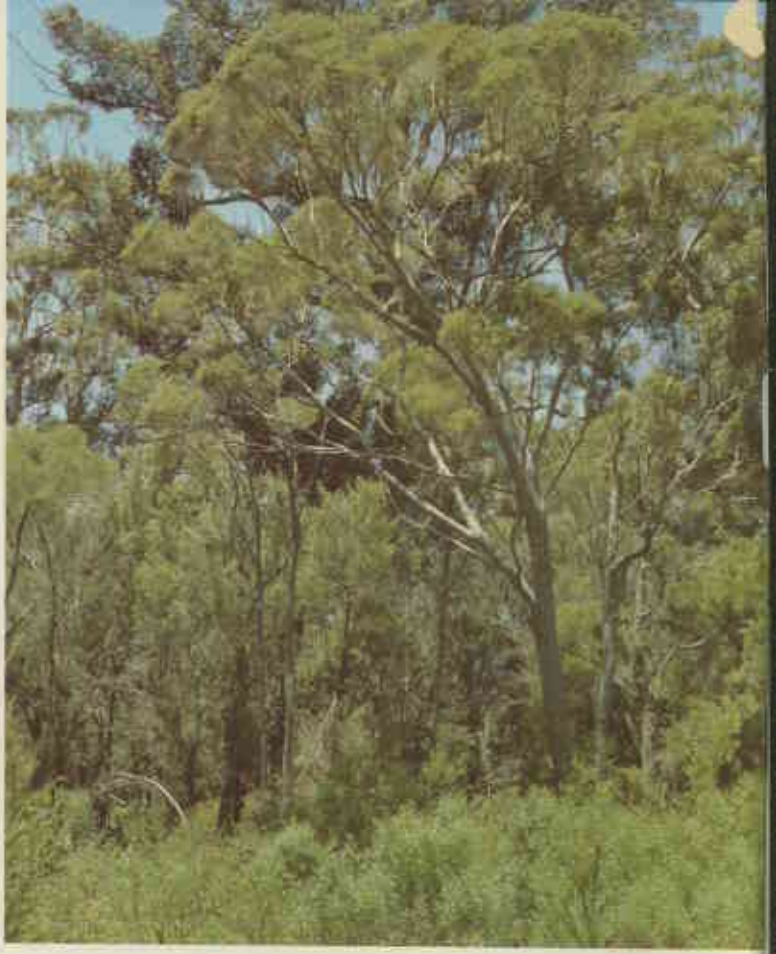
18.

FOREST FOCUS NUMBER 18 AUGUST 1977

SOUTHERN RECREATION AND CONSERVATION MANAGEMENT PRIORITY AREAS

▲▼ *Christmas tree and flower in Soho.*

▼ *Paperbark on the flats, Soho.*



▲ Agonis juniperina *near the Chesapeake Road bridge, Lower Shannon.*

▲▼ *Red flowered gum, Soho.*

FOREST FOCUS

Number 18, August 1977

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Due to pressure of other work there has been a fifteen-month delay in the publication of *Forest Focus.*

New Minister Appointed

Following the last State election and a reallocation of portfolios, the Hon. Margaret June Craig was elevated to Cabinet as Minister for Forests and Lands.

Mrs. Craig was elected Member of the Legislative Assembly seat of Wellington in 1974 and re-elected in 1977. She is only the second woman Minister in the history of the W.A. Parliament. The State's first woman Minister resigned twenty-five years ago.

Mrs. Craig has always maintained an active interest in community involvement, which has included school, church and sporting activities, and the initiation of a community service bureau in Bunbury.

FOCUS on SOUTHERN RECREATION AND CONSERVATION MANAGEMENT PRIORITY AREAS

by B. J. White

The further people become enmeshed in the urban conglomeration, the more they seem to long for the magic and peace of forest landscapes. What they once took for granted they now value highly, and are becoming more and more concerned that its continued existence be secured. However, the recreation and conservation values of forests are but two of many. Others of importance include water supply and wood production.

When more than one activity or value is catered for at the same time in one forest area, it is called "multiple use" forestry. In many cases these various uses do not conflict to the extent that a number cannot be carried on simultaneously. Where uses do conflict—such as exotic plantations and the conservation of native flora—one must be given priority. Where conflict does occur it may be partial or total, and the degree to which other uses can be permitted depends upon the degree of conflict of any particular use with the given priority.

In practice an area of forest is evaluated and "zoned". Each zone has characteristics suitable for particular purposes and is allocated these priority uses.

Multiple use is the policy of the Forests Department of Western Australia and the detail of how it will be implemented is given in Working Plan No. 86 of 1977. When an area is allocated a specific priority use, it is called a Management Priority Area or M.P.A.

This issue of *Forest Focus* describes how M.P.A.s for conservation and recreation were identified and selected in the southern forests of Western Australia.

DESCRIPTION OF AREA

Geomorphology

Five broad geomorphological regions can be recognised in the area under consideration (Figure 1).

1. The Swan Coastal Plain
2. The Donnybrook Sunkland
3. The Leeuwin-Naturaliste horst
4. The southern tableland
5. The southern coastal plain

Each region has its own separate characteristics, but similarities exist between some. The Swan and southern coastal plains have vegetation similarities, but important differences are the existence of tuart (*Eucalyptus gomphocephala*) in the former; and a more dramatic and spectacular coastline due to a higher degree of exposure to wind and wave and a more diverse geology, in the latter. The Leeuwin-Naturaliste horst and the southern tableland have a similar geology, but the littoral history of Leeuwin-Naturaliste horst has endowed it with a partial cover of coastal limestone not present in the southern tableland. The horizontally bedded sediments of the Sunkland give this region a generally subdued, monotonous topography, quite different from the others. The Whicher scarp, marking the boundary between the Swan Coastal Plain and the Sunkland, warrants mention because of topographical changes and interesting differences in plant species occurrence.

A greater frequency of granitic outcrops endows the lower catchments of the Deep and Frankland Rivers with a scenic grandeur not possessed elsewhere in the region.

Front cover

View from the top of Mt. Frankland, one of the granitic outcrops which endow the lower catchments of the Deep and Frankland Rivers with a scenic grandeur not possessed elsewhere in the region. (B.J. White)

Back cover

Karri surrounding a limestone rock face in the Boranup forest on the Leeuwin-Naturaliste horst.

The names Soho, Lower Shannon, O'Donnell, etc., after picture titles refer to M.P.A.s—see Table 2.

The main rivers in the area are the Blackwood, Frankland, Warren, Donnelly, Deep, Gardner, Shannon and Margaret. All are permanent streams which make a big contribution to the conservation and recreation values of the area.

Vegetation

The vegetative cover differs from region to region but certain types, in particular the jarrah (*E. marginata*) and jarrah/marri (*E. calophylla*) associations, are common to all. However differences in the ground vegetation, stand structure and vigour are discernible in this association between and within the regions.

▲ *Karri wattle* (A. pentadenia) *and*
▼ *good karri in O'Donnell.*

The most important association is the karri (*E. diversicolor*) forest community. It reaches the height of its development in the wetter parts of the southern tableland, but a substantial patch occurs on the Leeuwin-Naturaliste horst, and in the southern coastal plain. One small patch occurs on the southern rim of the Sunkland.

Vegetative associations have been recognised by Specht (1973), Smith (1973) and the Forests Department of Western Australia [Anon. (1975); Havel (1968, 1975); McNamara (1959)]. Each authority uses stand structure (height and density) and dominant species representation to isolate associations. A list of associations, abbreviated to the extent that not all structural or ground species variations are nominated, is given in Table 1 and is the basis for gauging the adequacy of flora representation of conservation areas.

Apart from plant associations there are certain species which, because of rarity of other special values, demand special recognition in conservation. These are listed also in Table 1.

FAUNA

Because native fauna populations depend ultimately on the vegetative cover for food, shelter, nesting site and general habitat, conservation of plant associations, in general, ensures conservation of fauna. Some, like kangaroos, crows or black cockatoos, appear able to adapt to and even benefit from, the changes brought about by European man. Others such as woylies and numbats, seem particularly prone to habitat change.

It is fortunate that the rarer marsupials prone to habitat change (woylie, numbat, tammar) inhabit only the drier eastern wandoo (*E. wandoo*) and jarrah woodlands where wood productivity is low, and where the impact of wood harvest has tended to be slight. These associations have suffered less from the establishment and spread of *Phytophthora cinnamomi,* the fungus which causes dieback disease. Provision has been made for their continued survival by the allocation of a substantial, area (40 000 ha) between the Perup and Tone Rivers as a fauna M.P.A. (see *Forest Focus* No. 10).

State Forest contains few areas of wetlands listed as being important. However, recognised wetland areas abutt State Forest at Ludlow, in the Lake Muir area and along the south coast. As land use adjacent to wetlands can have an effect on habitat, management of State Forest nearby must take into account wetland values.

Populations of aquatic animals and fish contribute to the value of streams for recreation and conservation. Marron, in particular, are widely fished, as are the introduced rainbow and brown trout and redfin perch.

RECREATION

From the early days when agriculture and sawmilling first opened up access into it, the karri forest region has endeared itself to those who have spent time there. Over a period of time certain places have become preferred and better known. The Warren National Park, Brockman forest, the Rainbow Trail, Fontanini's pool, Gloucester Tree, the Cascades, and the Pemberton swimming pool are some of the more familiar ones.

Equally well regarded but probably less well identified because of their extent, are the forest and farm landscapes to be seen from the Vasse and South West Highways. For the visitor, Pemberton is probably the township which fond memory retains longest.

This quality of being a place apart endows a locality with special value, though it is difficult if not impossible to put a dollar value on it. As land manager responsible ultimately to the people of Western Australia the Forests Department is aware that an important part of this value is the forest, and due consideration is given this aspect in policy and management strategy. (Forests Department Working Plan No. 86/1977)

It is important to recognise that this quality is an amalgam of many different influences. While virgin karri is important, the streams, the pastures, the orchards, the forest operations, the sawmills and townships, the lifestyles and skills of the local populace, the fishing, the access, the climate, the hotels and boarding houses, and the history are all essential parts of the whole. To neglect or eliminate any one aspect detracts from the sum total.

It was easy for the Forests Department to identify the more popular attractions in State Forest because the populace has already done so, and the essential components of their attraction are fairly obvious. Gloucester Tree provides a unique platform to view forest, farm and coastal sandhill, as well as an adventurous climbing experience, and an introduction to fire control activity. One Tree Bridge offers an interesting historical item in a beautiful forest-

▲ *Albany bottlebrush between Deep and Frankland Rivers, Mitchell.*

▲ *Blue daisy, Boranup.*

▲ Beaufortia sparsa, *O'Donnell.*

▼ *A grevillea from Whicher.*

riverside setting. The Cascades presents a spectacular length of permanent wild water and falls in a forest setting. The Four Aces displays mature karri at its magnificent best. Rainbow Trail offers the more disciplined beauty and vigour of the regrowth karri within easy reach of the township of Pemberton.

It is a simple matter to group these spots where possible and immerse them in a forest surround by giving the environs a recreation priority. By excluding normal harvest operations the setting is thus secured for years to come. Brockman, One Tree Bridge and Muirillup are examples of this approach. The retention of Pemberton's surrounding forest character is ensured by Brockman forest to the east and National Park to the west.

Noteworthy is the the fact that virgin forest is not necessary to furnish a popular forest setting. Gloucester Tree, Diamond Tree, One Tree Bridge, the Rainbow Trail and the Cascades are all located in forest which has been selectively logged or clear felled in the past.

When planning multiple use for the overall forest it was necessary to select areas of visual excellence and with amenity potential which were not as well known, and which in some cases were known only to very few. Some assumptions had to be made which were considered justifiable.

Despite evidence that people in general felt just as happy in regrowth forests, it was assumed that most people would prefer to traverse forests which were predominantly mature. All the major roads were therefore allocated a strip of forest 400 m wide on either side (total 800 m) in which wood harvest operations would be curtailed or excluded where they would conflict with their scenic value. The amenity and recreational value of the rivers and larger streams was considered obvious enough to warrant retention of similar strips 200 m wide. In fact the primary purpose for this reservation was to protect the stream and water values, but recreation conflicts little, at least until the water is needed for domestic use.

The road and stream reserves automatically secured many special features such as the Rooneys bridge picnic area, Timber week tree, the old Shannon townsite and surround, and many more favourite stopping places. All the pools, falls, rapids, billabongs and shady bends along the rivers likewise remain intact. It was assumed that streamside reservation would meet the approval of most fishermen and canoeists, as well as those who prefer to just sit and look.

Those fortunate enough to have worked in or traversed many areas of forest agree that certain places have qualities which set them apart from the rest. Such places are the lower Deep and Frankland Rivers with their wealth of granite outcrops, their dramatic vegetation changes from high forest, to low woodland, to open flat, and their abundance of vantage points from which to view the distance. The steep sides and dense luxuriant karri of the lower Donnelly River just before it disgorges into the southern coastal plain is another.

The transition from forest to coastal sandhill and swamp, to mobile dune, beach and cliff, so impressed one group of Forests Department officers that they privately submitted a proposal for some 129 km of this complex to be made National Park. Its acceptance by Cabinet, having gained the approval and support of the Institute of Foresters, the Conservator of Forests, the Conservation Through Reserves Committee and the Environmental Protection Authority, gives lifelong and profound satisfaction to those involved. Thus State Forest and National Park complement one another, and the way is open for planning and development to proceed in a rational and sensitive way.

For many years opportunities have been sought within and by the Forests Department to have tracts in localities such as these given special status. The official adoption in 1976 of the policy of multiple use, supported by amendments to the Forests Act, rather than its tacit acceptance in the past, has now made this possible. Working Plan 86 of 1977 now details how recreation and conservation values will be taken into account

Old Shannon Dam, Curtin, and below, Barrabup Pool, St. John's Brook.

Rapids Pool on the Margaret River, Rapids.

in planning and operations, and lists the areas to be given a recreation or conservation priority.

The monotonous and depauperate appearance of the Sunkland detracts from its general appeal as a recreation resource. The outstanding exception to this general statement is the magnificent stretch of permanent waterway of the Blackwood River which traverses it from east to west. Other notable exceptions are the St. Johns Brook, the pools along the Margaret River in Rapid's Block and the atypically more incised nature of the streams of the upper catchment of the Sabina River in Whicher Block. All these have received consideration in allocating recreation or conservation priority to selected areas of State Forest.

By comparison with other areas, State Forest occupies only a small proportion of the total area of the Leeuwin-Naturaliste horst. The most notable is the fine regrowth karri forest at Boranup, which is the largest area of karri growing on sands derived from coastal limestone. Following a recommendation by the Environmental Protection Authority, a National Park has been created along this coast by the amalgamation of all vacant crown land and miscellaneous reserves under the one heading. The Boranup State Forest complements National Park adjoining to the north, west and south and conservation has been given priority in its management. Its value as an important segment of the karri occurrence was considered more important than its recreation value, but in this case there is little clash between conservation and planned recreational use. Its historical significance as part of the original M. C. Davis empire late in the nineteenth century, has also been recognised.

The tuart forest at Ludlow on the Swan Coastal Plain has a high recreational value, but like the karri at Boranup its conservation value was considered higher.

CONSERVATION OF FLORA AND FAUNA

Sound scientific, practical and commercial reasons exist to keep portions of each major ecosystem free from the normal and necessary disturbances caused by European man. The degree of disturbance varies. For instance:

- Total and widespread replacement of vegetation takes place in agriculture.
- Total removal of vegetation and severe soil alteration take place in strip

mining, making vegetation replacement expensive and sometimes impossible.

- Natural forest can be replaced by exotic plantation.
- A surprisingly large area of vegetation disappears for the provision of facilities such as roads, powerlines, dams, townsites, etc.
- At the lower end of the disturbance scale are wood harvest with regeneration to natural communities, and recreational use.

Even recreational use has the potential to trigger ecological degradation:

- Off-road vehicles pose a serious soil erosion threat.
- Trampling in heavily used, and usually the most spectacular, sites causes vegetation loss.
- Stream pollution can result from fishing, camping, etc.
- Insidious damage can be caused by pathogens such as *Phytophthora cinnamomi*, often introduced in a most innocent and well intentioned way.

Recreation and the conservation of natural ecosystems are therefore not necessarily synonymous or even in harmony. Management and control are necessary.

Individual species and communities of plants and animals, including man, adapt to changing conditions by retaining and developing variation within themselves. Should, for example, the climate become drier, a community will survive if enough individuals are inherently drought resistant, even though the community may have no need to be drought resistant in present circumstances. Those with the greatest variation have the greatest chances of survival—such is the essence of the adaptive, evolutionary process.

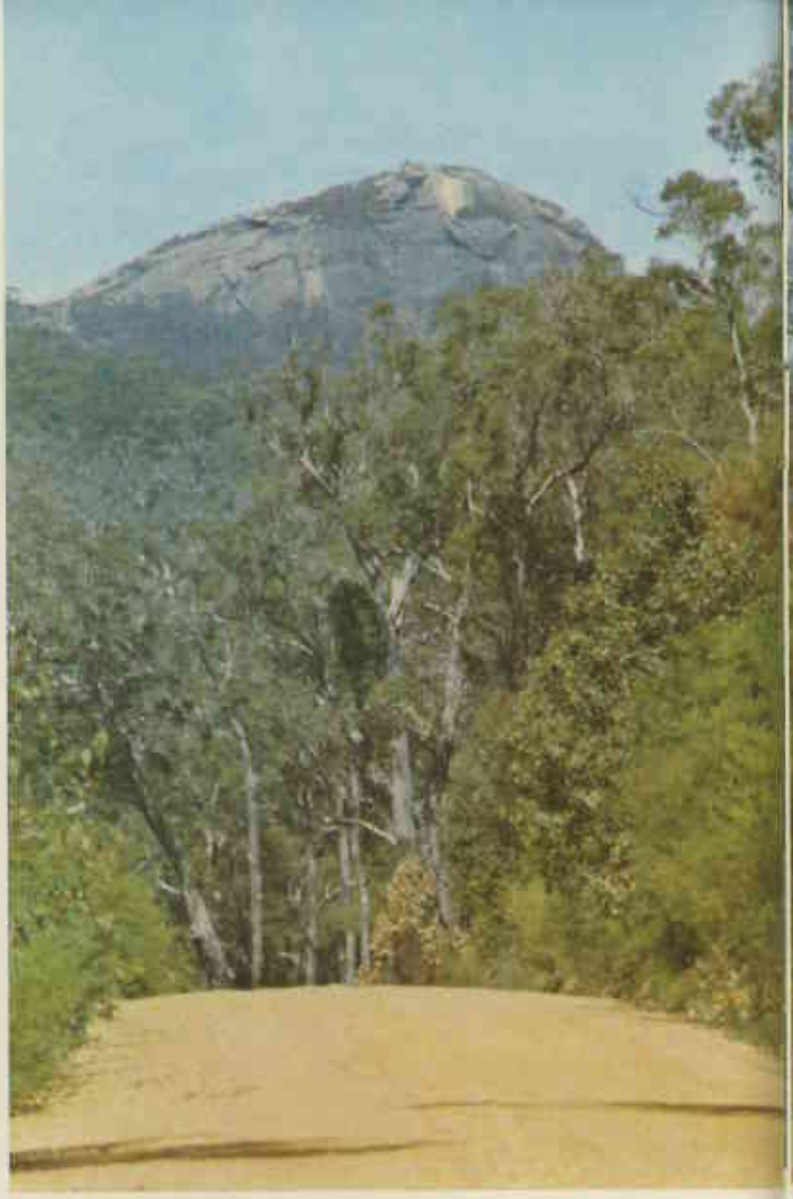
The most important scientific justification for keeping some areas apart is to retain this natural variation, and thus assist in the continued survival of its occupants.

The practical and commercial reasons for supporting this process are many. Natural communities are a resource of plants and animals which will provide for the changing needs of future generations, be they for food, fibre, drugs, chemicals, shelter or decoration. Who knows what plants or animals may provide key solutions for future problems? For existing commercial species, such as karri or radiata pine, the naturally occurring variation is most important in allowing tree breeders to develop strains which may have exceptional growth, form, or resistance to disease. Natural

Regrowth karri forest in Boranup, and below, scenic lookout on the coast, Boranup.

Typical Sunkland jarrah forest, Paget.

▲ *Good quality young karri regrowth, Hawke.*



▲ *View of the western face of Mt. Frankland, Mitchell Crossing.*

communities are necessary for the elucidation of ecological adaptations and processes. Retention of natural communities is the best and cheapest way to protect steep mountainous terrain or similar difficult sites important in the overall hydrological systems. Conservation of flora and fauna is accepted as being a major value in the multiple use of State Forest.

For the most part, State Forest is managed as a natural ecosystem, whether the priority be for water, wood, conservation or recreation. Because natural processes are used to obtain regeneration, logging on its own causes only normal seral changes in vegetation, and thus constitutes no threat to most wildlife species. The general extent of State Forest can therefore be looked upon as a conservation reserve.

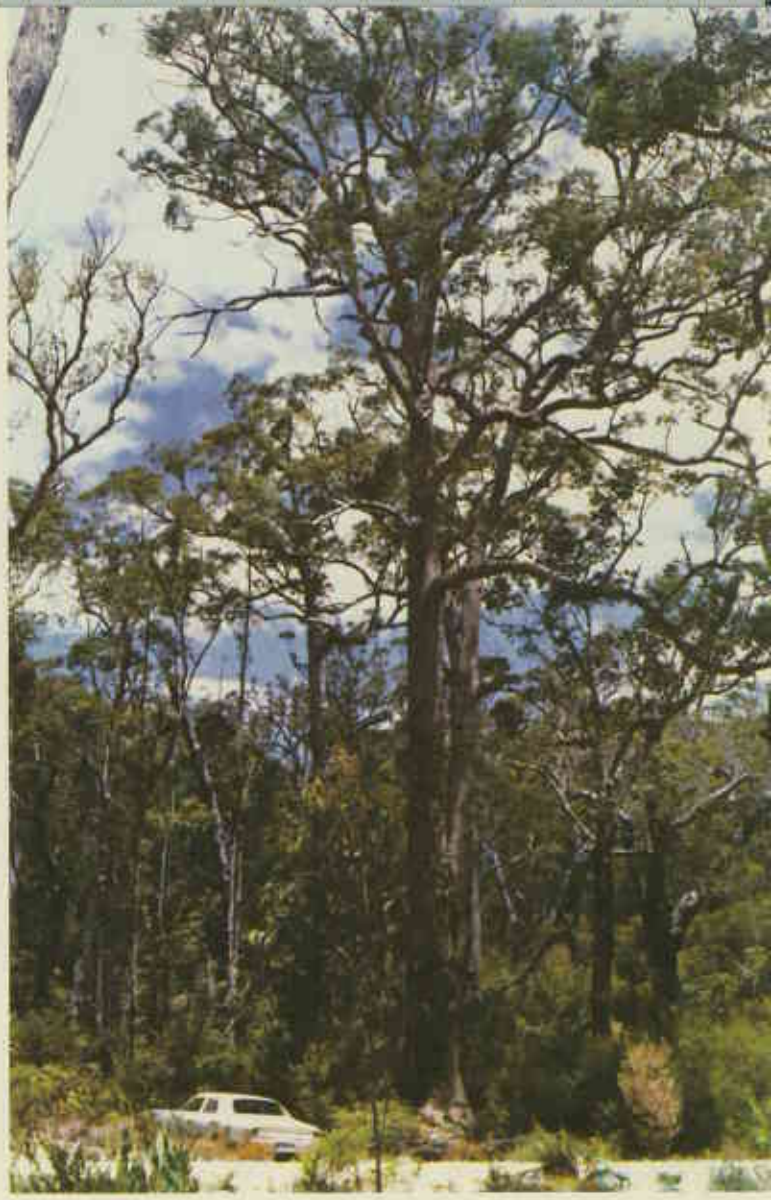
Important exceptions to this occur where plantations have been or will be established, where dams have flooded valleys, where mining has pillaged the soil mantle, or where *Phytophthora cinnamomi* has left the vegetation bereft. Given the high conservation value of the major extent of State Forest it was decided that the best way to accommodate conservation within the multiple use complex was to select a series of enclaves throughout the ranges of the natural plant associations, within which all disturbance would be eliminated or kept to an absolute minimum. Thus the normal multiple use State Forest acts as a gigantic buffer to the enclaves, and management can arrange that the degree of disturbance lessens as the boundary of an enclave is approached.

In the southern forests, unlike those in the north, a large proportion is still in the virgin state. In choosing enclaves it was possible to give preference not only to virgin forest but to the healthier, least fire damaged, and least over-mature among the virgin stands. The enclaves so selected were nominated as M.P.A.s with a conservation priority.

The most important association within the southern forests is the karri forest community. Variation in its floral composition and structure exists from river catchment to river catchment, and from the coast to the inland extent of its occurrence. Hazel (*Trymalium spathulatum*) dominates the understorey at the peak of its development. The typical understorey in the Donnelly River valley is netic (*Bossiaea laidlawiana*), whereas in the Shannon Valley and eastwards, wattle (*Acacia pentadenia*) dominates. Some stands have *Acacia urophylla* dominating the understorey, others have bluebush (*Hovea elliptica*).

Karri typically is confined to soils derived direct from the granite gneiss country rock: for example, in drainage

Yellow tingle and below, mature fruits, Mitchell.



The recently named Rate's tingle and mature fruits, Soho.

▲▼ *Karri forest in a stream reserve, Pine Creek, with a dominant scrub layer of* Acacia urophylla (*below*).

▲▼ *Mixed karri/marri forest, Strickland, with a dominant scrub layer of netic* (Bossiaea laidlawiana).

▲ *Karri/marri forest in a stream reserve near the old Shannon Dam, with a dominant scrub layer of bluebush* (Hovea elliptica) *(left).* ▲

lines and on the sides of valleys in the central part of its occurrence, where stream flow has incised through the laterite cap. Toward the coast the topographic position of karri reverses, because granitic gneiss occurs as residual tors in a previously drowned coastal plain. Here the karri occurs on hilltops, sometimes rising dramatically from the flat plain. Important exceptions occur in the Leeuwin-Naturaliste horst and along the south coast where stands occur on red sands derived from limestone. One unusual small patch occurs in the Sunkland.

To encompass these various expressions of the community it is necessary to look for reservation in all the major river valleys and from both the coast and inland.

Over the past decade or so it has become clear that State Forest has a limited capacity to absorb further demands put on it, no matter how legitimate or worthy each demand may be. The demand now exceeds the capacity of the resource to supply.

Therefore no single demand, be it conservation, wood or recreation, can expect to be met without some degree of compromise, and there are a number of ways in which conservation can compromise. One is to allocate suitable State Forest surrounding or as an extension to existing National Park, thereby creating a conservation reserve superior to either taken alone. Forest of high conservation value is not always of high value for other purposes such as commercial wood production. Vegetation on steep slopes can be an expression of a forest at the peak of its development and be at its scenic best, yet be difficult to extract for commercial use.

Again, areas where the vegetation types are very mixed, showing many sharp changes from treeless plain to forest, to heath, to rocky outcrop can be a headache for commercial extraction, yet, because of its diversity, be valuable for conservation. It is reasonable for conservation to be allocated such areas, with those of easier gradients and uniform type allocated for harvest. The Lower Shannon, O'Donnell, and Strickland M.P.A.s were selected partly for these reasons.

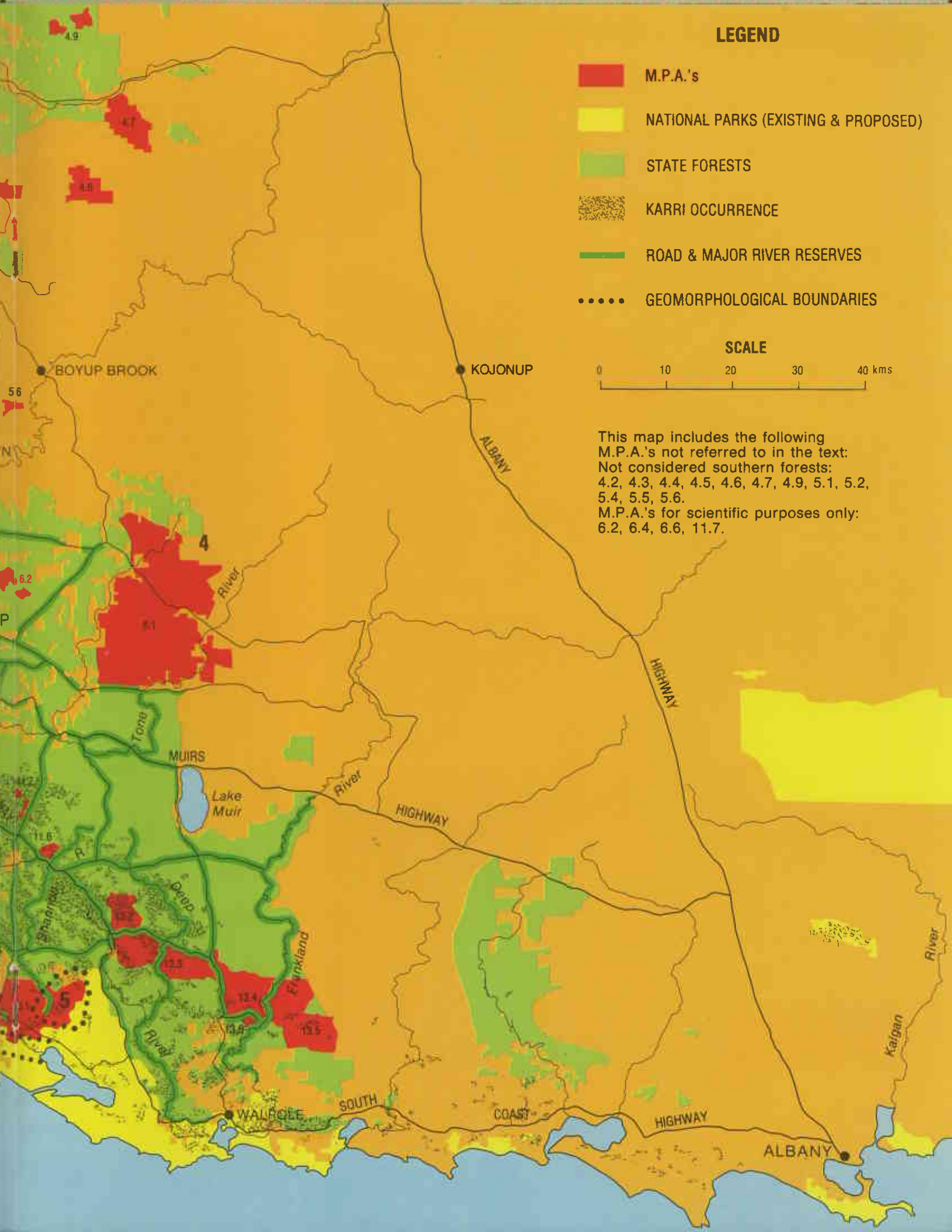
The approach adopted in the karri forest community was to demarcate two separate large areas (Lower Shannon and the combination of Wattle, Johnston, O'Donnell, Mitchell Crossing and Soho) which are then supported by a series of smaller areas spread through all river valleys and at the inland and seaward extremities of its range. By locating the Lower Shannon adjacent to the South Coast National Park, it was possible to create a large, compact reserve which satisfies even the most generous size requirements for mobile mammals and rare species (in excess of 40 000 ha). The other large area satisfies most requirements for size (28 000 ha) even ignoring the fact that it is buffered by State Forest. The latter has everything to offer conservation: range of biotic associations, diversity of genetic resource (including most forest types and many rare species), as complete a lack of disturbance as is possible to achieve, rivers, undisturbed catchments, scenic grandeur, and buffering within State Forest. Three M.P.A.s, Brockman, One Tree Bridge and Boranup, have recreation as their first priority, but nevertheless contain stands of karri most important for the conservation of flora and fauna. Important outlying stands occur in Dalgarup, Chester and within the South Coast National Park. Hawke-Treen expands the Warren National Park. At the request of the E.P.A., Giblett and Beavis are designated for M.P.A. status following cutting and regeneration. Giblett will also expand the Beedelup National Park.

No anomaly is seen in reservation following cutting because regeneration uses natural processes, and stands now 40 to 80 years old reproduced in similar fashion contain flora and fauna identical with virgin forest. Ideally a conservation reserve contains all successional stages, and therefore a newly regenerated karri stand adds another stage.

Perhaps the most bedevilling factor in the quest for a conservation scheme is the insidious presence of the root pathogen *Phytophthora cinnamomi.*

The Sunkland region is the worst in this respect because so much is prone to its infection and spread, and indeed is already infected. The jarrah and banksia-like (*Proteaceous*) associations suffer most. Karri, marri, blackbutt (*E. patens*), tuart, flooded gum (*E. rudis*), bullich (*E. megacarpa*), riverain and coastal limestone associations appear to cope without much impact. Within the jarrah associations the impact varies from light in the more fertile soils strongly influenced by the underlying

BUNBURY
COLLIE
Collie River
CAPE NATURALIST
BUSSELTON
HIGHWAY
1
KIRUP
BUSSELL
Margaret River
MARGARET RIVER
3
2
Blackwood
VASSE
NANNUP
HIGHWAY
BROCKMAN
SOUTH
WESTERN
BRIDGETOWN
MANJIMUP
Scott River
AUGUSTA
CAPE LEEUWIN
Lake Jasper
5
PEMBERTON
Warren
INDIAN
OCEAN


LEGEND
M.P.A.'s
NATIONAL PARKS (EXISTING & PROPOSED)
STATE FORESTS
KARRI OCCURRENCE
ROAD & MAJOR RIVER RESERVES
GEOMORPHOLOGICAL BOUNDARIES
SCALE
0 10 20 30 40 kms
This map includes the following M.P.A.'s not referred to in the text:
Not considered southern forests:
4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.9, 5.1, 5.2, 5.4, 5.5, 5.6.
M.P.A.'s for scientific purposes only:
6.2, 6.4, 6.6, 11.7.
BOYUP BROOK
KOJONUP
ALBANY
HIGHWAY
MUIRS
Lake Muir
River
Tone
Deep
Shannon
Frankland
Kalgan
WALPOLE
SOUTH COAST HIGHWAY
ALBANY

Banksia attenuata *flowers and trees in O'Donnell.* (Flower by Brian Stevenson.)

granite-gneissic parent material, rather than from the more typical lateritic cap, to heavy in the poorly drained lower quality stands in the higher rainfall areas.

Pockets of infection are so widespread that it is impossible to isolate any large areas anywhere which are free of the disease. Since no reservation scheme can possibly exclude it, spots of infection are accepted within the enclaves, though whenever possible small catchments apparently free of the disease are included. At least the process of adaptation to an introduced pathogen can now be studied free of the further confounding influence of European man.

In the Sunkland, four areas have been selected for conservation:

- Whicher block, on the northern edge, encompasses the upper catchment of the Sabina River in the Whicher Range area. While it contains typical Sunkland forest, it also includes some rare species such as mountain marri (*E. haematoxylon*), an endemic grevillea, and some disjunct occurrences of species more typical of areas further north and east. *Phytophthora cinnamomi* is confined to the drainage lines from which spread, with no further disturbance, will be very slow.
- Milyeannup in the south includes an extensive stand of high quality jarrah on soils influenced by intrusions of basalt. The area contains few internal tracks so that its central core is not only mostly free of *Phytophthora cinnamomi,* but could be naturally fairly resistant. It also includes more typical Sunkland forest and the interesting *Kingia* suite of soils.
- Mowen includes swamp complexes and typical Sunkland jarrah in the headwaters of the Mowen River, a tributary of the Margaret River.
- St. John's Brook secures fine regrowth stands of blackbutt and jarrah from further harvest, and protects a lengthy strip of fine permanent streamflow.

As mentioned previously, Boranup is the largest occurrence of karri on coastal limestone soils, and represents the western fringe of the karri occurrence.

Ludlow contains tuart at the height of its development, which coincides also with the southern extent of its range. Tuart being one of the more widely planted eucalypts in other lands, particularly the Mediterranean, the conservation value of this patch as a seed source and as a fund of ecological information is paramount. It also has high recreation value.

All M.P.A.s selected to date for conservation or recreation are listed in Table 2. The plant associations conserved are listed in Table 1.

Scientific criteria for conservation reserves

From a scientific point of view the perfect conservation reserve would firstly have to be representative of the biome it was intended to conserve. It would contain the complete range of vegetation types and animal population involved, and would encompass the widest diversity of genetic resource within the species making up the various communities of plants and animals. It would be large (20-50 000 ha), circular or compact in shape, and would have natural boundaries such as coastlines, rivers, watersheds, geomorphological changes, etc. It would be in a natural, undisturbed state, free of introduced pathogens or species. Its tenure would be secured by Act of Parliament, requiring the agreement of that body to effect a change of purpose. It would contain a core area which would remain inviolate from any disturbance other than for approved research, and which in turn would be surrounded by a buffer area in which certain uses, compatible with the continued existence of the populations to be conserved, would be permitted. It would be managed and physically protected by a skilled organisation of a size adequate for the task. It would be replicated elsewhere. (Aust. Academy of Science, 1975.)

The need for large size in conservation reserves is based mainly on the spatial requirements for the more mobile large mammals (kangaroos in this instance), and the rarer species of animals and plants to maintain viable population levels. The actual minimum areas recommended vary from 10-50 000 ha.

In the karri forest particularly, it is significant that fauna species diversity is low (Pentony and Kimber, 1976), no species is completely forest dependant, and no animal species lives exclusively in karri forest. Kangaroos are demonstrably under no threat. Having secured the needs of the rarer and general population of mammals in the Perup M.P.A. the karri forest could then be evaluated primarily as a vegetation community. By selecting a range of buffered smaller reserves greater emphasis is put on conserving the greatest possible range of ecological association and genetic diversity. Even so, two of the reserves meet the criteria

▲ *Lane-Poole falls on the Canterbury River, Boorara* (Roger Underwood)

▼ Banksia ilicifolia *on flats, Soho.*

▼ *Below, deep water just downstream from Mitchell Crossing in the Frankland River, Crossing.*

▲ *Cool, shady banks of the Donnelly River, and moss-covered*
▼ *log below old understorey of hazel.*

▼ *View from the top of Mt. Frankland, showing stunted bullich in the foreground.*

for size and replication. Given the constraints of mounting use pressure and the obligation to practise multiple use, the Forests Department is satisfied that the needs of conservation have been met.

Security of tenure

State Forest has "A" class security of tenure, in that the approval of both Houses of Parliament is necessary to effect change. The purpose of an M.P.A. is secured by the Working Plan, which is approved by the Governor in Executive Council, and changes can be made only at that level with the approval of the Conservator of Forests.

However, to further secure the purpose of most conservation M.P.A.s the E.P.A. and the Conservator of Forests have agreed that their specific working plans as detailed in the General Working Plan will have the status of a parliamentary regulation. This means that a change in their working plan requires the scrutiny of both Houses of Parliament. Thus both their tenure and working plans for the M.P.A. have the highest possible security. M.P.A.s having this double protection will be called Forest Parks, and in due course legislation will be prepared to give effect to this.

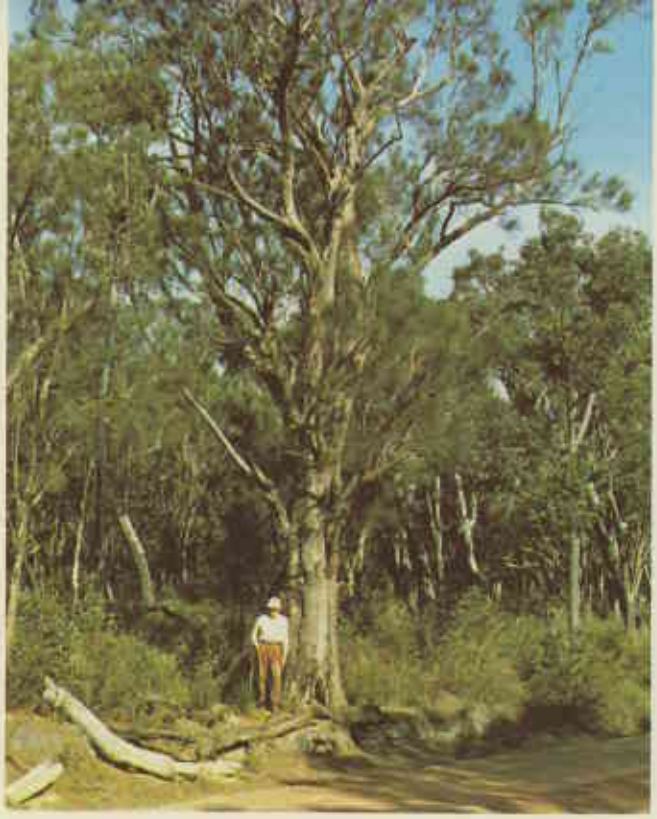
Management of conservation M.P.A.s

Forests are living entities, which means that they naturally undergo a process of birth, youth, adolescence, maturity, senescence and death. Conservation M.P.A.s therefore cannot remain as they are indefinitely, any more than a person can elect to cease ageing after forty years. In a climate such as ours in Western Australia, fire is as much a part of the environment as the rain and the soil itself. To exclude fire in Western Australia is equivalent to excluding snow in the Alps. Fire is the usual agency which finally terminates the lifespan of a stand in the senescent stage, and in so doing creates the ideal conditions of nutrient rich, competition and disease free ashbed needed for its rebirth. In a completely natural situation this can happen more or less at random over large or small areas. A Forest Park is a contrived situation in this day and age, so it is unrealistic and inappropriate to expect that its regeneration can be left to chance.

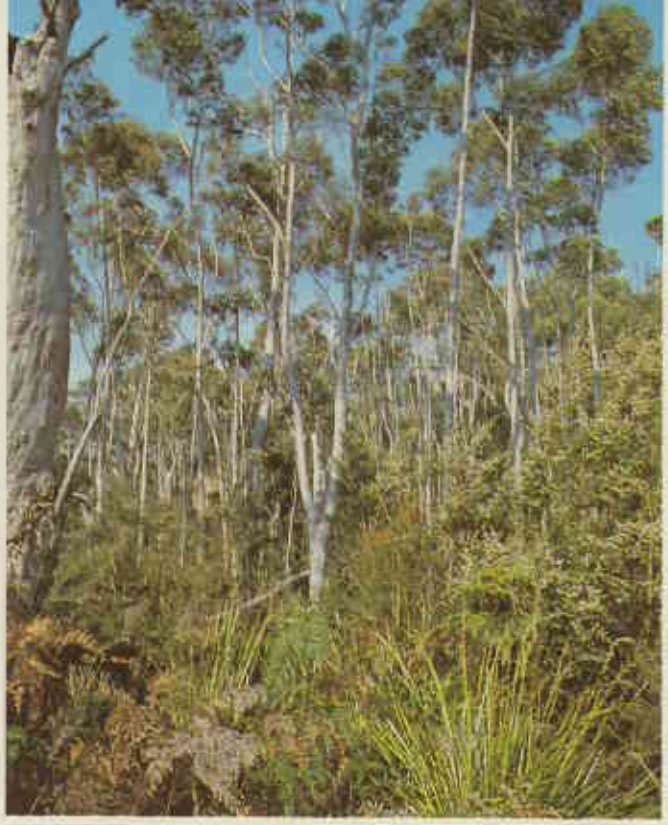
(*Continued on page 21*)

▲ *A tributary of the Donnelly River, Strickland.*
▼ *Regrowth tuart forest, Ludlow.* (Brian Stevenson)

▲ *Mature forest blackbutt, Strickland.*
▼ *Stunted blackbutt, Soho.*



Sheoak, Mitchell.



Bullich, Mitchell.

An isolated patch of karri in the Sunkland, Chester.

Jarrah forest near Dickson Road, Dickson.

TABLE 1—VEGETATION ASSOCIATIONS RECOGNISED IN SOUTHERN FORESTS

VEGETATION ASSOCIATIONS				GEOMORPHOLOGICAL ZONES					
Structural Groupings	*No.*	*Upper Strata Species Alliances*	*Important Understorey or Ground Indicator Species (incomplete)*	*Swan Coastal Plain*	*Southern Coastal Plain*	*Donnybrook Sunkland*	*Southern Tableland (high rainfall)*	*Southern Tableland (dry inland)*	*Leeuwin-Naturaliste Horst.*
Forest and Woodland	1	*Eucalyptus diversicolor*	Casuarina decussata		x		x		x
	2	*Eucalyptus calophylla/Eucalyptus diversicolor*	Trymalium spathulatum Bossiaea laidlawiana		x		x		x
		Eucalyptus diversicolor/Eucalyptus calophylla	Acacia pentadenia Acacia urophylla Hovea elliptica Agonis flexuosa Bossiaea linophylla		x		x		x
	3	*Eucalyptus calophylla*		x	x	x	x	x	x
	4	*Eucalyptus marginata*	Casuarina fraserana Banksia grandis	x	x	x	x	x	x
	5	*Eucalyptus calophylla/Eucalyptus marginata*	Hakea lasiantha Bossiaea linophylla	x	x	x	x	x	x
		Eucalyptus marginata/Eucalyptus calophylla	Bossiaea ornata Banksia littoralis Dasypogon hookeri Xylomelum occidentale Adenanthos obovatus Gastrolobium bilobum Eucalyptus decipiens Agonis particeps Banksia attenuata Petrophile linearis Stirlingia latifolia Davesia incrassata Mesomelaena tetragona Hakea ceratophylla Melaleuca preissiana Hypocalymma angustifolium Agonis linearifolia Leucopogon australis Pimelea spectablis Hakea lissocarpha Xanthorrhoea gracilis Isopogon sphaerocephalus Hovea chorizemifolia Hovea elliptica Persoonia longifolia Pteridium esculentum	x	x	x	x	x	x
	6	*Eucalyptus patens*	Forest form			x	x	x	x
	7	*Eucalyptus patens/Eucalyptus marginata*	Low woodland form			x	x	x	x
	8	*Eucalyptus megacarpa*			x	x	x	x	x
	9	*Eucalyptus rudis*		x		x	x	x	x
	10	*Eucalyptus wandoo*						x	
	11	*Eucalyptus marginata/Eucalyptus wandoo*	Eucalyptus decipiens					x	
	12	*Eucalyptus wandoo/Eucalyptus patens*						x	
	13	*Eucalyptus gomphocephala*	Agonis flexuosa	x					
	14	*Eucalyptus cornuta*	Agonis flexuosa	x	x			x	
	15	*Eucalyptus ficifolia*			x		x		
	16	*Eucalyptus jacksonii*					x		
	17	*Eucalyptus jacksonii/Eucalyptus diversicolor/Eucalyptus calophylla*					x		

VEGETATION ASSOCIATIONS				GEOMORPHOLOGICAL ZONES					
Structural Groupings	*No.*	*Upper Strata Species Alliances*	*Important Understorey or Ground Indicator Species (incomplete)*	*Swan Coastal Plain*	*Southern Coastal Plain*	*Donnybrook Sunkland*	*Southern Tableland (high rainfall)*	*Southern Tableland (dry inland)*	*Leeuwin-Naturaliste Horst.*
Forest and Woodland—*continued*	18	*Eucalyptus guilfoylei/Eucalyptus calophylla/Eucalyptus marginata/ Eucalyptus diversicolor*	Banksia *spp.*				x		
	19	*Eucalyptus brevistylis/Eucalyptus marginata/Eucalyptus calophylla*					x		
	20	*Melaleuca rhaphiophylla*		x	x	x	x	x	x
	21	*Melaleuca preissiana*		x	x	x	x	x	x
	22	*Agonis juniperina*			x		x		
	23	*Agonis flexuosa*		x	x	x	x		x
	24	*Eucalyptus haematoxylon*				x			
	25	*Banksia attenuata*		x	x	x	x	x	x
	26	*Banksia littoralis*		x	x	x	x	x	x
	27	*Banksia littoralis* var. *Semi nuda*				x	x	x	x
	28	*Banksia illicifolia*		x	x	x	x		x
	29	*Casuarina fraserana*		x	x	x	x	x	x
Scrub, Heath, Shrubland	30	*Kingia australis/Eucalyptus marginata*				x			
	31	*Pultenaea scrub*			x	x	x		
	32	*Ironstone shrubland*				x			
	33	*Myrtaceous scrub*	Agonis linearifolia Agonis juniperina Melaleuca preissiana Melaleuca incana Agonis parviceps Beaufortia *spp.* Leptospermum firmum		x	x			x
Herblands, Sedgelands	34	*Acid peaty flats*	Beaufortia *spp.* Evandra aristata Leptocarpus scariosus Anarthria scabra Anarthria prolifera Lepidosperma persecans Lyginia barbata Leptospermum firmum Leptospermum oligandrum Astartea fasicularis Agonis linearifolia		x		x		
Lithic Complex	35	*Granites, granite/gneiss*			x		x		x
	36	*Coastal limestone*							x
Aquatic Complex	37	*Freshwater*	Juncus *spp.* Melaleuca rhaphiophylla Agonis juniperina Melaleuca preissiana Eucalyptus rudis	x	x	x	x	x	

VEGETATION ASSOCIATIONS				GEOMORPHOLOGICAL ZONES						
Structural Groupings	*No.*	*Upper Strata Species Alliances*	*Important Understorey or Ground Indicator Species (incomplete)*	*Swan Coastal Plain*	*Southern Coastal Plain*	*Donnybrook Sunkland*	*Southern Tableland (high rainfall)*	*Southern Tableland (dry inland)*	*Leeuwin-Naturaliste Horst*
Other Plant Species of Special Value	38	*Boronia megastigma*			x	x	x	x	x
	39	*Boronia heterophylla*						x	
	40	*Cephalatus follicularis*			x		x		
	41	*Dryandra baxteri*			x	x	x		
	42	*Dryandra formosa*	Relict populations in Whicher Range			x	x	x	
	43	*Conospermum acerostum*				x			
	44	*Grevillea brachystylis*				x			
	45	*Grevillea* sp.	Endemic to Whicher Range			x			
	46	*Banksia meissneri*				x			
Animal Species of Special Value	47	*Setonix brachyurus* (quokka)	Widespread in swamps		x	x	x		
	48	*Bettongia penicillata* (woylie)						x	
	49	*Macropus eugenii* (tammar)	Rare species found in Perup M.P.A.					x	
	50	*Myrmecobius fasciatus* (numbat)						x	
Bird Species of Special Value	51	*Dasyornis brachypterus* (bristle bird)			x	x			
	52	*Pezoporus wallicus* (ground parrot)	Old report from Soho				x		
	53	*Oreoica gutturalis* (crested bellbird)							
	54	*Water fowl*				x			

Eventually, therefore, the regeneration process should be instigated by man, though it could still happen by chance despite his best efforts to prevent it. The option to regenerate and to use the tools required (fire, wood harvest) must remain with the managing authority, within the constraints of the working plan. However, the wood resource in conservation M.P.A.s is not taken into account in the calculation of forest capital or sustained yield so there is no justification for its utilisation on this basis at any time.

As the healthier, less over-mature virgin stands are selected for M.P.A.s the decision to regenerate or not has been postponed as far as possible into the future.

The only management activity envisaged at this stage, apart from scientific research activity, is an occasional prescribed burn of light intensity intended to prevent premature disruption of the normal life cycle by unwanted high intensity wildfire.

CONCLUSION

To be effective, the scheme of reservations has to be conceived as being part of a multiple use plan for the whole of State Forest. The special reverence to be given the enclaves depends upon the balance of State Forest being able to absorb greater usage from all the other legitimate forest uses.

At all times any one use must be seen in relation to all other forms of land use.

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TABLE 2—MANAGEMENT PRIORITY AREAS IN SOUTHERN FORESTS

Work Plan 86 No.	*M.P.A. Name*	*Area (ha)*	*Priority Use*	*Geomorpho-logical Zone*	*Vegetation Association Represented (see Table I)*	*Special Fauna Represented (see Table I)*	*Landscape Type Represented and Special Features*
1.6	Ludlow	2 880	Conservation of Flora and Fauna	Swan Coastal Plain	13, 14, 23	54	Spearwood Dune system. Tuart at height of its development. Recreation. Historical significance of first railway and early settlement.
1.5	Boranup	3 142	Conservation of Flora and Fauna	Leeuwin-Naturaliste Horst	1, 2, 3, 4, 5, 6, 8, 14, 23, 36		Regrowth karri forest on calcareous soils. Caves in limestone, karst features. Historical significance of early M. C. Davis timber empire. Recreation.
1.2	Mowen	3 242	Conservation of Flora and Fauna	Donnybrook Sunkland	4, 5, 9, 20, 21, 26, 28, 29, 33, 37		Swamps. Lateritic uplands in upper catchment of Margaret River.
1.3	Chester	489	Conservation of Flora and Fauna	Donnybrook Sunkland	2, 5, 8		Only occurrence of karri in Sunkland.
1.4	Paget	1 427	Conservation of Flora and Fauna	Donnybrook Sunkland	4, 5, 7, 8, 21, 26, 32, 33, 34, 37, 38		Typical of wetter southern extremity of Sunkland; in Scott River catchment, much of which has been alienated and cleared. Abundant *Boronia megastigma.*
1.1	Whicher	6 765	Conservation of Flora and Fauna	Donnybrook Sunkland	4, 5, 24, 25, 28, 29, 30, 33, 41, 42, 43, 45, 46	53	Lateritic uplands and incised valleys of the upper Sabina River. Endemic vegetation species. Recreation potential. *E. haematoxylon.*
12.2	St. John's Brook	3 194	Conservation of Flora and Fauna	Donnybrook Sunkland	3, 4, 5, 6, 9, 26, 27		Incised valley of St. John's Brook in east Sunkland. Outstanding development of blackbutt with shrub understorey. Possible rare fauna habitat. Recreation. Historical (Barrabup Mill and Pool).
12.3	Milyeanup	5 665	Conservation of Flora and Fauna	Donnybrook Sunkland	3, 4, 5, 6, 20, 21, 29		All variations of Sunkland landscape. Complete range of vegetation types from open jarrah/marri to sedgeland and shrubland.
12.4	Blackwood River	18 450	Recreation	Donnybrook Sunkland	3, 4, 5, 6, 8, 9, 20, 21, 23, 26, 27, 37		Major stream suitable for canoeing, fishing and swimming. Scenic.
1.7	Rapids	2 393	Recreation	Donnybrook Sunkland	4, 5, 6, 9, 20, 21, 26, 29, 32, 33, 37		Medium sized perennial stream suitable for swimming and fishing. Pools.
6.1	Perup	39 000	Fauna	Southern Tableland (dry inland)	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 20, 21, 26, 33, 37	47, 48, 49, 50	Contains rare endemic fauna populations. Mainly Perup soil association.
6.3	One-Tree Bridge	666	Recreation	Southern Tableland (high rainfall)	1, 2, 3, 4, 5, 6, 23, 27, 33, 37		Medium sized perennial stream (Donnelly River) suitable for fishing. Historical bridge. Outstanding karri trees. Pemberton soil association.
6.5	Dickson	261	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	4, 5, 6,		Pemberton and Balbarrup soil association. Virgin tall open jarrah and marri/jarrah forest.
6.7	Strickland	1 276	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1, 2, 3, 4, 5, 6, 22, 23, 27, 37		Pemberton and Balbarrup soil association.Virgin tall open karri, karri/marri and marri/jarrah in lower Donnelly River valley.
11.1	Hawke-Treen	989	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1, 2, 22, 23		Pemberton soil association. Virgin tall open karri forest. Five-year-old and 35-year-old regrowth karri. Complements Warren National Park in lower Warren River valley.
11.2	Dombakup	130	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1		Pemberton soil association. Virgin tall open karri forest.

Work Plan 86 No.	*M.P.A. Name*	*Area (ha)*	*Priority Use*	*Geomorpho-logical Zone*	*Vegetation Association Represented (see Table 1)*	*Special Fauna Represented (see Table 1)*	*Landscape Type Represented and Special Features*
11.3	Brockman	630	Recreation	Southern Tableland (high rainfall)	1, 2, 3, 6, 22, 23, 27		Pemberton soil association. High quality karri forest. Perennial streams with cascades, suitable for fishing. Gloucester Tree Fire Lookout.
11.4	Boorara	597	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1, 2, 3, 22, 23, 27		Pemberton soil association. Virgin tall open karri and marri/karri forest. Marri at its highest development. Rapids in Gardner River.
11.5	Muirillup	209	Recreation	Southern Tableland	1, 2, 35		Virgin karri forest. Granitic outcrop. Good views.
11.6	Curtin	1 256	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1, 2, 3, 4, 5, 6, 22, 23, 26, 27		Pemberton and Balbarrup soil association. Virgin tall open karri forest and jarrah/marri open forest in upper Shannon River.
13.1	Lower Shannon	8 113	Conservation of Flora and Fauna	Southern Tableland and Southern Coastal Plain	1, 2, 3, 4, 5, 6, 7, 21, 22, 23, 26, 27, 28, 29, 33, 34, 37		Boorara, Quagering and Chudalup soil association. Diverse vegetation forest and flats. Borders Broke Inlet. Complements South Coast National Park.
13.2	Wattle	2 898	Conservation of Flora and Fauna	Southern Tableland (high rainfall)	1, 2, 3, 4, 5, 6, 8, 22, 23, 26, 27		Pemberton and Quagering soil association. Virgin tall open karri forest. Entire undisturbed catchment.
13.3	Johnston-O'Donnell	6 202			1, 2, 3, 4, 5 ,6, 7, 8, 21, 22, 23, 26, 27, 28, 29, 31, 33, 34, 35, 37, 40		Pemberton, Balbarrup, Chudalup and undescribed soil association. Lithic complex. Diverse vegetation association, undisturbed in central Deep River basin.
13.4	Mitchell Crossing	7 335			1, 2, 3, 4, 5, 6, 7, 8, 9, 18, 20, 21, 22, 23, 25, 26, 27, 28, 29, 31, 33, 34, 35, 37, 40		Undescribed soil association. Lithic complexes. Scenic. Undisturbed in lower Frankland River basin. Very diverse vegetation.
13.5	Soho	3 236			1, 2, 3, 4, 5, 6, 7, 8, 9, 15, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 33, 34, 35, 37, 39, 40	52?	Undescribed soil association. Endemic flora—Rates tingle and red flowered gum. Scenic.
	Road Reserve	59 747	Recreation	Southern Tableland and Southern Coastal Plain	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27, 28, 29, 31, 33, 34, 35, 37, 38, 40	47, 48, 49, 50	All soil associations in Southern Tableland and Southern Coastal Plain. Provides mature forest landscape for the vast majority of forest viewers and recreation seekers.
	Stream Reserves	42 465	Stream Protection	Southern Tableland and Southern Coastal Plain	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 29, 33, 34, 35, 37, 38. 40	47, 54	High conservation and recreation value for foreseeable future.
12.1	Dalgarup	3 552	Conservation of Flora and Fauna	Southern Tableland	1, 2, 3, 4, 5, 6		Lateritic uplands. Incised valley of Blackwood River. Most northerly occurrence of karri in State Forest.
	Beavis	1 755	Conservation of Flora and Fauna	Southern Tableland	1, 2, 3, 4, 5, 6		Pemberton and Balbarrup soil association. To be made an M.P.A. following regeneration, at the request of E.P.A.
	Giblett	2 849	Conservation of Flora and Fauna	Southern Tableland	1, 2, 3, 4, 5, 6		Pemberton and Balbarrup soil association. To be made an M.P.A. following regeneration, at the request of E.P.A. Expands Beedelup National Park.