USING PRESCRIBED FIRE TO MANAGE FOREST FAUNA

by Dr. PER CHRISTENSEN

▲ Profusions of wildflowers three years after a burn. A wide diversity of species are favoured by mild prescribed burns. Some species require special conditions. *(P. Skinner)*

▼ Ashbeds which are a feature of intense fires burning in dry fuels during summer or autumn provide favourable growing conditions for certain species of mosses and liverworts. *(G. Wardell-Johnson)*

Initially established in September 1971, the Perup Fauna Management Priority Area was the first of the Department's fauna M.P.A.s. Indeed, it was here that the concept of Management Priority Areas, was first conceived (see *Forest Focus No. 10*). It is therefore fitting that the first fire management plan, designed primarily to conserve and enhance fauna rather than timber values, should have been developed for this area.

Areas of Management Priority have been established throughout the State Forest (see *Forest Focus Nos. 18* and *24*). The designation of areas of forest for a priority use is one of the methods by which the multiple use concept is being practised in forestry in Western Australia. By this means different areas may be designated to priority uses other than timber production, for example, watershed management, recreation, fauna, etc. Areas with priorities other than timber may benefit from management which is different to that of the rest of the forest. In order to optimise their potential, special management plans are being prepared for individual M.P.A.s. Such plans cover many different aspects of forest management, such as road building, dieback quarantine, timber harvesting, prescribed burning and other activities. One of the most significant of these management factors, in terms of the change it has the potential to cause, is prescribed burning or fire management.

Research throughout Australia, in recent years has shown that fire is an essential part of many forest ecosystems. Communities of plants and animals respond in different ways to fire. Some plant communities depend on certain fire regimes to maintain their present composition and structure and in some instances the continued survival of certain species may be linked to fire. For some plants infrequent fires provide the best conditions, for others frequent fire may be more suitable. In certain instances the intensity and the season of burning may be the most important factor.

Habitats created by plant associations generally are not long enduring. They are not static but dynamic and subject to continuing changes and fluctuations with time. Animals are frequently adapted not only to specific plant communities but in many instances to certain phases or stages in their development.

For these reasons it is not possible to achieve optimum conditions for all species of plants and animals in one area at any one point of time. Under more natural conditions which existed in the past before the arrival of both European and aboriginal man, periodic fires, started by lightning strikes in the vast areas of virgin forest

ensured a high degree of diversity of different types of burns and fuel ages. Optimum conditions would be created for each species of plant and animal somewhere in the forest at one time or another.

Today vast unbroken tracts of forest no longer exist in the south-west, the total area has been very much reduced and what is left is now broken up by farms and townships. Under these conditions natural wildfires can no longer be permitted to burn unimpeded since they are a threat to lives and property. Prescribed fires which can be controlled have to be substituted in place of the naturally occurring wildfires of former times.

Management Priority Areas which have been set aside for conservation of flora and fauna or for scientific values therefore require some form of prescribed fire treatment if diversity is to be maintained in the natural environment. Prescribed fire in these areas should favour the main priority or purpose for which the areas were set aside.

The Forests Department's broad-scale prescribed burning programme, designed primarily to provide protection for our timber resources, adjacent landholders and townships, is not necessarily the best for all the different M.P.A.s. The fire regime which has been adopted as the most suitable to achieve the protection aim, whilst not necessarily harmful, nevertheless may not always represent the optimum fire regime for

Certain grasses, including many exotic species, thrive under an annual burning ▲ cycle to the eventual exclusion of scrub species. (*T. Leftwich*)

The mardo or yellow-footed marsupial mouse (*Antechinus flavipes*), is often most common in areas of forest which have remained unburnt for long periods. ▼ (*A. G. Wells*)

Brush-tailed possum and young. Line ► trapping of fauna at regular intervals enables researchers to check on the effect of management practices.

(*T. Leftwich*)

▲ The tammar wallaby at night. Mainland populations of this species are becoming increasingly rare.
(T. Leftwich)

conservation of those values for which a particular M.P.A. was selected.

For this reason it may be necessary to develop special burning plans for individual M.P.A.s. The burning plan for the Perup area is the first of these which has been put into operation and it is interesting to examine some of the concepts and the reasoning behind them, as well as the problems involved in developing and executing such a plan.

Before the details of the burning plan could even be considered it had to be accepted that there must be a trade off between protection on the one hand and conservation on the other. Long-term burning cycles with heavy fuel build up might in certain instances be desirable but they are unacceptable under today's conditions. If the whole area were to be burnt in one huge wildfire it could be disasterous for the fauna as well as other values. Compromises also have to be made between what is desirable and what is possible. It is neither feasible nor practical to mimic the natural wildfire situation within the relatively small areas now available.

Only a relatively few burns can be fitted into the area. There are very real problems relating to the size, practicability and cost of prescribed burns, particularly high intensity summer burns. And there is a minimum size to a burn which is dictated by ecological factors. Thus small burnt areas tend to be heavily grazed by kangaroos and wallabies, as well as many insects, which all flock on to the burn from nearby unburnt forest areas to graze the new growth. Their combined effect may markedly affect the post-fire plant succession. The nitrogen-rich legumes for example, much favoured by many grazers, often suffer to the extent that all the small germinating plants of certain species may be eliminated entirely on small burns.

These are some of the factors which make any management plan designed to optimise conditions for every species in each and every M.P.A. a pipe dream, for instance an infinite mozaic of different small burns burnt on different rotations at different seasons. Something close to this fancied ideal may

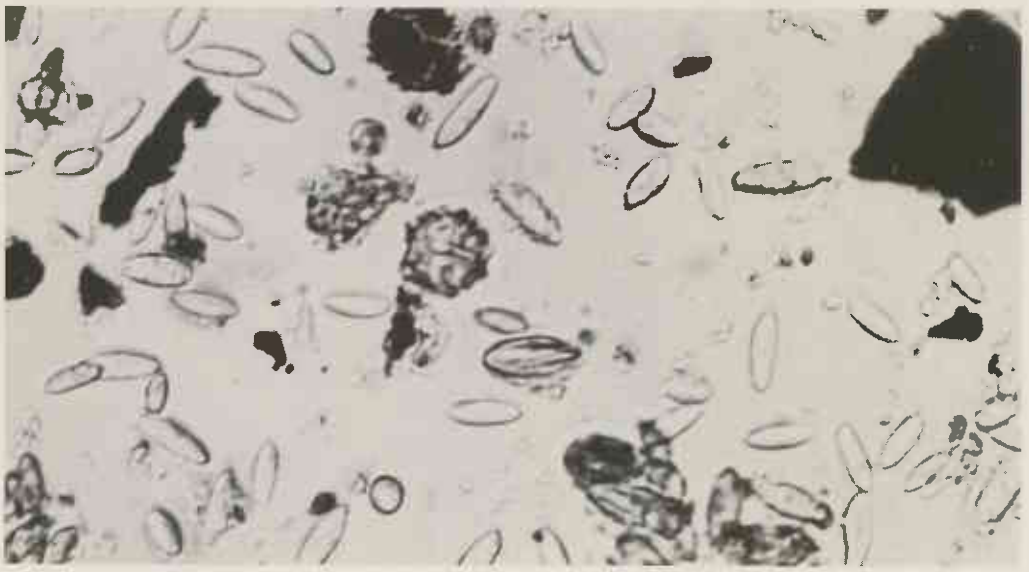
perhaps become a reality in the future as more information becomes available. For the present a simpler approach is considered more realistic. Because of this, management aimed primarily at particular species, so called "selected species management" has been adopted as the basis for the Perup fire management plan.

The species which have been selected are ones about which some knowledge of their biology is available and which are uncommon or rare. The woylie (*Bettongia penincillata*), an animal on the rare and endangered list, the tammar (*Macropus eugenii*), a species which is uncommon on the mainland, and the numbat (*Myrmecobius fasiatus*), are the species of primary concern in the Perup forest.

Selected species management does not infer that other species have been forgotten or are being ignored. No species exists alone and since each selected species depends on a whole suite of other species, particularly plants, management which is designed to favour these species will also ensure the perpetuation of many others besides. Data which has been collected over the last decade from experimental burns and biological surveys also suggest that,

The numbat—numbers have decreased alarmingly in recent years. The Perup ▲ forest is one of its remaining strongholds. *(L. Schick)*

The woylie—an animal on the rare and endangered species list is now almost ▼ entirely restricted to areas of State Forest. *(D. Watkins)*



Magnified several thousand times ► under the electron microscope fungal spores, found in the woylies' scats or droppings, can be identified. The fungi belong to a group of beneficial fungi which grows below the ground on the roots of trees and shrubs. The woylie and other animals have a role in spreading these fungi which in turn provide them with food under difficult conditions such as those following a fire. *(T. Leftwich)*

◀ Woylie nest well hidden beneath a branch. Woylies require adequate cover in which to conceal their nests. (*T. Leftwich*)

▲ Understorey cover in the wandoo forest is frequently inadequate for the woylie ▼ to nest in (above). Adequate cover may be provided for a period by burning during the hot dry summer months which encourages thickets of *Acacia pulchella* providing cover for a period of about ten to twelve years (below).

(*T. Leftwich*)

while the fire regime proposed for the Perup forest may not be the absolute optimum for all species of plants and animals in the area, it will nevertheless maintain viable populations of each species. The burning rotation that is being imposed on the area is somewhat longer than the standard prescribed burning cycle. It is combined with variations in the season of burning and is likely to ensure the maintenance of a greater diversity of habitats than would generally be available elsewhere in the forest. This is expected to benefit many species, in particular perhaps the short-nosed bandicoot (*Isoodon obesulus*), the Western native cat (*Dasyurus geoffroii*) and the mardo (*Antechinus flavipes*).

One advantage in selected species management lies in having definite and quite specific management objectives. This means that the progress, success or failure, of any management strategy may be measured and evaluated quantitatively. A continuing programme of monitoring and checking in the Perup will record the effects of management, not only on the selected species but also on other components of the environment. Detailed research into the fire ecology of heartleaf as well as work on the fire ecology of the brush-tailed possum and bird communities is also in progress in addition to the work on selected species ecology.

Changes and alterations can be made to the present management plan depending on

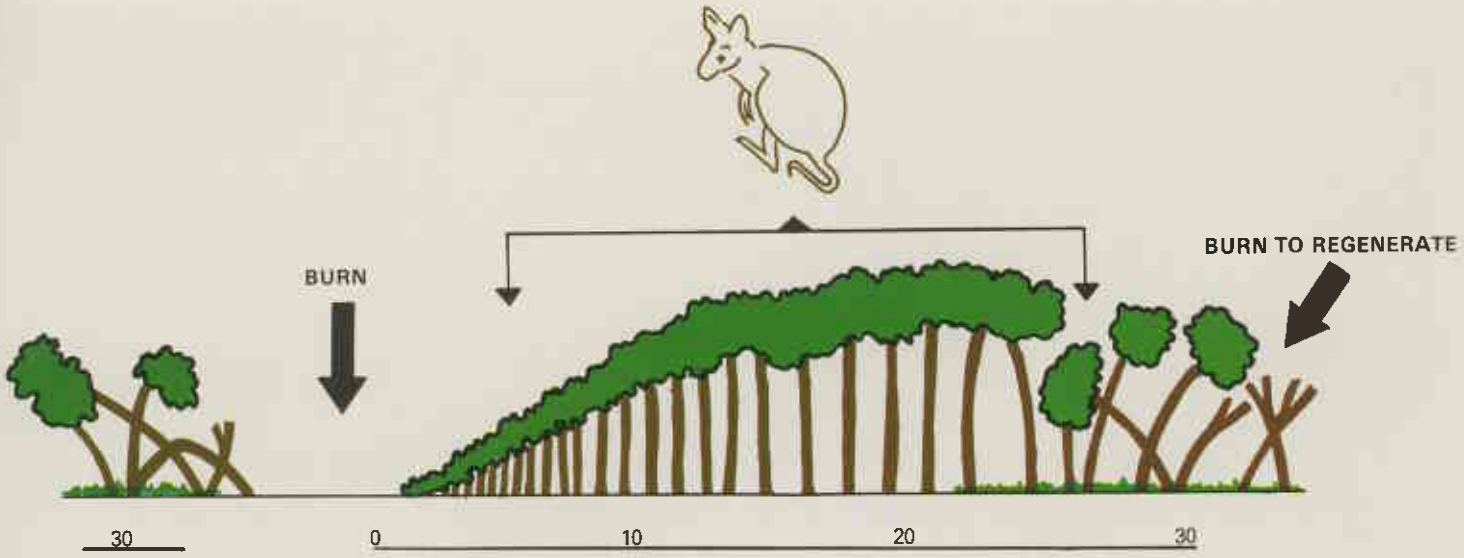
▲ A ringtail possum incinerated on the ground after being driven from its tree by the fire. Some animals survive and young possums soon move in to replace the casualties as the leaves on the trees regenerate.

Top, left: Intense autumn fires are ideal to regenerate tammar thickets but there is a price to be paid. This tammar wallaby was caught by the flames and incinerated. Others will replace it as the thickets regenerate.

Top, right: Although not selected for special management, other species in the Perup are receiving attention. A ringtail possum caught on a spotlight survey is held by a researcher.

Middle, right: Young joeys may be removed from their mother's pouch for measurements to be taken. Twins are rare. Only two pairs have been recorded from amongst several hundred joeys.

Bottom, right: The tammar wallaby lives in dense thickets with an open ground cover. Note the grass understorey on which the tammar feeds. *(T. Leftwich)*



▲ Fig. 2—Tammar thickets in the Perup develop after intense autumn or summer fires. For the first five to six years the thickets are too dense for the tammars. Competition between the plants thins them out and the tammar may live in the thickets till the plants die and the thickets collapse after 25-30 years.

the results of the monitoring programme and as further research data becomes available.

The main data on which the current burning plan is based has been obtained from studies of the woylie and tammar in the Perup over a ten year period. Amongst the factors which have been taken into consideration are the animals' food, cover, size and type of home range, breeding biology, life span, dispersal and movement pattern and mortality factors.

The woylie's major food item, underground fungi, is available at all times, even directly after a fire. Its cover in the Perup is largely clumped *Bossiaea ornata* scrub which takes three to four years to recover following fire. Woylies breed rapidly at a rate of three young per year and live to approximately four to five years of age. Dispersal is limited, although the woylie occupies comparatively large individual home range areas.

The tammar on the other hand eats grasses and other green forage which is not available for several months following a fire. Tammars are restricted to thickets of heartleaf poison (*Gastrolobium bilobum*) and *Melaleuca viminea* which die and degenerate at the age of twenty to thirty years and do not regenerate successfully in the absence of an intense summer or autumn fire. Following regeneration by fire, it takes five to six years before the thickets become suitable again for the tammar. Tammars are relatively slow breeders, one young per year, living to the age of approximately six or seven years. They occupy group territories, groups of the animals living together in different sections of the thickets. In addition to the data on these two species there is also limited data on the numbat, some of which has been obtained by radio tracking animals in the area. The numbat feeds on white ants, occupies large home ranges of up to a square kilometre in size, and needs many hollow logs in which to build nests and seek refuge from predators. They breed comparatively fast, having approximately four young once every year. The ideal burning regime for this species is still unknown but animals are known to be present in areas ranging in age from three to twelve years since burning.

Bearing in mind the need for fire protection, a burning plan has been conceived whereby large blocks are burnt on a nine to twelve year rotation, to cater for the numbats' and the woylies' large home range areas, and to make it possible to use the comparatively cheap aerial ignition techniques. This rotation allows for two to three generations of woylies between burns. It also means that tammar thickets can be included every second or third

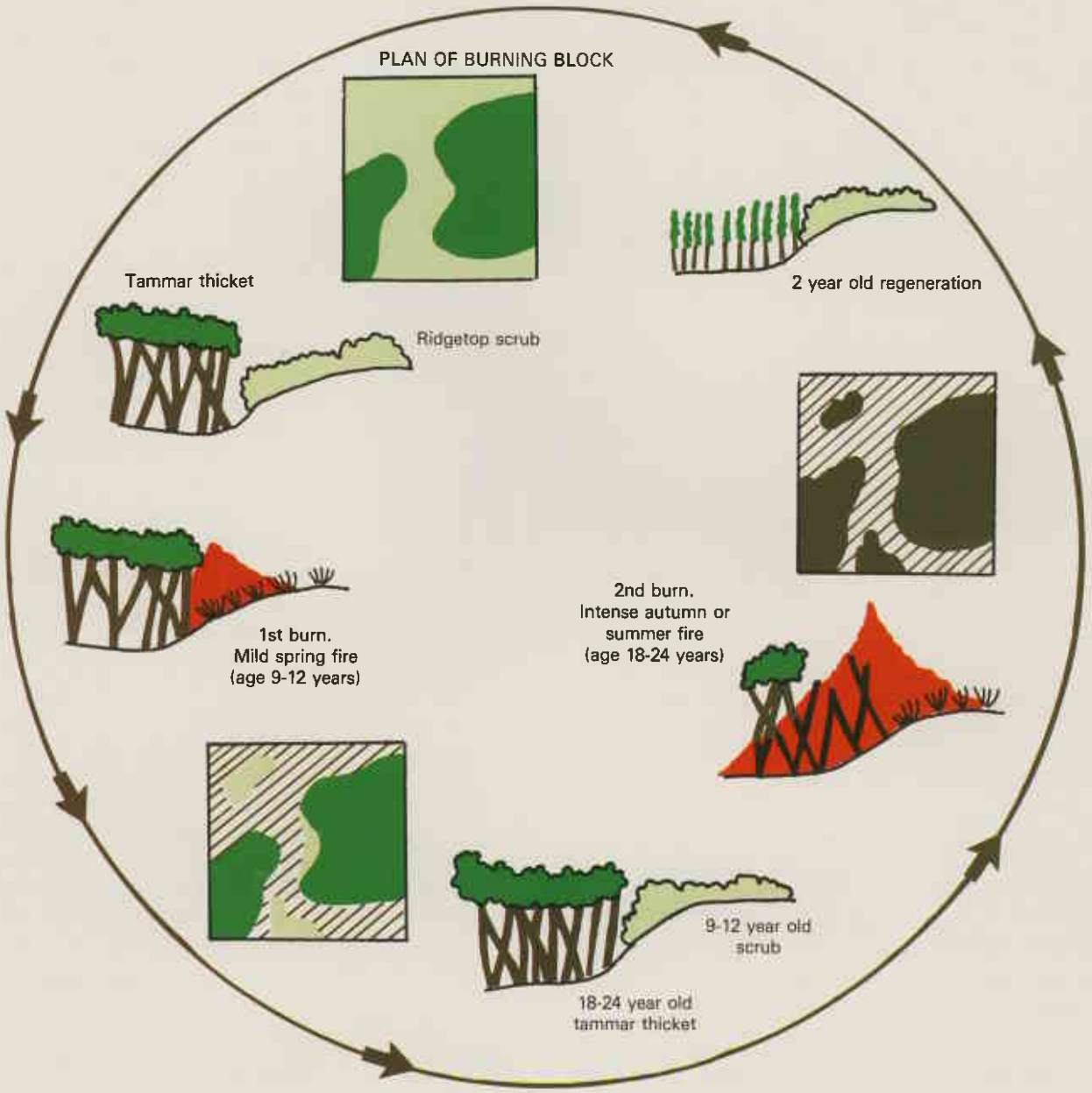


Fig. 3—Differences in structure, flammability and moisture content between the tall open tammar thickets in the valleys and the low dense scrub on the ridges are used as a natural firebreak. The diagram illustrates cyclic spring to summer/autumn burning of a block in the Perup. Tammar thickets may be regenerated every second (aged 18-24 years) or third (aged 27 plus years) burn depending on whether a spring or summer/autumn burn is prescribed.

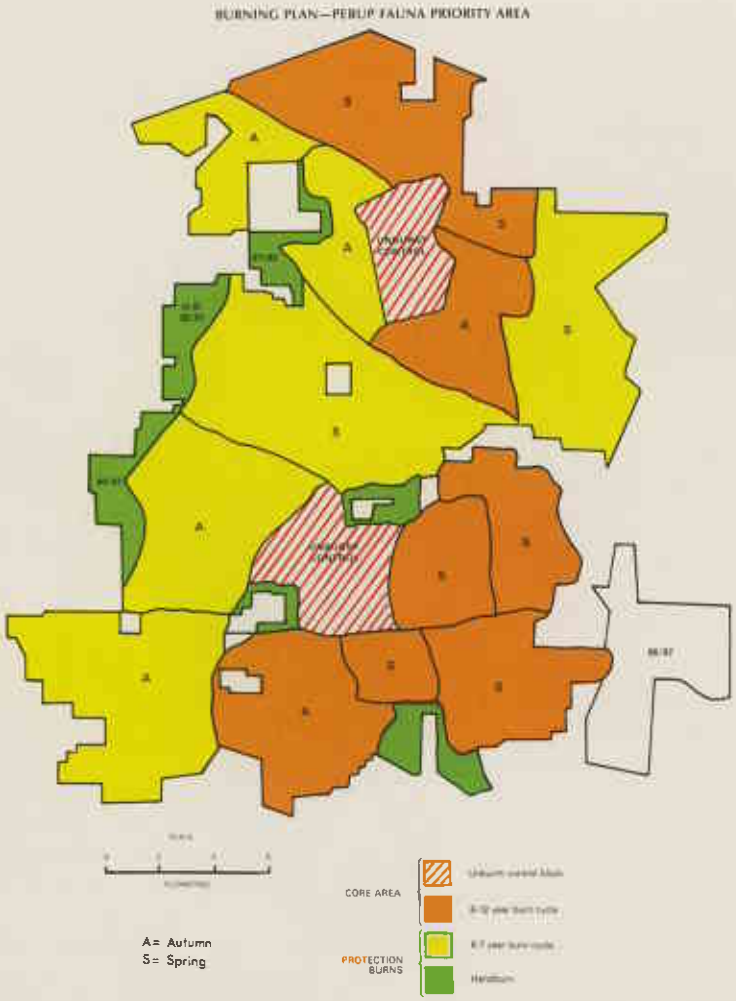


Fig. 4—Burning plan for the Perup. The two special "core" (high fauna value) areas, one in the north, the other in the south, form the basis of the plan. Protection is provided by the buffer zones which are burnt in a shorter rotation. In addition the blocks are burnt on rotation in different seasons which is designed to provide added protection and increases the habitat diversity (see text).

▼ Tammar thicket eight months after a fire. Note the height of the grass in the enclosure protected from grazing by tammars. *(T. Leftwich)*

rotation, a period of eighteen to thirty years or more, which is suitable for their regeneration.

The scheme works as follows: the natural variation in structural composition, fuel moisture content and inflammability between the two different eco-types i.e. the low clumpy *Bossiaea ornata* on the ridges and the tall heartleaf and *Melaleuca* thickets with an open understorey in the valleys, is utilised to form a "natural" fire break. The first burns in the rotation are done in spring when the fuels in the valleys are still comparatively moist and will not burn. The fire burns only the understorey scrub in the ridges and dies out on the edge of the valleys, leaving the tammar thickets unburnt and intact (see Fig 3). The second or third burn in the rotation is carried out in summer or autumn under conditions of low fuel moisture and high fire danger, when the fire will burn the scrub on the ridges together with the valley thickets. Using such ecological gradients obviates the need for extra roads and tracks within the area, which break up the habitat.

The blocks are burnt in a pattern which will ensure that there is always a block of three- to four-year-old vegetation adjacent to the one being burnt. This is to ensure that there are always areas from which re-colonisation of the burn can take place. In addition to this two large blocks located centrally, have been left unburnt as future benchmark reference areas (see Fig. 4).

For safety reasons the longer burning rotations are located in two areas, one in the northern section, the other in the south. These are also the best fauna

areas. Burning has been planned so as to isolate these core areas with slightly more frequently burnt (safer) surrounds. The sections adjacent to farmland are also burnt more frequently for protection of both the fauna area and the farms. In addition, and as an extra safety precaution, the entire western and north-western sectors are burnt on a more frequent cycle designed for protection. Experience of fire managers over many years has shown that it is north-west winds during bad fire weather which contribute to the worst wildfire situations. The threat of wildfires which could cause problems for neighbouring farmers and for the animals in the area is very real.

Tammar thicket three years after a fire. Note also the recovery of the tree crowns. There is a good population of both brush-tailed and ringtail possums in the area. *(T. Leftwich)*

The first management plan was reviewed and changes were made following concern expressed by local farmers in the wake of the 1981 summer wildfires in the district. One of the fires originated on adjacent private property and spread into the Perup. Another was deliberately lit by persons unknown, and the third started from a lightning strike within the Perup area itself and spread to neighbouring farmland.

The preparation of burning plans for M.P.A.s with specific priorities is considered an important aspect of future planning. However, there are many M.P.A.s with a multitude of different priorities and it will take time to prepare detailed plans for them all. The management plans are reviewed on a regular basis because the data upon which they are based is constantly being added to. Burning plans are no exception, fire ecology is an active field of research and new information is constantly becoming available. Such new information may be incorporated in fire management plans and these can be altered as and where necessary.

The concept of ongoing research coupled with constant reviews and changes in plans is an important one. Nothing is static, there is constant change in all things, organisms must change in order to adapt. Scientific investigations are never complete, particularly in the field of ecology, no answer is ever final, there is always more to learn. This is no reason for managers to sit back and do nothing. It is preferable to act on the best available data, recording the results and being ready and willing to make changes when the situation demands. In many cases, doing nothing may ultimately lead to greater changes than a well planned action based on the best available knowledge. Under Western Australian conditions, with long dry summers, avoidance of prescribed burning may ultimately result in intense wildfire with widespread and severe ecological impact. In the unlikely event that an area would remain naturally free of fires for a very long period, changes in vegetation would still inevitably occur.