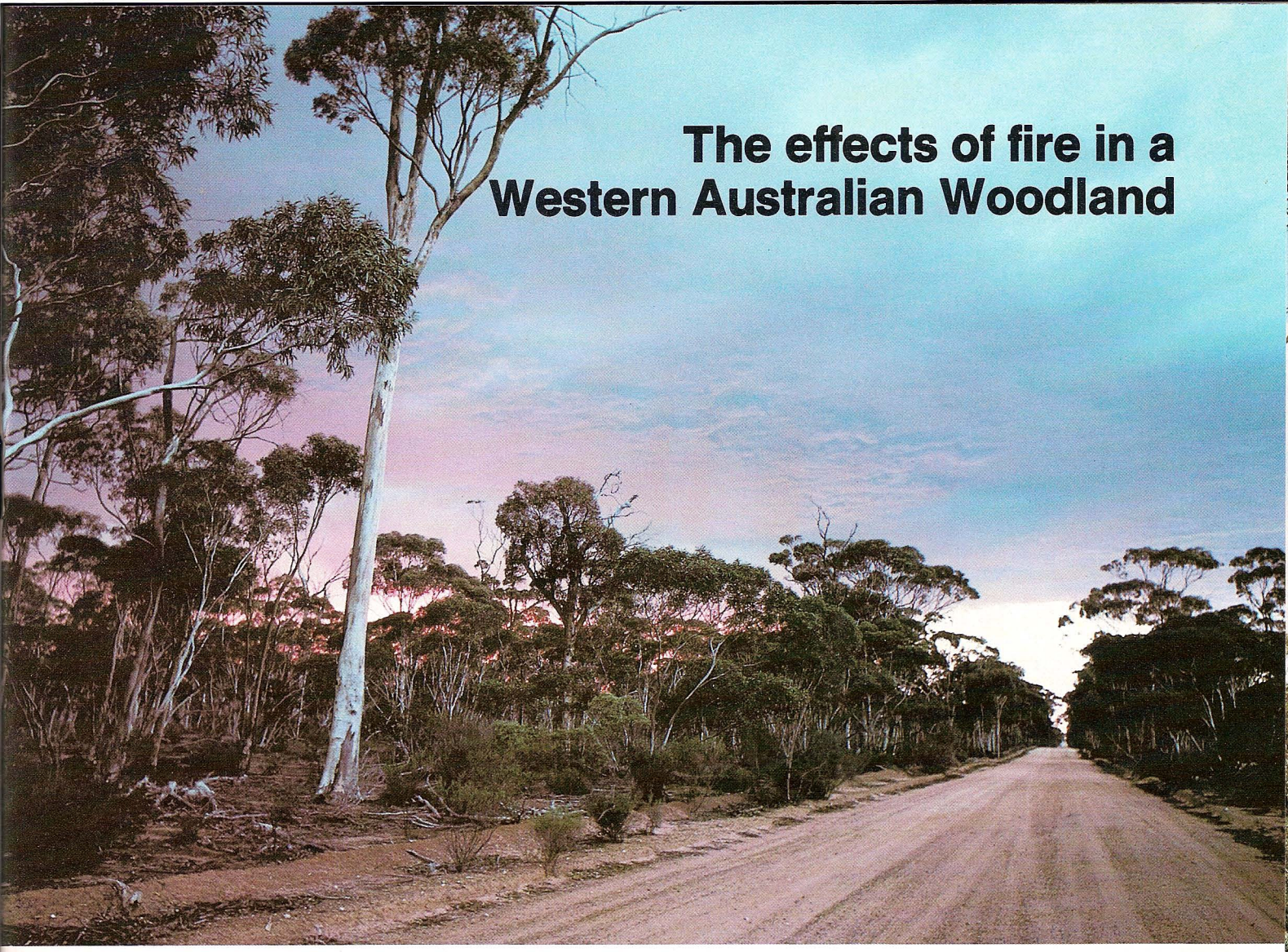
The effects of fire in a Western Australian Woodland



▲ Woodland Vegetation between Lake King & Salmon Gums. (Photo A. J. M. Hopkins).

The hot dry summers experienced in south-western Australia are very conducive to a high incidence of bush fires, with resulting damage to vegetation. Many native plants are adapted to withstand the effects of fires—which suggests that fires may have occurred naturally, e.g. from lightning strikes, for a considerable period. Nowadays, it is generally agreed that fire has been a feature of the evolutionary environment in Australian sclerophyllous (hard-leaved, i.e. non-rain forest) vegetation types for thousands, if not millions, of years. Ancient sources of fire included such phenomena as lightning, spontaneous combustion, volcanic activity and friction. As a result, many native plant species appear well adapted to recover after fire.

Since the arrival of European man in Western Australia and the introduction of new techniques, such as prescribed burning and the use of fire by farmers for land clearing, the incidence of fire has increased greatly.

Because of the importance of fire in the management of our Nature Reserves, researchers at the W.A. Wildlife Research Centre, in collaboration with others, have been conducting studies on fire effects at a number of sites throughout the Western Australian wheatbelt from Shark Bay to Israelite Bay. Results of one of these studies have recently been published. This study was of the effects of a single fire on eucalypt woodland at a site east of Lake King, south-western Australia (32°41'S, 120°42'E).

The study site is situated in a remote spot approximately 120 km east of the Lake King Townsite on the Lake King-Norseman Road (see map).

This fire, about 40 years ago, effectively converted the woodland into a mallee-heath.

The researchers measured the effects of the fire both in terms of what are called physiognomic factors (i.e. life forms and height) and floristic composition (i.e. variety of species present).

The area was relatively undisturbed except for a number of large fires which could be accurately mapped from aerial photography (March 1958, April 1971 and, in more recent cases, Landsat imagery, November 1976). It is possible that

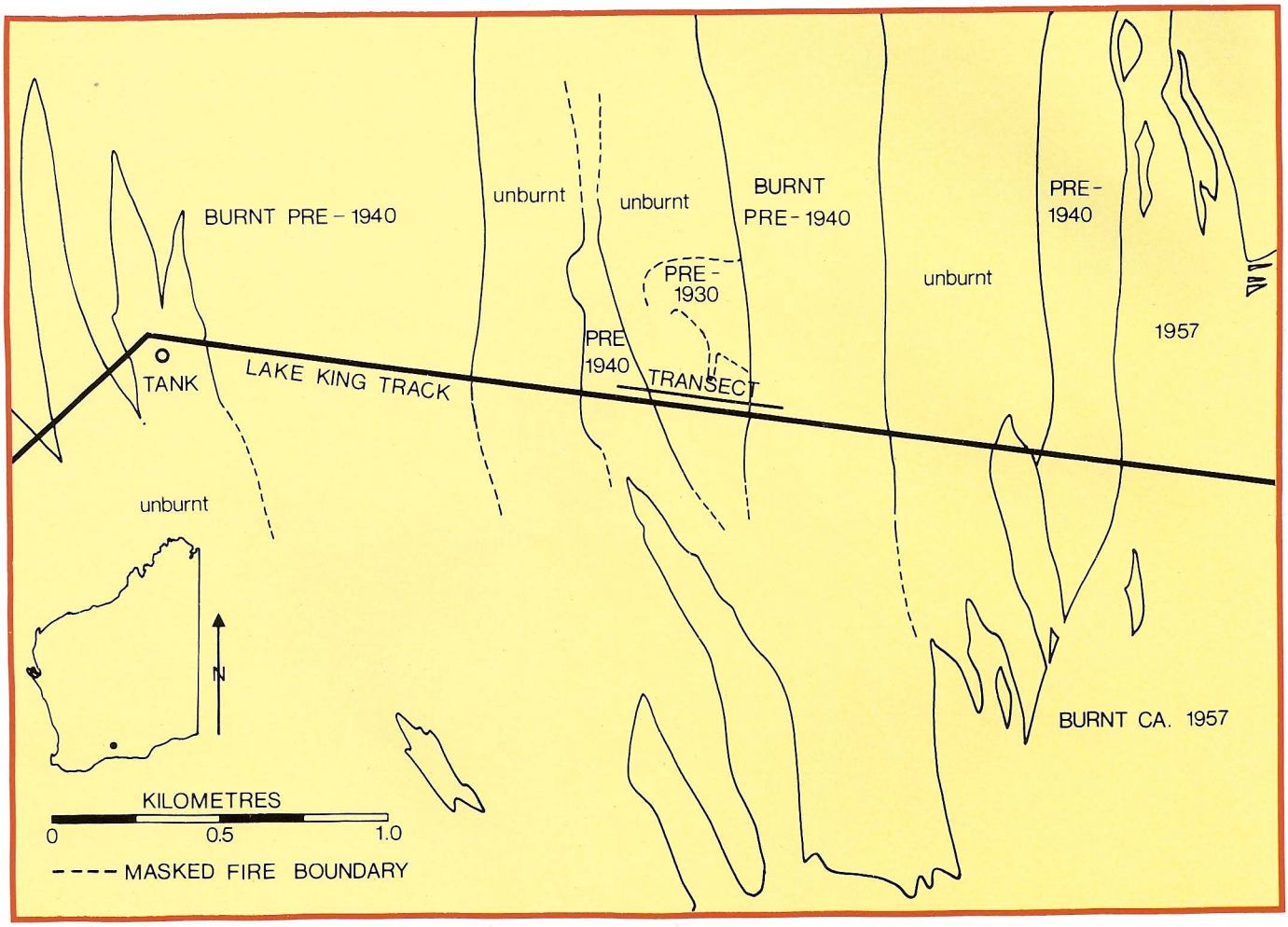
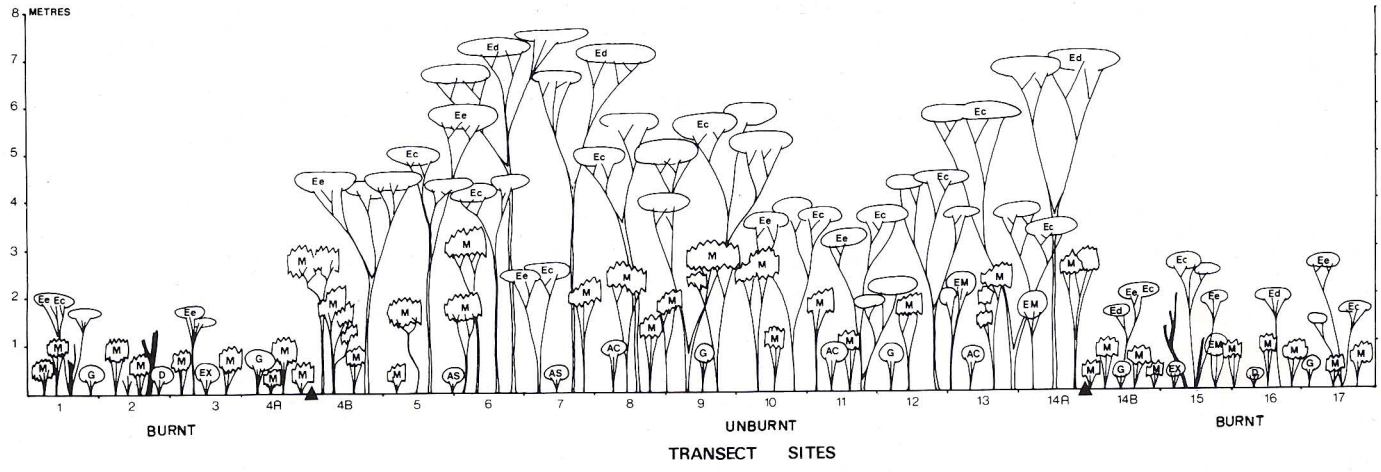


Fig. 1—Fire history map of study area showing study transect.



Profile diagram of the vegetation along the study transect. AC = *Acacia mackeyana*, AS = *Astartea ambigua*. Ec = *Eucalyptus cylindiflora*, Ed = *E. diptera*, Ee = *E. eremophila*, EM = *Eremophila pachyphylla*, EX = *Exocarpus aphyllus*, D = *Daviesia acanthoclona*, G = *Grevillea pinaster*, M = *Melaleuca* spp.

a number of these fires were of natural origin, but a greater number are likely to have a human cause resulting from development of roads, farms in the area, improved vehicular access and encroaching rural activity.

The fire history of the area was estimated from aerial photography and inspection of regeneration on the ground—this history is shown on Fig. 1.

It was estimated that a large fire burnt much of the study site about 40 years ago. This fire is labelled "pre-1940" on Fig. 1 while areas which escaped the effects are labelled "unburnt".

The researchers sampled the vegetation at seventeen points (along the 400 metre long straight line shown on the map and known as a transect) at 25m intervals. At each sampling point a 10 m diameter circular plot was delineated. The height, habit and reproductive status of all species within each plot was recorded.

As the Figure shows, the transect passes from a 40 year old regeneration area through a long unburnt area and into the 40 year old area again. Soil samples were collected for later study and results from sampling of soils showed no change along the transect. Similarly there was a continuity of plant species present along the transect although there was a tendency for herbs and grasses to be more important in the long-unburnt woodland area. Three species of *Eucalyptus* were continuously distributed along the transect.

A total of fifty-one species of plants were encountered along the transect.

The structurally dominant shrub species of the woodland, *Melaleuca* spp. and *Eremophila pachyphylla,* were generally common to both the woodland and the mallee-heath. However, herbs and grasses were much more common in the woodland (ten species, fifty-two records) than in the mallee-heath (eight species, fifteen records), and this probably reflects the lack of disturbance in the woodland.

▲ Eucalypt growing in Mallee form. (Photo A. J. M. Hopkins).

▼ Close-up of the base of *Eucalyptus cylindriflora* in the mallee-heath showing the development of the mallee habit by resprouting. (Photo A. J. M. Hopkins).

Analysis of the species distribution data showed that the high degree of floristic continuity along the transect, regardless of structural variation is consistent with the properties of the soil along the transect.

However, the structure of the vegetation varied markedly along the transect. The substantial structual discontuities in the vegetation which are illustrated in the profile diagram accord closely with the boundaries of the "pre-1940" fire. The long-unburnt area was comprised of a low *Eucalyptus* woodland with a well-developed shrub understorey. The 40 year old regenerated area was dominated by shrubs of *Melaleuca* spp. with emergent mallee eucalypts. This formation is described as a mallee-heath.

The study revealed a very slow rate of regeneration of the vegetation in the area. These results, together with observations on the vegetation of nearby areas of known fire history suggest that complete post-fire regeneration to the structure of mature woodland may take as much as 100 years. However, since little is known of the fire ecology, biology and in particular, the growth rates of the species of this area, a more precise determination cannot be given.

▼ The eucalypt woodland formation (Photo A. J. M. Hopkins)

Probably the effects of a single fire may be imprinted on the vegetation for a period much longer than this estimate. In particular, the eucalypts in the mallee-heath had developed a mallee habit with many thin stems, whereas the eucalypts in the woodland more commonly had a single vertical stem.

At least for the eucalypts, the pre-1940 fire appears to have favoured resprouting as a means of regeneration, over regeneration from seed. The potential for seed regeneration in the burnt formation at present is poor as the eucalypts in the mallee-heath had a very low seed store in the canopy (0-500 fruits per plant) relative to that of the woodland eucalypts (5 000-10 000 fruits per plant).

It was suggested that this changed appearance of the eucalypts would be reinforced by a second fire in the near future.

Some long-term successional processes are suggested as a result of this study. The development of the woodland formation is associated with a gradual thinning of shrub species and an increase in abundance of herbs and grasses.

The study graphically illustrates the extremely long term effects of a single fire on vegetation. Even after 40 years the effects on vegetation are easily discernable at this site, which suggests that considerable thought should go into the consequences of adding a man-made burning regime to areas of bushland before action is taken.

EDITORS NOTE

This article is adapted by M. L. Taylor from a paper by A. J. M. Hopkins and C. J. Robinson entitled 'Fire induced structural changes in a Western Australian Woodland' published in the *Australian Journal of Ecology*— (vol. 6 p. 177-188 1981).