PLANT SUCCESSION AND PAST AND PRESENT BURNING IN THE KARRI FOREST

by

P. Christensen

INTRODUCTION

The effect of fire on the vegetation has long been a subject of interest to the forester and the public alike. The reports of early explorers and settlers seems to indicate that the karri forest had an open understorey at the time of settlement. Many records suggest that one could ride through the forest on horseback. To anyone familiar with the present dense karri forest understorey these claims appear somewhat exaggerated. It is therefore of interest to examine the validity of these claims and to speculate on the apparent change that the karri understorey has undergone.

SUCCESSION

In order to gain some understanding of changes in karri forest scrub communities, it is necessary first to examine one of the fundamental concepts of ecology, the theory of plant succession.

An area of ground if stripped bare of its original vegetation, for example by fire, does not remain bare for very long. It is rapidly re-colonized by one or more species which will subsequently modify one or more environmental factors which in turn allows further species to become established. A subsequent development of the vegetation, by this reaction of the vegetation on the environment, followed by the appearance of fresh species, is termed succession. The concept was largely developed by Warming in 1896 and later by Clements 1904, who introduced the term sere to describe the developmental stages through which vegetation passes until it reaches an ultimate state of equilibrium with the climate and major geological factors of the area. This final stage of the succession is related directly to the environment and is referred to as the climax.

In other words, following a fire there is rapid regeneration of vegetation. This vegetation changes continually as it develops,

different species being dominant at different stages during development until there are no further apparent changes and the vegetation is said to have reached a climax state.

However even the climax state is not stable. Cooper in 1926, said: "The climax period comes into being insensibly, it is characterized by a gradual diminution of the rate of change. The climax itself being merely a continuation of the process it is not possible to mark it off absolutely from the period of more active succession."

Thus even seemingly stable vegetation types such as forests, grasslands, heathlands etc., are continually changing, albeit slowly. To illustrate this the major changes in vegetation that have taken place in England since the last glacial period, approximately 10,000 years ago, are illustrated by the tree-pollen diagram in figure 1. The information has been obtained from pollen analysis of samples taken from peat bogs. This is a recognized and reliable scientific method.

Immediately following the glacial period the dominant vegetation in England was open tundra of grasses and sedges with scattered copses of birch. Later mixed pine/birch woodlands replaced the open tundra and this was in turn replaced by oak, elm and hazel as the climate became warmer and wetter. Later during a drier period alder and lime appear and flourish at the expense of hazel.

Similarly, although little work has been done in Western Australia it has been demonstrated, using the same techniques, that karri was far more widespread in earlier times than it is at present. Thus there must have been a change along the fringes of the present karri areas from karri forest to jarrah or marri forest with an accompanying change in understorey species composition.

These examples serve to illustrate the fact that plant communities are not stable, they are continually changing and will continue to do so whether or not man interferes with them.

To return to the present, figures 2 and 3 represent a diagramatic conception of typical karri forest scrub community as it changes over approximately thirty years.

Fig. 1. TREE POLLEN DIAGRAM, HOCKHAM MERE, EAST ANGLIA (ENGLAND) 1940.

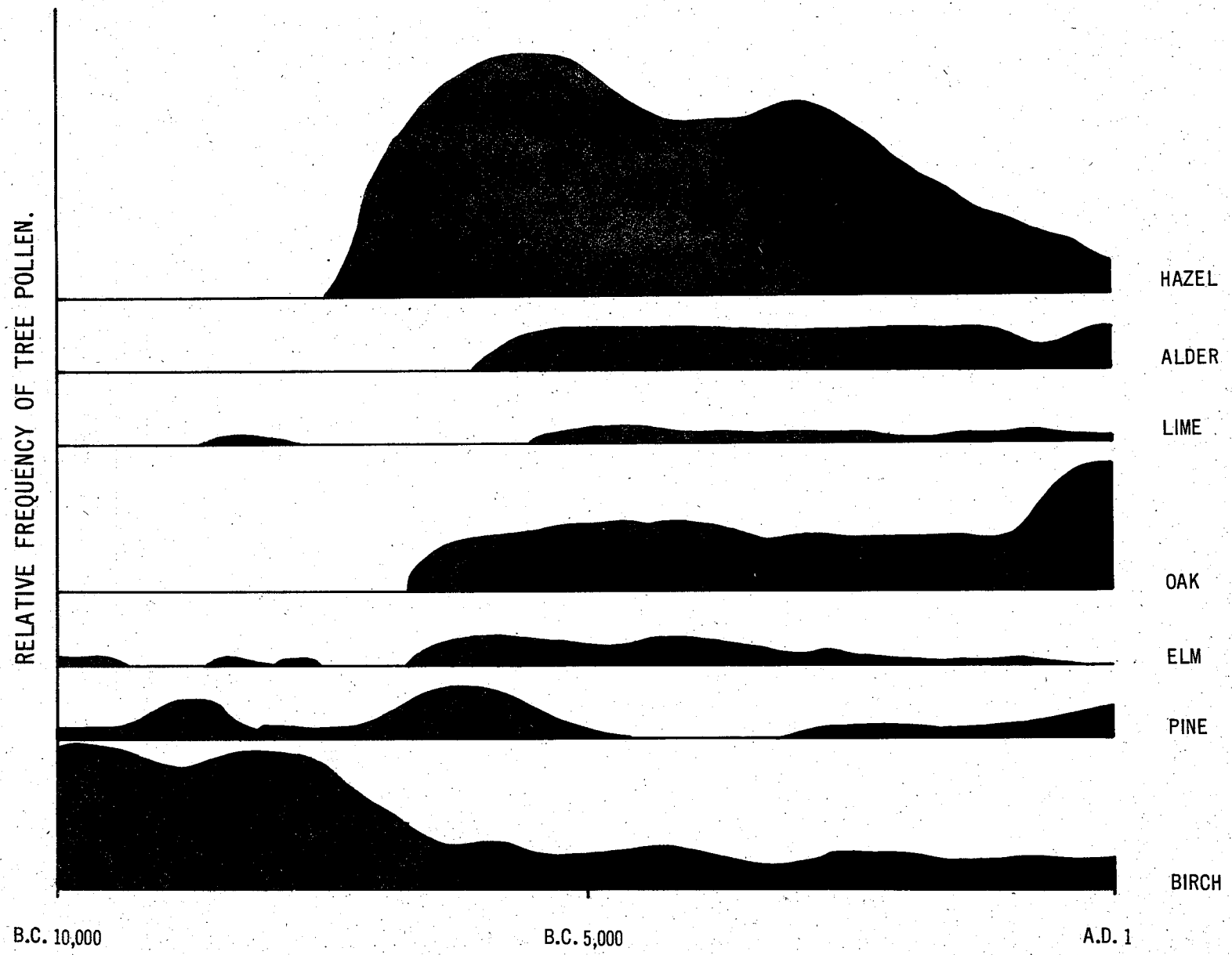
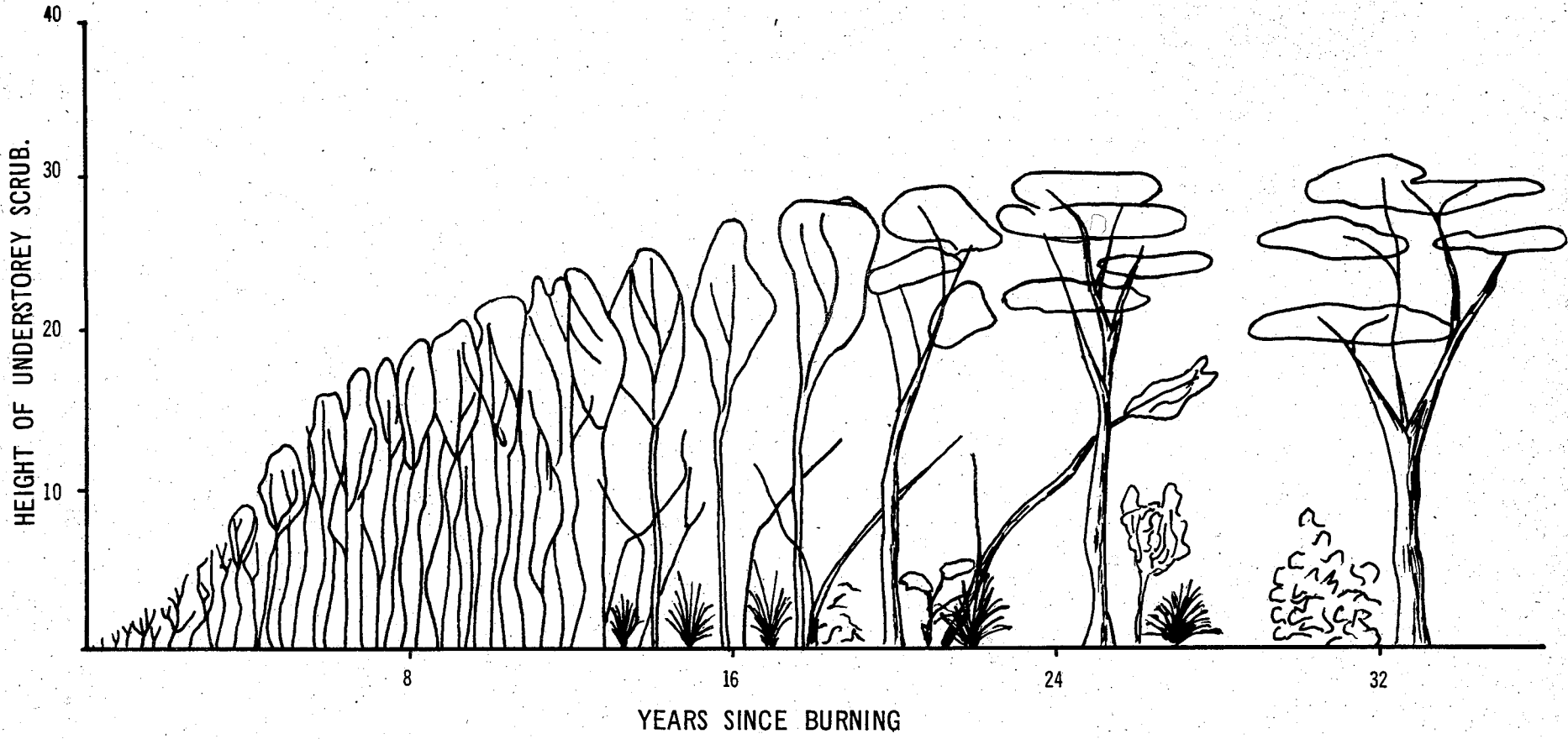
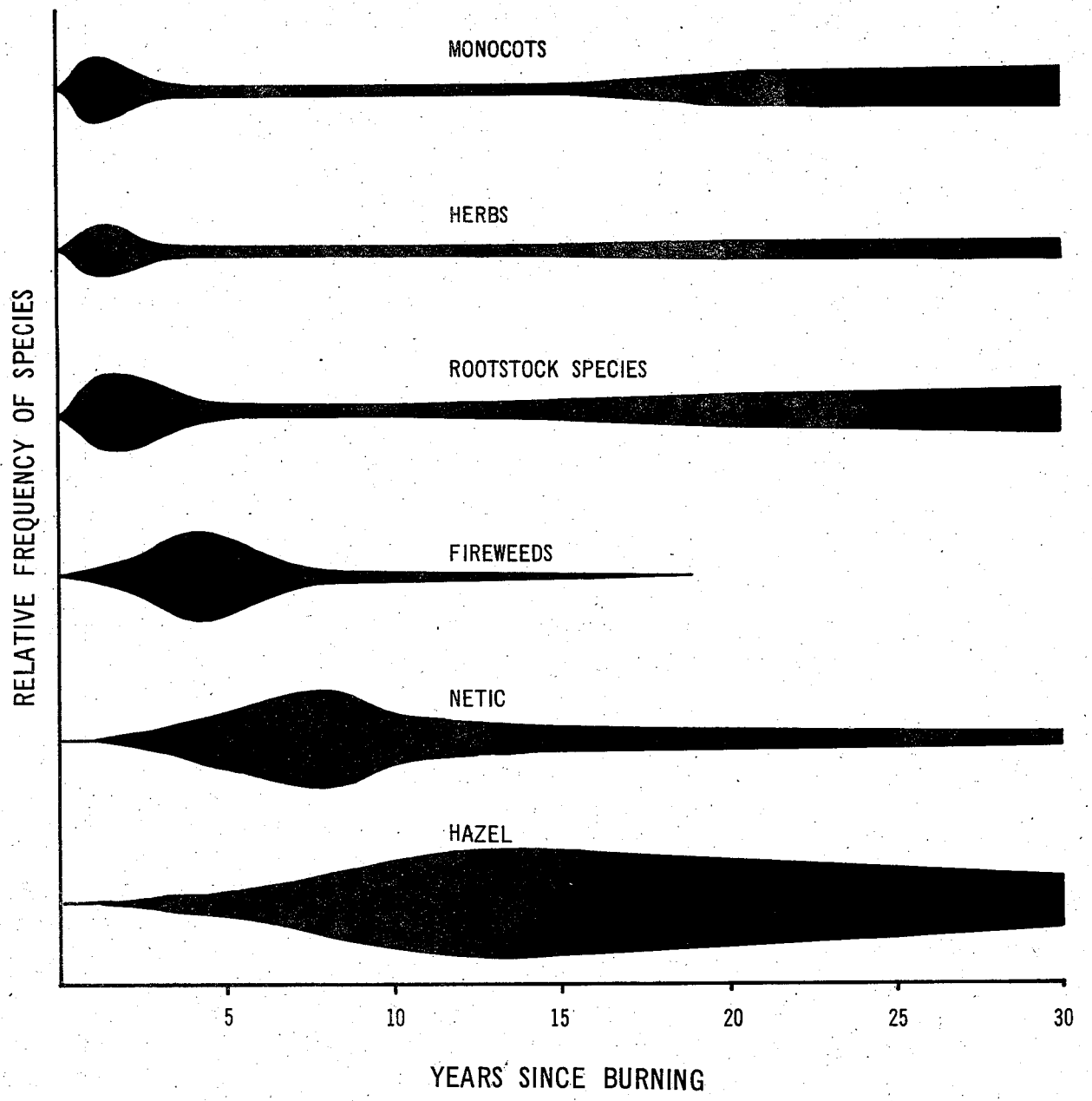


Fig. II DIAGRAMATIC ILLUSTRATION OF SUCCESSION IN A HAZEL DOMINANT SCRUB.



DECREASE IN THE No. OF SPECIES PRESENT.

Fig. 111 DIAGRAMATIC ILLUSTRATION OF SUCCESSION IN A KARRI SCRUB TYPE.



Immediately after burning the area is occupied by monocots (sedges and grasses etc.), herbs and species that regenerate from rootstocks, e.g. emu bush, blue bush, native buttercup etc. Later seedlings of fireweeds such as Acacia pulchella (prickly moses), Ac. strigosa and A. urophylla etc., become the dominants. These species germinate soon after the burn but take a few years to develop and assert their dominance. If larger scrub species such as Bossiaea aquifolium (netic) and Trymalium spathulatum (hazel), are present then these gradually assume dominance of the site by reason of their large size and longer life span. Hazel, if present, will eventually assume complete dominance of the scrub overstorey and at this stage in the succession the scrub tends to open up again and some of the smaller rootstock species return, e.g. Hibbertia sp. sword grass etc.

As far as can be ascertained from the few remaining patches of unburnt forest, the climax in typical Karri understorey vegetation appears to be a kind of relatively open 'parkland' with scattered large hazel and an understorey of various grasses, herbs, smaller scrub species and creepers. The species composition, including the hazel overstorey, may vary locally.

Relatively few wildflowers are present since many species such as Crowea, red creeper, the Acacias etc. require fire treatment for their seed to germinate. The few Hibbertias, native Wisteria, blue bush etc. that develop from rootstock are usually somewhat straggly. This may be partly due to the light intensity under the canopy, but it could also be due to the limited supply of nutrients. Most of the available nutrients are bound up in the few large understorey scrub plants and much is also bound up in the litter which forms a thick mat on the forest floor.

The community is also poor in species composition, the numbers present being only about one third to one half of those present in younger communities. Fire is necessary to 'liberate' this stagnant community, so that the succession can re-commence and each species be given a new lease of life.

At this juncture it might pay to digress a little in order to clarify an important point with regard to the season of burning. The seed of all fireweed species, and as far as we can ascertain the seed of many other local scrub species

also, will remain viable for long periods in the soil. Seeds of some American legumes have been found to remain viable for up to 90 years and it is likely that Australian species are at least as long lived.

Therefore, providing that a species has had time to seed a year or two before a burn it matters little whether burning is done during spring, summer or autumn. The seed is already in the soil and present evidence indicates that it will take several short burning cycles to reduce fireweeds for example. Other phenomena are associated with season of burning such as the rate of return of ground cover and the vigour of the plants etc., but the ripeness or otherwise of the current seed crop is of comparatively little consequence.

To return to the subject, there are only two possible ways in which one can achieve a relatively open understorey in karri by the use or exclusion of fire:

1. by not burning for very long periods.
2. by burning very frequently as often as fuel allows and thus keeping the succession at a very early stage, and the vegetation very low.

Space does not permit an extended discussion on the pros and cons of these two alternatives. However if the report of King (1963) and such books as Mitchell (1848) are read it is clear that fires were of frequent occurrence before the advent of Western man.

In many areas of Australia the aboriginals used fire whilst hunting as a means of flushing game. The new growth resulting after a fire also served to concentrate game animals such as the kangaroo in these areas. In some localities where the seeds of various grasses and reeds were used as food, fire was often used to regenerate them annually.

Burning was generally done in dry warm weather, and it is probable therefore that once a fire had been lit it would have continued to burn until such time as it met a natural barrier such as a river, or there was a change in the weather. Therefore it seems likely that the forest may have been

alight with numerous fires burning continually throughout the summer. As pointed out by Frank Quicke in a recent article, karri can be burnt on a very short rotation if fired during the hot dry summer months.

This would explain the open type of forest encountered by the early explorers and settlers, since the frequent burning would encourage herbs, sedges and grasses and restricts the development of the thicket forming Acacias and other large scrub species. Frequent burning also tends to encourage certain wildflower species such as Orchids, the various creepers, Patersonia, Pimelea, trigger plants etc.

On the other hand infrequent burning also results in a relatively open forest. As karri is comparatively poor in fauna in comparison with the more open jarrah/wandoo woodland the aborigine may have had little reason to frequent it, and it is possible that large tracts of the karri forest may have remained unburnt for prolonged periods. However it would need to remain unburnt for upwards of 30 years before it can in any way be described as open forest. How likely is this when most of the fauna-rich lighter forest types round about were probably fired continually every few years?

One fact is certain however, if horses were ridden through the karri forest in the early days, it could not have been burnt on anything like the present 6 to 8 year rotation. The current control burning cycle encourages dense thickets of Acacias and other large scrub species through which no horse, not even a carthorse, can be ridden.