

Trouble in the Tuart

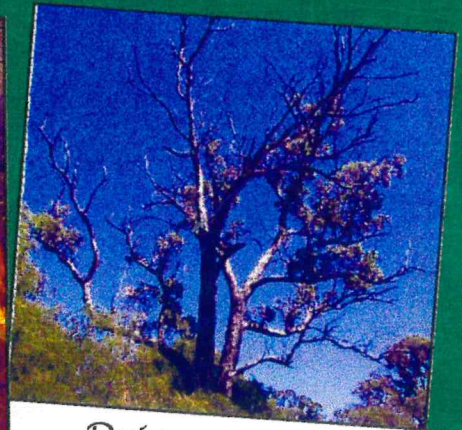
A Brief Fire History



Healthy tuart seedling
after fire



Tuart germinates
best on ash beds



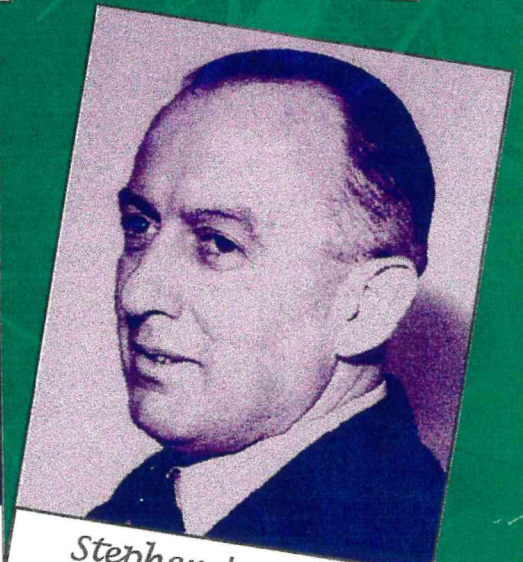
Dying veteran
tuart in long
unburnt area



Charles E. Lane-Poole



Healthy tuart
sapling four
years after fire



Stephen L. Kessell

by

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Summary

Increasing deaths of mature tuart trees (*Eucalyptus gomphocephala*) have been noticeable in Western Australia since the 1920s. Dr. J.S. Beard commented on the problem in King's Park, Perth, in the 1960s. In the 1990s the deaths along the coastal road from Bunbury to Perth have provoked public comment and complaint. There are few tuart seedlings to be seen. This document provides some historical background to the problem, and suggests some research directions.

An early description of tuart forest came from Lt. Henry Bunbury, who, in 1837, said that it had "plenty of grass" (Bunbury & Morrell 1930). Baron Ferdinand von Mueller described the tuart tree in a report to the Governor in 1879, but mentioned no problem with deaths or lack of germination. In 1910 Charles G. Richardson, the acting chief of the fledgling Woods & Forests Department, reported that tuart, like most eucalypts, regenerated easily after fire. He was aware that the Noongar people of the south-west had traditionally used fire widely and frequently. Richardson seems to have regarded fire as a disadvantage to timber production, but not a major forest problem.

The first professional forester to comment on the south-west forests was David E. Hutchins, an eminent man in his day, trained at the famous École Nationale des Forêts et d'Eaux at Nancy in France, and experienced in India and Africa. He visited Western Australia in 1914, at the invitation of the government, wrote his report in 1915, and it was published in 1916. Hutchins carried with him from India and Africa an authoritarian aversion to traditional burning by the natives of those lands.

In 1916 Richardson was replaced, on Hutchin's recommendation, by a young graduate forester, Charles E. Lane-Poole. Like Hutchins, he was a graduate of Nancy, and had worked under Hutchins in South Africa. His annual reports as Conservator of Forests show the horror of fire and grazing which seems to have been drummed into cadets at Nancy. One of his first edicts was to exclude fire from State Forest No. 1, the tuart forest at Ludlow.

A few years after this unprecedented exclusion of fire, problems were noted with tuart flowering, seed production, germination and insect attack. The problems initially involved the seemingly increased prevalence or activity of the Tuart Bud Weevil (*Haplonyx tibialis*), noticed by Mrs. Lane-Poole, which destroyed large numbers of flower buds, so preventing seed production.

In 1921 Lane-Poole clashed with the government of the day over the renewal of timber contracts, and resigned. He was succeeded by Stephen L. Kessell, a forestry graduate of Adelaide and Oxford Universities. Kessell continued the policy of fire exclusion from all forests. However, as fuels accumulated, and fires became noticeably fiercer, his views changed. He allowed some controlled burning around key points. By 1925, he was suggesting running fires through the whole forest.

A recent investigation into fire marks on balga grasstrees (*Xanthorrhoea* spp.) shows that before 1900 fires at 2-4 year intervals were the general rule in tuart forest. In some parts this frequency was maintained up to the 1960s by settler families to maintain grass for cattle feed. Since the declaration of Yalgorup National Park in the 1960s a fire exclusion policy means that intervals between fires have increased to an unprecedented 40 years or more in many places.

As good detectives we must avoid a facile connection between cause and coincidence. At the same time we must avoid the equally facile assumption of no connection. The reader must decide, on the balance of scientific and historical evidence, if there is a likely connection between an altered fire regime and problems with tuart health, reproduction, and insect attack. Some well directed research is needed to establish the ecological role of fire in the tuart forest. Without such research, we are not much wiser than Mr. Lane-Poole and Mr. Kessell eighty years ago.

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Trouble in the Tuart

A Brief Fire History

by David Ward

1. Early Forest Management

*There is a history in all men's lives,
Figuring the nature of the times deceased,
The which observed, a man may prophesy,
With a near aim, of the main chance of things
As yet not come to life, which in their seeds
And weak beginnings lie intreasurèd.*

William Shakespeare, Henry IV, 1597.

In the early days of British settlement in Western Australia, there was little government control over logging. Private enterprise ran amok. Government permits were issued, but there was no regulation of the amount cut, nor was any official thought given to regeneration of forest after cutting. The forest was regarded as inexhaustible, and clearing it was laudable development. This was not a unique situation in colonial forestry. The historian Richard Grove has described a similar short sighted exploitation of the Indian and Burmese teak forests until the far sighted Lord Dalhousie created the Indian Forest Service in 1860 (Grove 1995).

One of the first to show concern about the management of West Australian forests was Baron Ferdinand von Mueller, who recommended that there should be some "*Initiatory measures suggested for establishing forest administration in West Australia*" (von Mueller 1879). The Surveyor General of Western Australia, Malcolm Fraser, included von Mueller's report in one of his own to the then Governor, Sir William Robinson (Fraser 1882). He also included some comments on forest fire from a retired magistrate, Joseph Strelly Harris, who, in 1883, was appointed as Inspector of Timber Forests.

Harris was the son of a migrant general practitioner, Dr. Joseph Harris M.D., who held the post of Colonial Surgeon from 1844 to his death in 1846 (Statham 1979). In those days most medical men dabbled in botany, so it is likely that the younger Harris had some exposure to natural science at an early age. The younger Joseph was described as eccentric, but he clearly had some knowledge of the south-west forests, carrying the mail from King George Sound to Perth in the 1830s, when the road was but a bush track (Harris 1978). He was the first man to drive sheep overland on the same route in 1839. He was also the co-discoverer, with the Colonial Botanist James Drummond, of the poison plants which caused so many stock deaths in the early days. He held responsible posts as magistrate at Williams, Toodyay and the Vasse between 1840 and 1861 (Statham 1979). During that period the first Bushfire Ordinance of 1847 was enacted, which was aimed mainly at curtailing traditional burning by the indigenous Noongar people (Ward 1997). With that *curriculum vitae* there can be no doubt that he was familiar with the tuart forest, and with the traditional use of fire by Noongars.

Harris died in 1889, and a small Woods & Forest Department was set up in 1895, headed by John Ednie-Brown as Inspector General of Forests. Ednie-Brown was not a trained forester, but clearly had a keen interest in trees. Just before his sudden death in 1899 he produced a report called *“The Forests of Western Australia and their Development”* (Ednie-Brown 1899). Unfortunately, he said little about the tuart forest, beyond a botanical description of the tree, borrowed from von Mueller, and a description of the timber. It is reasonable to assume that absence of comment means that there were no perceived major problems with tuart deaths or lack of reproduction at that time.

Ednie-Brown was succeeded by his Chief Clerk, Charles Gough Richardson, who, under various titles, compiled the Annual Reports from 1899 to 1915. Richardson had no forestry training either, but his reports are clearly written, and show some understanding of the native forests. He was born in Dublin in 1865, and was educated by a private tutor and in Germany (Battye 1912). He came to Western Australia in 1887, not long after the serious measles and diphtheria outbreaks of 1883/4 (Broome 1884, Cumpston 1927).

Together with violence, alcohol, whooping cough, scarlet fever, influenza and venereal diseases, these epidemics nearly annihilated the native Noongar people of south-western Australia (Radcliffe-Brown 1930, Hammond 1933, Bates 1938, Hasluck 1942, Neville 1948, Green 1981) and their tradition of frequent light burning in summer subsided (Ward & Van Didden 1997). In grazing areas, such as the present Yalgorup National Park, frequent burning was maintained by European settlers up to quite recent times (Mrs Elaine Marchetti, personal communication).

2. Fire in South-Western Australia

*A little fire is quickly trodden out,
Which, being suffered, rivers cannot quench.*

William Shakespeare, Henry VI, 1592.

In his 1879 report, Baron von Mueller, talking of south-west forests in general, remarked that fires were common, yet not very destructive. He said *“In West Australia the forest-fires are not so excessively destructive as in the eastern colonies, nor do they as there leave in ghastly deadness vast numbers of standing trees, after the burning element has swept through the woods; on the other hand the woods of West Australia are charming at all times, no lifeless trees disfiguring the landscape, all fresh and ever verdant with Zamias, Xanthorrhoeas, and Kingias remaining unimpaired by the scorching flames. Nevertheless, the bushy vegetation and underwood, and all kinds of herbaceous plants, are at least periodically apt to be annihilated in the woody country, when the bush ignites...”*. Anyone familiar with the south-west forests will know that they appear most *“fresh”* and *“verdant”* for the first two to four years after a fire.

In a report to the Governor in 1882, the Surveyor-General, Mr. Malcolm Fraser, included both von Mueller’s report of 1879, and the remarks of Mr Joseph S. Harris, whose background has already been discussed. Harris recommended frequent burning, to avoid fuel accumulation, which would lead to fierce, destructive fires. He discussed the burning of *“lanes”* or *“strips”*.

This sounds very much like the Aboriginal technique of burning with a fresh breeze in light fuel, so that the back and flank fires are blown out, and the headfire cuts a narrow strip, which can be deliberately aimed at some natural fire break, such as rocks, a lake or swamp, or recently burnt country (Kimber 1983). The long lakes, and the coastal dunes in Yalgorup National Park would make ideal fire breaks. Coastal Aborigines were (and some further north probably still are) very proud of their ability to anticipate diurnal wind changes from land to sea breeze, so that a strip fire would swing around in a hooked or loop shape, extinguishing itself before nightfall (Personal communication, Mr Stan Gratte). In northern Australia older Aborigines regard it as bad practice to allow fires to burn through the night (Russell-Smith 1997).

In 1882, Harris said that *“There would be practically no difficulty in stopping bush-fires, but no great advantage would accrue from the attempt – sooner or later fires will come, and the advantages gained by bush-fires more than counterbalance the disadvantages. In fact, such conflagrations are frequently advisable. Leave the forest unburnt for a few years, allow the shrubs to flourish, fallen trees to thicken on the ground, with dead leaves impregnated with turpentine, to accumulate and the destruction of the aged Jarrah, the many young plants and seeds will be completed. Allow the fires as a rule to take their course – if possible every 2 or 3 years. If you wish to preserve timber from an overgrown scrub burn the country in lanes, or on each side of a water-course; fires help to split the seed pods and make them more susceptible to the early rains.*

Fires South and West of Busselton travel at a rate of 3 miles per day, even not so fast. No doubt fires in the Northern ranges require greater caution...

Measures should be adopted to stay native fires on the timber ranges, particularly northwards from Bunbury. Heavy fines inflicted on persons leaving fires burning at their camps, firing the country, except at certain seasons and in certain localities, might tend to reduce the destruction of timber in this way. Permits might be granted, in the months of April and May, to burn strips of scrub between the belts of trees to improve the feed for stock and lessen danger from fire. At the South the timber country might, with advantage, be burnt every four or five years.”

Harris' comments may be compared with those made in 1846 by Lt.Col. John Molloy at the Vasse, Francis Corbet Singleton at Dandalup, and George Eliot at Bunbury (Ward 1997). Molloy said *“I must confess my utter inability to offer an opinion as to any effective means of controlling the incendiary propensities of the Natives. Speaking of this district I should say we have not suffered any great inconvenience from Bushfires, the Natives carefully abstaining from their practice until after the harvest is fully accomplished...so far from Bush fires being generally offensive I believe the opinion prevails in this quarter that they are not only necessary but salubrious.”*

At Dandalup, on the coastal plain just inland from Yalgorup, Singleton was aware of the importance of burning to the Noongars for obtaining food, and noted that they sometimes burnt with a strong wind to obtain a maximum kill of small animals. Talking of the Pinjarra area, he said *“...the vegetation will only burn once in two years. Further; It appears to be about one half of the sandy land burns over by the*

fires annually...". Burning with a strong wind in two-year-old fuels would produce a strip of burnt country, as described by Harris. Repetitive strip burning would produce a mosaic of burnt and unburnt vegetation, with a high perimeter to area ration, much like the strip burning of grouse moors in Scotland and northern England. The grouse have the advantage of old heather close by for shelter from predators, and easy access to the nutritious green pick which soon appears on the burnt areas. They cannot reach the tender tips on tall, old heather (Lovat 1911).

Eliot took it for granted that *"the Natives"* made fires in the bush *"accidentally or otherwise"*, but thought that they might be bribed to desist to some extent by the offer of a reward at the start of the rainy season to *"the Natives of the districts that have been least burnt."* He suggested a link between fire, grass, and insects, saying *"I am not myself at all averse to the practice of burning the Country inasmuch as it produces better food for the stock and also destroys an enormous number of Reptiles and Insects which would in a few years were it not for the fires increase to such a degree as to render the country almost uninhabitable."*

The first mention of fire in Forests Department Annual Reports is in 1910, when Richardson said *"Forest fires have been prevalent ever since the earliest days of settlement, when it used to be the custom of the blacks to set fire to the bush to facilitate hunting. Now settlers keep up the practice in order to improve the grazing, and the fact that the selectors throughout our timber areas have an actual incentive to fire the forest renders the work of fire protection doubly difficult."*

Like von Mueller, he noted the relatively benign nature of fires in south-west forests in those days. He said *"In this state the forest fires are not so exceedingly destructive as in other parts of the world, nor do they, as there, destroy vast numbers of standing trees."*

Richardson saw no problem with the regeneration of cut-over tuart forest. Talking about the forest near Ludlow, in the 1912 Annual Report he said that *"Tuart, in common with other eucalypts, possesses in a remarkable degree the power of natural reproduction, so that the problem of re-afforesting this reserve is a comparatively simple one. All that is necessary is to assist Nature by destroying the over matured useless trees, removing the inferior ones, such as peppermints, banksia etc. and cleaning up and burning off all the debris."*

As proof of his assertion, Richardson included in the report a photograph of regrowth tuart, saying *"Plate numbered 9 shows the young growth of tuart that has grown up on an area cut out in the early days of the timber industry, and proves how rapidly this species will reproduce itself even when exposed to fire, unrestricted grazing, and other disadvantages."*

3. The Consultant Comes

*As who should say, 'I am Sir Oracle
And when I ope my lips let no dog bark!'*

William Shakespeare, The Merchant of Venice, 1596-8

In 1914, the government of Western Australia invited an eminent British forestry consultant to visit, and report on the state of the forests. David E. Hutchins was highly regarded in his day, having graduated from the famous École Nationale des Forêts et d'Eaux at Nancy, in France. He had experience in India and South Africa. In both places he had done his best to eradicate burning and grazing in forests by the native people, seeing it as primitive, and not to be tolerated in 'scientifically managed' forests (Pyne 1991, 1997).

The École Nationale des Forêts et d'Eaux was an interesting establishment, established in 1824. Students were encouraged to regard themselves as an elite corps of forest officers. Cadets wore cloaks, carried swords, and did parade ground drill. French nationals received a commission in the army on graduation. The Indian Forest Service, established by the British in the 1860s, trained some of its early officers, including Hutchins, at Nancy, since Britain had no forestry school at the time. Perhaps as a reaction against incendiarism of aristocrats' forests during the French Revolution of 1789, cadets at Nancy were taught that fire was the enemy of foresters. They carried this message to India, and eventually to Western Australia (Pyne 1991).

Hutchins travelled briefly around the south-west of the state in 1914, wrote his report in New Zealand in 1915, and it was published in Perth a year later (Hutchins 1916). The style is authoritarian. He recommended a quasi-military Forests Department, headed by a professional forester. In line with his South African experience he proposed that Forest Rangers should be "*armed soldiers of the state*". He recommended as Conservator a promising young man called Charles E. Lane-Poole, who had served under him in South Africa, and was a fellow graduate of Nancy.

From today's perspective some of Hutchins' recommendations are quite bizarre (Ward 1999a). For example, he regarded the native jarrah forest as unproductive, and recommended that it be underplanted with exotic pine trees, so giving both softwood and hardwood from the same forest. True to his Nancy training, Hutchinson declared fire to be anathema, and believed that the shady pine trees would help to keep fire out of the forest. Possibly they would in northern France, but anyone who has seen a pine tree explode in flames on an Australian summer day would be very wary of spreading them throughout the jarrah forest. He proposed widespread grazing by pigs, cattle and deer in the jarrah forest, and the introduction of pheasants to provide shooting for tourists from England. As a shooting man, it is surprising that Hutchins seems to have been unaware of the burning done on English and Scottish estates to increase grouse populations.

The depth of Hutchins' understanding of south-western Australian forests may be judged by his statement that "*Owing to the absence of the hot winds of Eastern Australia and the comparatively light nature of the undergrowth in the forests of Western Australia, fire protection is easier there than in other fertile parts of the*

Australian continent. The Karri forest in its natural condition does not burn, nor does the drier inland forest.”

Anyone familiar with the hot easterly winds of summer in south-western Australia will conclude that Hutchins was somewhat inexperienced in local conditions. The “*light nature*” of the undergrowth that he saw was due to it being burnt every three years or so. (See Harris & Wallace (undated) where they say “*It should be remembered that there was virtually no forest area at that time which carried more than 5 years’ leaf litter and the greater part varied from 1 to 3 years. It appeared that virgin forest did not accumulate litter to any marked extent and subsequent accumulations of litter and scrub in protected compartments could not have been envisaged.*”)

The fire exclusion which he advocated eventually led to dense undergrowth, with dead litter loads of over 30 tonnes per hectare, even excluding logging debris. A summer fire in such fuel cannot be suppressed by any human means, only by heavy rain. Further, anyone who, like the writer, has seen fire fifty metres up in karri crowns will be rather interested to learn that karri will not burn.

Although Hutchins had clearly been informed of the traditional burning activities of the Aborigines¹, yet he believed that European “*science*” could do better. It was simply a matter of “*organisation*” (Hutchins 1916). Hutchins made little mention of the tuart forest, but his general opposition to fire, and blinkered belief in the infallibility of “*science*” were shared by his protégé, Charles Lane-Poole.

4. The Conservator from Nancy

“Much of what is taught at university, and the manner of teaching, amounts to little more than technical training and thus, however necessarily, curtails full intellectual development.”

Colin M Turnbull, *The Human Cycle* (1983)

Charles Lane-Poole was only 31 years old when, on his mentor’s recommendation, he became the first professional Conservator of Forests for Western Australia. He came from a talented family. His brother became an admiral, and founded the Australian naval academy at Jervis Bay. His father, Stanley Lane-Poole, was Professor of Arabic at Trinity College in Dublin. Charles was educated at St Columba’s College, and gained a place by competitive examination at the French forestry school at Nancy (Nairn & Serle 1986).

Lane-Poole had never been to Australia before, and had no first hand knowledge of Australian bush fire hazard, behaviour and effects. His views on fire may well have been influenced by Hutchins, who was his mentor in South Africa, and by the conclusions of the French chemist Professor Henry, of Nancy, who believed that forest humus had the power to fix free nitrogen from the air². This “*scientific*” finding

¹ “From an unknown period the Australian forest has been subject to the fires of the Blacks, fires lit for the purpose of providing food and hunting-grounds for the game... The general use of fire by the Australian mainland blacks has, I believe, never been questioned.” (Hutchins 1916)

² Henry was wrong, humus cannot itself fix nitrogen, and it creates more acid conditions which can immobilise nutrients. Nitrogen fixation occurs through bacteria and cyanobacteria which live in the

was enthusiastically embraced by the Indian Forest Service, under the aegis of the three successive German Inspectors-General, Dietrich Brandis, Wilhelm Schlich, and Berthold Ribbentrop. Richard Grove (1995) refers to the Indian historian Guha (1983), who attributed to Brandis “*many of the foundations of a ‘scientific’ ideology used to conceal straightforward consideration of the imperial need for raw-material resources.*” Since Indian villagers were not “*scientific*”, their views on fire were brushed aside (Slym 1876, Slym & Hill 1881, Shebbeare 1928). Both Hutchins and Lane-Poole had a similarly arrogant view of indigenous Australian fire knowledge and practice.

In sharp contrast to von Mueller’s comments of 1879, and Richardson’s comments in 1910, Lane-Poole’s first Annual Report to Parliament in 1916 mentions “*serious forest fires*” and makes the comment “*Annually a great part of the forests is swept away by fires and vast quantities of young and old timber are destroyed.*” His European education had not prepared him for the realities of the West Australian summer, when fires can occur quite frequently by lightning, quite apart from those caused by humans. There was no capacity to suppress fires in remote parts of the forest in those days, when horses and bicycles were the main means of transport. There are descriptions of fires trickling through the jarrah forest for months, flaring up in hot spells. For example, “*... it is not unreasonable to assume that the forest was completely burnt through every 2-4 years. Even as late as 1925 the writer was able to observe three fires of this nature in unmanaged virgin forest east of Jarrahdale. These fires were alight in December and continued to burn until the following March.*” (Wallace 1966).

In the summer of 1916/17 Lane Poole had some respite from fire, due to above average rain in the winter and spring of 1916, and also due to the absence on military duty of most young men. During this first year he seemed to have learned a few facts about scrub growth and litter accumulation in eucalypt forests. He realised that the “*light nature*” of the jarrah forest undergrowth described by Hutchins was actually due to frequent burning, and that, in the absence of fire, eucalyptus leaf litter, dead sticks and seed capsules tend to accumulate, and undergrowth to thicken³. In the 1917 report he warned “*If next summer happens to be a normally dry one, however, the added collection of dead leaves and twigs and the increased size of the undergrowth are likely to cause serious fires.*”

Due to World War I, any mention of fire and weather was censored from the 1918 Annual Report for fear of giving aid to the Germans. After the war, in 1919, we hear that “*As predicted in the report for 1917 the summer of 1918-1919 proved a destructive one from a fire point of view ... 200 acres of tuart re-growth 3 y.o. destroyed ...*”. It seems likely that some locally born Australians tackled Lane-Poole about his views on fire, as he mentioned that “*There are a few residents in the country who insist that fires do good to the forest ...*”. People who lived and worked in the bush knew then, as they do now, that for a few winters following a fire, there is a spectacular burst of green growth and flowering, due to the effect of heat and smoke

soil, and are favoured in the first few years after fire by the more alkaline conditions due to cations in ash (Kozlowski & Ahlgren 1974, and many others)

³ This thickening of the undergrowth is only true for a number of years, depending on species, soil and rainfall. Prolonged absence of fire, for decades, can lead to a thinning of the undergrowth due to senescence and nutrient lock-up in the dead matter (see Kessell’s observations below)

on seeds, the release of nutrients in ash, and increased nitrogen fixation by soil bacteria.

By 1919 Lane-Poole had No. 1 State Forest (tuart at Ludlow) “*under protection*” from fire. He proposed legislation to exclude fire from all state forest, but the clause was struck out at the political level, probably by Sir James Mitchell, then Premier and Minister for Lands. Mitchell, and his close friend Hal Colebatch had, in April 1919, toppled the Lefroy government which opposed forest clearing for soldier settlement, and Mitchell became premier in May 1919. He and Colebatch were, at that time, about to initiate the ill-starred “*Group Settler Scheme*”, under which migrants would be encouraged to settle on forest blocks, clear them, and presumably burn the debris.

The Annual Report for 1920 contains no mention of fire, which is odd in view of Lane-Poole’s vehement views. Possibly he realised that his job was in peril, and wished to avoid clashing again with the politician who had struck out his fire exclusion clause in the previous year. He does, however, raise a regeneration problem in tuart. “*From a sylvicultural point of view the tuart country presents some difficulty, as regeneration does not follow in so prolific a way as in the jarrah and karri forests.*” From later statements he illogically thought that further fire exclusion would solve the problem.

His identification of a tuart regeneration problem is intriguing in the light of his 1919 report on the destruction by fire of 200 acres of 3 year old tuart regrowth. Presumably this regrowth had germinated in 1916, before fire exclusion was imposed on State Forest No. 1. His identification of a regeneration problem is also in sharp contrast to the statement by C.G. Richardson in 1912 that such regeneration was a simple matter. In Richardson’s day, the tuart forest had been both grazed and burnt for many decades.

In the Annual Report for 1921 Lane-Poole seems agitated and repetitive. He returns to the theme of fire. Referring to the forest in general, he said “*The general condition of the forests is decidedly bad ... Seventy-five years of practically uncontrolled cutting and entirely uncontrolled burning have reduced this national asset to such a condition that only a negligible quantity of sound, young trees is growing to the acre on the portion which has been cut over.*” He announced that “*The department has already laid down its scheme for preventing fire in ... the Tuart belt and Working Plan No. II.*” With regard to tuart regeneration he alleged, somewhat wildly, that “*The regeneration in State Forest No. 1 is improving, definitely proving the contention of the writer that the entire absence of regeneration for the past 50 years is due to grazing and fires.*” In fact there had been tuart regeneration, as described and photographed by Richardson.

He had clearly had further arguments with others, probably locally born staff, on the role of fire in tuart regeneration. It seems that locals had pointed out to him that fire is needed for plentiful eucalypt germination, for he testily remarked that “*The general belief current in the timber areas that fires cause a good germination of trees of the eucalypt family (sic) through the mere roasting of the seeds is erroneous, as the seed falls, as a general rule, after the fire season is over.*” Lane-Poole was partly right, but ignored the effect of fire in opening the capsules to release the seed; the possible effect of smoke on seed while still on the tree; and the effect of seed falling into a

nutrient enriched ash bed, free of seed-rotting mould spores. He admitted that ash may inhibit the movement of ants, so preventing seed theft before germination. The bud cutting weevil continued to be a “*serious problem*”.

Further on the tuart regeneration theme, Lane-Poole stated “*Tuart: The causes of the complete failure of regrowth during the past forty years are discussed in the working plan report in full. Grazing and the associated fires are held to be the prime causes ... Fires must be kept out at all costs ... Fires are the worst enemy of the forest ... The tuart cutting beetle, which has been identified as **Haplonix tibialis**, was observed at work by Mrs. C.E. Lane-Poole.*”

It seems that Lane-Poole knew the 1921 report was his swan song, and he took a Parthian shot at the body politic which had frustrated him. “*The afforestation policy of the State, once embarked upon, should be as little as possible liable to be disturbed by political changes or moulded by political pressure.*” He resigned shortly after, and took up a position with the Commonwealth Government. His subsequent career was distinguished, including the founding of an Australian Forestry School in Canberra.

5. The Conservator from Oxford

A self-made man is one who believes in luck and sends his son to Oxford

Christina Stead, Australian novelist, 1902-1983

Whether his father was self-made or not, Stephen Kessell was a forestry graduate of Adelaide and Oxford Universities, and at 24 years old, he succeeded Charles Lane-Poole as Conservator of Forests. In the 1922 Annual Report Kessell gives a brief account of the circumstances surrounding Lane-Poole’s resignation, and continues the fire exclusion theme, proudly stating that for the Tuart Working Circle, “*The only fire which entered the plantation burnt about 20 acres of grass ...*”

Kessell was, however, observant, and willing to consider contradictory information. He noted that in an area near Hamel Nursery which had not been burnt for 20 years “*... the density and height of the undergrowth is less than on an adjoining plot which is burnt practically every year. A large percentage of the jarrah is forked low down for some unknown reason...*”

This was, of course, directly contrary to the rigid Nancy doctrine that fire impoverishes soil, based on the findings of Professor Henry. We now know that fire can, on some soils, raise soil pH, and so enhance soil bacterial activity and nutrient availability (Kozlowski & Ahlgren 1974, Ellis 1994). A good local example of this is the enhanced growth of zamias (*Macrozamia riedlii*) after fire, due to increased nitrogen fixation by cyanobacteria in the roots. Zamias can fix up to 35 kg of nitrogen per hectare during the first 5 to 7 years after a fire (Grove *et al.* 1980). Zamias used to be common in the tuart forest, but were destroyed in grazing leases because they cause rickets in cattle. A common and simple method of eradication was to drip kerosene in the middle of the plant (Mr. Stan Gratte, personal communication).

Kessell was more flexible in his attitude to fire than his predecessor. He recognized that total fire suppression was impossible, due to the slow decay rate, in a dry climate,

of nitrogen-poor dead leaves, twigs, bark and logging debris. He recommended the disposal of logging debris by spring fires. In the 1923 Annual Report, following a conference with field staff at Mundaring (Brockway 1923), he made a significant observation on the fire fighting methods of the day. *“Direct beating was the chief method employed in fire fighting, for which healthy young red gums proved the best weapons.”* Beating with green branches is only effective on fires with an intensity of 500 Kw/metre or less (personal communication, P. Cheney) - in other words a fire that most people can jump over.

Red gum, or marri (*Corymbia calophylla*) leaves are larger and juicier than those of jarrah (*Eucalyptus marginata*), and the settlers probably learnt this trick from the natives, who used *“large green boughs”* (the tops of marri saplings?) to prevent fire entering thickets they wished to conserve (Stokes 1846). As Kessell soon found out, this method was only possible where flame heights were low due to an accumulation of only a few years litter. With fire exclusion, litter began to pile up, and green boughs proved somewhat inadequate. Anyone who proposed tackling a wildfire with green boughs today would be regarded as somewhat eccentric, at least by those with any experience of fighting present day fires in heavy fuels.

In 1923 Kessell makes the first mention of peppermint (*Agonis flexuosa*) as a potential problem. *“The relation of the lower storey of peppermint to the tuart is at present unknown. Fires resulting in excessive coppicing of the peppermint have resulted in dense thickets of this species with a root formation in places resembling the so-called mallee roots. However, until the problem of obtaining satisfactory regeneration on the numerous open spaces which do exist has been solved, there is no justification for attempting to deal with the peppermint thickets. Grazing and fire control will go far towards solving the problem, but plentiful regeneration would seem to be limited to a heavy seed year, which up to the present we have not experienced since the forest has been protected.”*

With regard to fire, grass and peppermint, it may be interesting to consider the remarks of Mr. Lew Scott, talking in an interview about grazing leases on the south coast (Smith 1994). *“It was 1926 when I first went to the coast... native grass in those days, you don't see it now”*. In answer to the question *“Why do you think the native grasses have gone?”* he said *“Because it's not burnt, you have to burn to get native grass ... you would light it up at about ten o'clock in the morning and three or four o'clock it would all go out, the next day you would light it up again. The bush was alive with possums and wallabies and kangaroo rats [it] only went slowly ... it was only a little fire, it never used to get up in the trees and burn the possums ... Well, as I see it the real oldies followed the burning patterns of the natives in keeping the place green ... If we can assume, and we did talk to our grandfathers, the black man did burn 365 and one quarter days a year because [it was] his hunting tool, his biggest hunting tool – and so our old boys learnt a lot off them and learnt to burn – not great destructive fires as they go in for nowadays, but learnt to burn little patches, that they wanted for their existence the same as the blackfellow – of course not winter and not spring – because you kill all the little birds and animals – and so summer burning, that was the authorized thing ...”* *“And since the burning's been reduced, or cut out altogether, there's been some plants that have thrived and changed the appearance of the landscape?”* *“Well the earliest sketches, of this country, we have early sketches – and of course in the earliest photography with box-type blanket over your head*

*cameras – pin hole cameras – the country was much grassier – and far, far less of one obvious thing – the banksia, or similar – the parrot bush – hard to say because he’s difficult – but the terror called *Agonis flexuosa* – I mean there was one every – in those days of course acres – now there’s one million per acre ... peppermint – the peppy has shrouded out the grasses... ”*

Only 5 acres of tuart in State Forest No. 1 were burnt in the summer of 1922/23, but the summer of 1923/24 was hot and dry, and, according to Kessell, incendiarism was rampant, with deliberate attempts to burn out the protected forests. The protection of the tuart in State Forest No. 1 held fast, with only 6 acres burnt, despite fires all around. Kessell, however, noted an ominous change in fire behaviour.

“In previous years the method employed to extinguish fires was direct beating with bushes, and great success attended such efforts. In the season under review, however, the conditions were more difficult, due to the increased inflammability of the bush, through protection, the exceptionally dry summer, and the strong easterly winds experienced. During the first two months of November and December, the old method was employed, and direct beating found again successful. As the season progressed, however, the conditions became more difficult (owing to the increased inflammability of the bush) and many fires, after having been beaten down and swept in the old way, were found to break out again.”

We can detect a change in attitude to fire by Kessell, as he allowed his staff to do some deliberate burning, probably on the advice of older, experienced field staff. *“In order to reduce fire hazards, preliminary burning was carried out around all centres of bush working ... ”*

There was selective logging of tuart in State Forest No. 1 in 1924. The logging debris was burnt, probably in summer or autumn. That summer there was a heavy crop of seed on the tuarts, and *“in May 1925 an excellent natural regeneration appeared on the burnt areas.”* The heavy tuart seed crop was the first since 1918. It is not clear in the report whether the heavy seed crop was after a preliminary *“Group Selection”* burn, or not.

Kessell revisited the subject of ants removing seed, and suggested the following reasons for enhanced tuart germination after fire: *1. Fire destroys competition. 2. Fire destroys insects. 3. Fire dries capsules and releases seed.* He even talked of the need for running fires through the whole forest from time to time.

The 1926 Annual Report gives the area of tuart State Forest as 6091 acres, of which only 2 acres were burnt by wildfire. However, 1029 acres were treated by the *“Group Selection Method”* in that year. As mentioned above, this implies that the *“treated area”* was burnt twice within the space of a year or so. The first burn was to reduce litter fuels and ease access - although this was more likely in the jarrah, than in the open tuart forest of those days. The second burn was to get rid of logging debris.

In 1927 there were no wildfires in the protected part of the tuart forest, but *“... 15,000 one-year seedlings resulting from dense natural regeneration surviving on ash-beds were transplanted to adjacent open spaces where natural regeneration had*

failed.” The ash beds must have been either from the previous year’s small wildfire, or, more likely, from the extensive “*Group Selection*” burns.

In 1928 Kessell reported that *“In previous years it has been noted that natural regeneration of tuart survived only on ash beds resulting from the burning of old logs and trees.”* He had given some thought to eucalypt germination, and heat penetration of soil. *“Preliminary tests appear to show that sand is remarkably uncondutive, it being necessary to have a heavy fire burning for three and a half hours before temperature at 4 inches depth reaches over 60⁰ C. In a loam soil, however, while leaf litter and ordinary scrub when burnt will not affect soil temperature at 4 inches, a dead limb burning on the ground quickly raises the temperature at 4 inches to over 70⁰ C.”*

In 1929 Kessell was still worried about the lack of tuart regeneration. *“There has been little or no natural regeneration for several decades, and it is difficult to say how far frequent burning and over-grazing have been responsible for some change in the factors of the locality ... the problem of securing regeneration of this species is proving very difficult of solution.”*

His ideas on fire protection by deliberate burning were still evolving, but he seems, by this stage, to have accepted that widespread, regular burning was the only solution. Probably as a result of discussions with experienced field staff, he concluded that *“The solution of the whole question of fire control is bound up with the establishment of resident workmen throughout the forest, each man looking after a defined area which he knows thoroughly, and on which he can choose the best times for carrying out controlled burning.”* This emphasis on intimate local knowledge of vegetation and terrain sounds remarkably close to the traditional burning by Aboriginal people before Europeans arrived, and the burning by early white settlers who were familiar with those traditional methods.

Yet, in the 1930 Annual Report, Kessell returns to blaming fire and grazing for the lack of tuart regeneration. *“Excessive grazing and frequent burning of the Tuart forest have created abnormal conditions which render the regeneration of the species extremely difficult. The understorey of Peppermint which coppices very vigorously after a fire, has spread until parts of the forest are covered with dense thickets.”* He seems to have missed the point that more frequent burning of peppermint would tend to keep it as a low shrub, rather than as a tree. Thicket formation by peppermint is favoured by long intervals between fires.

By 1975 little progress had been made in understanding the tuart forest as an ecosystem. In a booklet *“Forestry in Western Australia”* (Anon. 1975) we learn that *“A fire assists in obtaining a general seedfall”,* but that *“The establishment of seedlings is a haphazard process of which the story is only partly known. Very little regeneration is found in the tuart forest and has not been apparent for many years. Seedlings generally die before they reach any appreciable size, and those that survive do so on an ashbed where a heavy pile of debris or a log has been burnt. Limited research indicates that the story is more complicated than this. Nursery stock planted on sites where they are free from competition from established seeds have developed quite satisfactorily.”*

6. Botanist, Conservationist & Noongar: Some recent comments on tuart

I shall light a candle of understanding in thine heart, which shall not be put out

The Bible

In the 1920s and 1930s decline of tuarts was noticed in King's Park. The eminent botanist Dr. J.S. Beard noted in the 1960s that, out of 84 tuarts, 42 were either completely dead, or died back to the base. He suspected links with logging and fire. In a paper in the WA Naturalist (Beard 1967), he said "*Basically the trouble is an inability to restore foliage lost through bushfire or borer attack, which suggests a weakening of the tree by some other cause*". He suggested the following scenario:

1. *Early settlers opened the canopy by felling jarrah. This stimulated the understorey.*
2. *Fires became less frequent but more destructive due to more fuel and so damaged the eucalypt canopy more.*
3. *The canopy was progressively more and more opened, and the undergrowth became denser and thicker between fires.*
4. *Eventually the increased number of understorey trees came to compete for moisture in summer with the eucalypt dominants which died back progressively.*

Beard also commented that "*It has been found in studies of tuart regeneration in the forest at Ludlow (Mr. G.E. Brockway, private communication) that the species will regenerate vigorously on ashbeds, but is soon susceptible to the competition of established surrounding trees and declines as in King's Park. In open, cleared plots, however, young tuart will continue to make good, healthy progress.*" Early travellers described the tuart forest as open and grassy. In Lt. Henry Bunbury's journals, published in 1930 by a descendant, there is a description of emerging from thick spearwood swamps into "*an undulating Tooat country of considerable extent, with plenty of grass*" (Bunbury & Morrell 1930, in Hallam 1975). This was in 1837, when Bunbury was travelling south from Perth to the Vasse, or Busselton as it is now known. At the same time, it should be noted that Noongars protected good spearwood thickets (*wattan*) from fire (Kelly 1998) to allow the shafts to grow straight and long (Personal communication, Mr. Jo Wally).

Some, but by no means all, conservationists are aware of the key role that traditional Aboriginal burning has played in the evolution and maintenance of Australian ecosystems. For example "*The ecological balance in Fraser Island's magnificent forests has been upset by the failure to adopt, let alone implement, a fire management plan. If a wildfire were to occur now, Fraser Island would be an ecological disaster. For eons the ecology has evolved and adapted to traditional Aboriginal burning, but most of Fraser Island has not been control-burned for more than 20 years and significant areas have been fire free for over 40 years. This is resulting in a loss of biodiversity, through a reduction of habitat for most of the fauna and an altered floristic composition. The island has developed a dense shrubby understorey and grass is now much sparser with a consequent reduction in the population of kangaroos, wallabies and many small mammals and, as a result, dingos.*" (Sinclair 2000).

A few years ago, under the Regional Forest Agreement process, a survey of Aboriginal opinions on forest management was carried out by a team from Edith Cowan University in Perth (Black 1997). A Noongar Elder interviewed at Busselton said:

“There are areas that CALM does not burn. The tuart forest is an important example. Noongars regularly burned in young forests. This should have been done all the time as tuart forests need to be burnt. Now this cannot be done, because the old growth would be burnt out. The forest is now a museum piece, as when those old growth trees die, there will not be any young tuart trees to replace them.”

7. Tuart Forest Fire History from Grasstrees

*Oh wrangling schools, that search what fire
Shall burn this world, had none the wit
Unto this knowledge to aspire... ?*

John Donne 1572-1631

Over the past few years a technique has been developed which gives reliable fire history data from fire and growth marks on the stems of grasstrees (*Xanthorrhoea* spp) (Ward 1995, 1996, 1997, 1998a, 1998b, 1998c, 1999a, Ward & Sneeuwjagt 1999b, Ward & Challinor 1999c, Lamont *et al.* 1999a, Lamont & Ward 1999b). From April to June 2000 a survey of grasstrees in tuart forest in Yalgorup National Park was carried out. Selection of grasstrees for sampling was opportunistic rather than random or systematic. Tall grasstrees in good condition are rare. However, good coverage from north to south of the park is evident in the map shown in Figure 1.

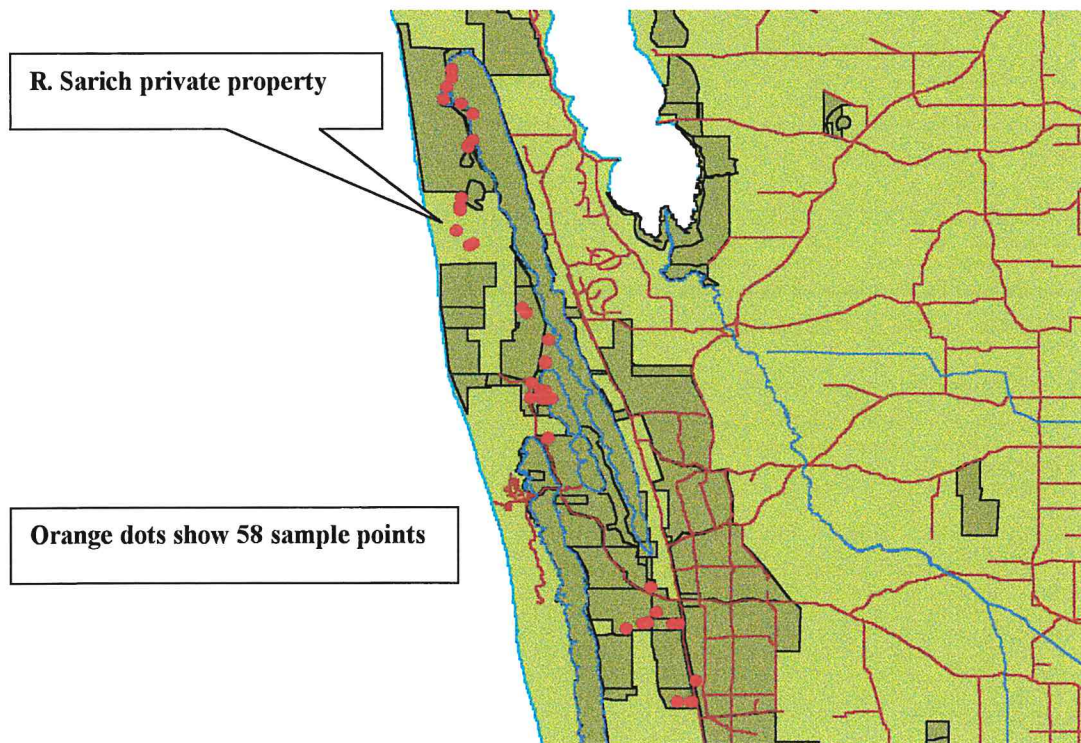


Figure 1: Map of Yalgorup National Park and adjacent private property

From the sample of 58 grasstrees, spread from north to south, information was obtained on 533 fires occurring between the years 1809 and 1999. The simplest way of looking at fire frequency is to plot the number of fires per decade. This is shown in Figure 2, comparing the National Park with some adjacent private property. Both areas were grazed up to the 1960s, but burning on the private property seems to have continued a little longer. In the present decade, the Shire of Mandurah has banned all burning (personal communication, Des O'Brien). The median is used as a more appropriate measure of central tendency for skewed data than the arithmetic mean.

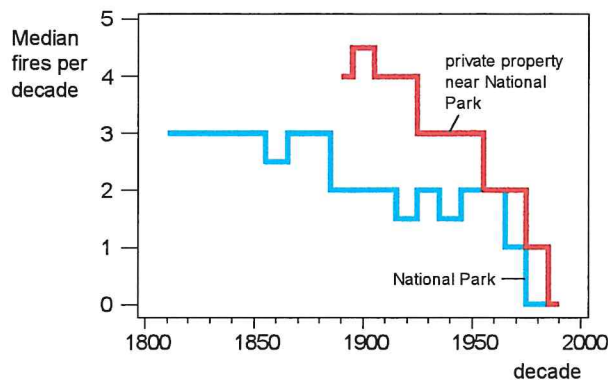


Figure 2. Fire frequency on grasstrees at Yalgorup

A more sophisticated way of looking at the data is to consider thatch age. Pooling the data from private property and National Park yields 3139 estimates of thatch age, ranging from 1 to 77 years. A survival chart for grasstree thatch divided into different eras is given in Figure 3. This shows the percentage (y-axis), within each era, of grasstrees that could be expected to remain unburnt for more than a given number of years (x-axis). For example, in the era 1800-1899 very few survived beyond 15 years. In the 1990s, nearly 50% survived for over 20 years, and some for nearly 80 years.

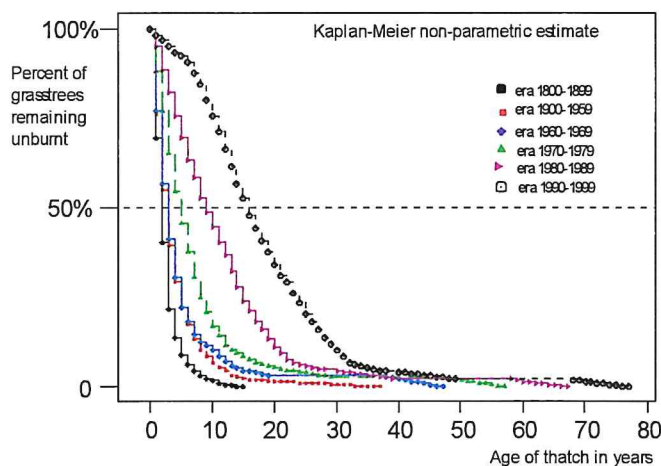


Figure 3: Survival Chart for Grasstree Thatch at Yalgorup

A third way of interpreting the data is to use pie-charts, and managers may find these the most practical. The two pie-charts in Figure 4 show the situation in the 19th century, compared with the situation in the 1990s. Again, private property and National Park data are pooled. It will be seen that the percentage of grasstree thatches less than five years old has changed dramatically.

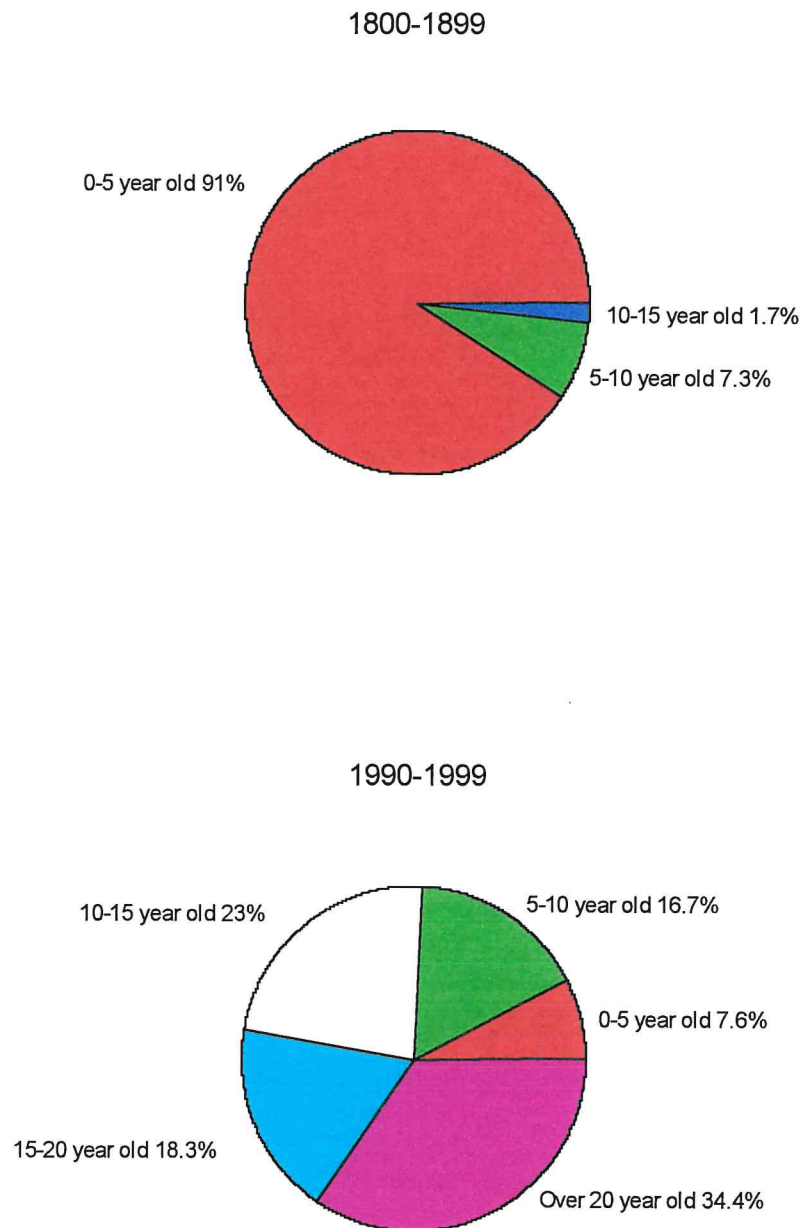


Figure 4: Proportions of various grasstree thatch ages from 1809 to 1999

A fourth way of presenting the data is to use median fire intervals. Figure 5 shows these, separated into private property and the National Park.

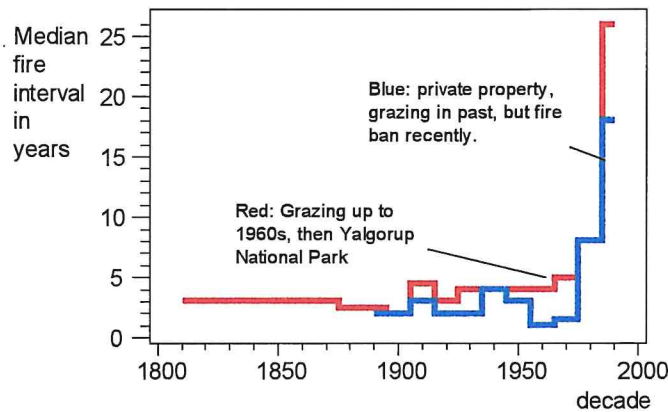


Figure 5: Fire intervals on grasstrees at Yalgorup

8. Discussion

With regard to research, the tuart forest has always been a cinderella compared with the other forest types of the south-west. Yet the prognosis for tuart is gloomy if present trends continue. Already parts of the former tuart forest could now be more realistically described as a peppermint thicket with some dying tuart.

Much emphasis has been placed by some researchers and conservationists on the role of exotic weeds in reducing biodiversity, yet there is an urgent need for research into some native plants which can behave like invasive weeds given a change in fire regime to less frequent, and therefore fiercer, fires. Peppermint is one of these. Others are Rock Sheoak (*Allocasuarina huegeliana*) in the wheatbelt, and both Parrot Bush (*Dryandra nivea*) and Bull Banksia (*Banksia grandis*) in the jarrah forest. They all seem to reduce biodiversity by invasion and smothering of other native plants in long inter-fire periods. We should investigate the possibility of allelopathy.

Further research in Yalgorup National Park could shed some light on ways of dealing with “native weeds” in other forest types. Restoration of traditional Noongar fire regimes seems to be the most likely answer, but we need to move carefully. We need to learn a wider range of fire techniques than we use at present. For example, at Yalgorup, instead of broadcast burning, we should try hand-burning of narrow strips from east to west, aimed at a lake or coastal dune. Swamps and sword-grass areas need careful consideration as animal refuges. Rangers should be encouraged to use their local knowledge, and burn small areas opportunistically, in harmony with season, landform and the biota. Where traditional Noongar owners can be identified, and have knowledge to contribute, they should be paid to become involved in the fire management of the park. Some present or former grazier families may have useful advice to offer.

The study involved close inspection of many grasstrees. There is a serious conservation problem looming with these plants. Following unprecedented periods without fire, thatch loads are massive, and the stems are rotting underneath. Termites are exploiting the dark, humid conditions under the thatch to build mud tunnels up to, and into, the crown. Also many young grasstrees are dying, apparently due to shading or other competition from peppermint. While there are plenty of grasstrees still in Yalgorup National Park, the possibility of a mass collapse of the population cannot be ruled out if fire exclusion continues. There will also probably be some deaths of older grasstrees if they are now burnt, due to the inevitable ferocity of fire in massive thatch loads. However, the survivors will flower and seed, so helping the regeneration of the population (Ward & Lamont 2000). This problem of grasstree rot and termite attack is common in other long unburnt areas, such as John Forrest National Park, and Amphion Block at Dwellingup, unburnt since 1931.

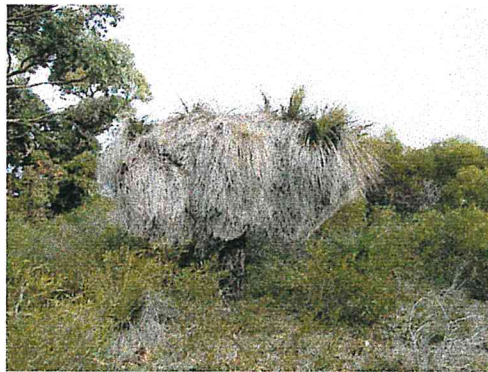
Having spent several months working in Yalgorup National Park, I believe that it is, at present, a potential death trap for tourists and fire crews in summer. The peppermint thickets and vast grasstree thatches will, in a summer wildfire, burn like napalm. Narrow tracks through areas of dense peppermint give no opportunity to turn a vehicle around should a wildfire occur. To go off the track would lead to bogging in sand. I believe that the park should be closed to the public in the fire season, until the thickets and ground fuel loads can be reduced, or at least broken up by tactical patch and strip burning. There is an urgent need for the creation of frequent turn-around points on all tracks.

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Appendix 1: Some photographs from Yalgorup



Photograph 1: Massive thatch on long unburnt balga at Yalgorup National Park. Note dead & unthrifty heads. A fire now would probably kill this grasstree.



Photograph 2: Young balgas dying in peppermint thicket at Yalgorup National Park. Are these early deaths due to shade or root competition?



Photograph 3: Dead tuarts & long unburnt balga at Yalgorup National Park.



Photograph 4: Healthy tuart seedlings germinated by fire 4 years previously.



Photograph 5: Fire and annual growth marks on balga.



Photograph 6: Long unburnt balga with thatch removed to show rotting.

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