

# Resolving the Grasstree Fire History Dispute for the Benefit of both Nature and Humans in Western Australia



A cleaned grasstree at Beekeeper's Reserve, Eneabba

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BAppSc (maths & biology), MHumanEcology (Brussels),  
IntCertHumanEcology (WHO & UNESCO), GSM (Cyprus)

*A pro bono* report to the Hon. Mark McGowan MLA, Minister for the Environment, Western Australia, as a supplement to the contract report 'Dating Fires from Balga Stems: The Controversy over Fire Histories Determined from south-western Australian *Xanthorrhoea*' by Dr Malcolm Gill, BAgSc, MSc, PhD, OAM, for the Department of Environment & Conservation, Perth, August 2006

**August 2006**

## Summary

The Conservation Council of WA is an environmental pressure group. Its voice on fire and forests is Dr Beth Schultz. In a 1996 Conservation Council Policy Statement on fire<sup>1</sup>, more research into Aboriginal burning was suggested, with the findings incorporated into fire protection and management policies to ensure they 'are ecologically sustainable'. Over the past ten years I have investigated the history of bushfire in south-western Australia, including Aboriginal burning, through fire marks on old grasstrees. Some of these date back to the 1700s, well before Europeans settled on the Swan River in 1829. They show regular and frequent (2-4 year) burning in the dry jarrah, tuart, and wandoo forests, and the *Banksia* woodlands north of Perth. There is strong historical evidence that this is true. However, Dr Schultz has long seemed unhappy with the results. In 2003 she made a public attack on the grasstree results, in a statement to a Parliamentary Committee. The statement was demonstrably misleading.

In 1999 I was invited, by Professor Lamont (Curtin University), and Professor Enright (Melbourne University), to clean some grasstrees in *kwongan* heath, and report on their fire history. I found the growth rates to be more variable than those found further south. The fire dates were, therefore, less accurate. This led to a paper<sup>2</sup>, suggesting the grasstree technique is unreliable, and rashly extrapolating the criticism to all grasstree results for southwestern Australia.

In 2006 DEC organised a colloquium on the topic. I believe Dr Schultz was one of those who called for such a meeting. Both I and Professor Enright presented our evidence. I presented evidence from grasstree stems, and historical evidence of frequent fire from older people. Professor Enright concentrated on his seed bank model calculations. The colloquium was chaired by Dr Malcolm Gill, formerly of CSIRO in Canberra.

Dr Gill has produced a contract report on this colloquium. He suggests that the grasstree technique be independently scrutinised, but seems to accept the seed bank model as correct. While I welcome independent scrutiny of the grasstree technique, Dr Gill's suggestions lack balance, in that no independent scrutiny of Professor Enright's model is suggested. He downplays local knowledge on past fire frequencies. Dr Gill's suggestion on how to check the grasstree work suggests a lack of practical understanding of the time and cost involved.

We may note that both Dr Gill and Professor Enright were co-authors of the Esplin Report into the Victorian Bushfires of 2002-3. This report recommended that more attention be paid to local knowledge. There is much local knowledge for the *kwongan* and the jarrah forest, yet investigation of this was only the last of Dr Gill's suggestions. Experts in landscape ecology say that an understanding of history is a first essential in understanding landscape processes. Fire is a landscape process.

In this report I offer different suggestions from those of Dr Gill. I believe they are more practical; more likely to get to the heart of the matter; and cheaper. In three appendices, I offer some local information on the *kwongan*, and on the jarrah forest, to show the rich potential for further work in this field. Such information is of direct use to field managers, and is an astringent reality check on untested, and potentially risky, botanical theories on fire.

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<sup>1</sup> Fire in the Natural Environment. Policy No. 50, January 1996. Conservation Council of WA, Perth.

<sup>2</sup> Enright *et al.* (2005) Anomalies in grasstree fire history reconstructions for south-western Australian vegetation. *Austral Ecology* **30**, 668-673.

## Preface

Some history is misleading, some is richly informative. To reject all bushfire history as mythology is false induction<sup>3</sup>, something which scientists should always try to avoid. We do not reject all science as mythology, just because some papers published in refereed journals are misleading. Many of them are correct and informative. However, we should constantly question both history and science, and seek cross-checks. Some would see this as the central task of both science and humanities.

In Australia, over the past few decades, a polarisation has arisen over bushfire, especially the practice of prescribed, or controlled burning. On one hand, some environmentalists and academics say that regular controlled burning is harmful to nature. On the other, most experienced fire managers, fire fighters, and land owners say that regular controlled burning is essential if we are to avoid uncontrollable bushfires, which threaten both humans and nature. Rural people, who may be killed by bushfire, tend to support regular prescribed burning. City people, inconvenienced by slight smoke from prescribed burning, tend to oppose it. In Western Australia, some older people remember the frightening ferocity of the fires at Dwellingup, and elsewhere, in 1961. I was not present, but have a relevant historical link, which may surprise those unfamiliar with the history of fire in Mediterranean lands.

In the late nineteen-fifties I was sent, as a teenage soldier, to Cyprus, where the British Army was on active service against EOKA terrorists. I served in the Troodos Mountains. Fresh in the memory of some of my older comrades was a ferocious forest fire in those mountains a few years before, when 19 soldiers were killed, and another 18 seriously burned. As usual in war, each side blamed the other. EOKA said the fire was due to army mortar bombs; the army blamed arson by a fleeing group of terrorists. The basic cause was the foolish planting of large, continuous areas of Turkish Pine (*Pinus brutia*) on steep rocky slopes, which were tinder dry in summer. These plantings, dating from before the First World War, replaced the former native *maquis* and *garrigue* scrub, which burned frequently and mildly, in small patches, due to deliberate ignitions by shepherds promoting fresh growth. Much of the hostility to British rule in the mountains was caused by this ban on traditional grazing and burning. The fire and grazing ban, and the pine plantations, were largely due to the advice of a British Colonial forester, Sir David Hutchins<sup>4</sup>. The same forester visited Western Australia in 1914, to advise the government on forestry and fire. He recognised that '*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. With the advent of the Whites, the fires have become more severe...*'. His foolish advice on fire exclusion from the jarrah forest led, eventually, to the very severe Dwellingup fires of 1961, in which, luckily, nobody was killed.

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<sup>3</sup> Induction is reasoning from the particular to the general, and is risky. Inductive statistics put a probability on that risk. Deductive reasoning is the safer path, from general to particular. Historical reasoning can follow either path.

<sup>4</sup> Pyne, S.J. (1991) *Burning Bush: A Fire History of Australia*. University of Washington Press. Also a recent commentary by Rose, D.B. (2004) Stephen Pyne. *Burning Bush: A Fire History of Australia*. Australian Journal of Anthropology. Dec Issue. Deborah Bird Rose advocates more use of Aboriginal fire knowledge.

As a sample of his expertise, in his 1916 report he advised the government of Western Australia to plant pines and oaks throughout the jarrah forest. According to Sir David, the acorns would support a thriving pig industry, and the pines would, incredibly, prevent forest fires. He also proposed the introduction of deer, and game birds such as pheasants, to promote a tourist industry based on shooting. He died in New Zealand in 1920, but not before urging the New Zealand government to release wild elephants in the *kauri* forest. Captured and tamed by the local people, he suggested they could be used for logging.

On the subject of fire, Sir David noted the creeping fires, at 2-4 year intervals, then prevalent in the jarrah forest<sup>5</sup>. He was adamantly opposed to them, on the grounds that they caused damage to potential saw-logs. He proposed total fire exclusion from high quality sawlog forest, such as around Mundaring and Dwellingup. This policy was attempted by his protégé, Charles Lane-Poole, the first Conservator of Forests, and the attempt was continued by the second Conservator, Stephen Kessel. Predictably, the attempt failed, and resulted in dangerous and destructive fires, due to heavy litter accumulation. This was recognised by Kessel, who eventually came to the view that regular burning was necessary, based on local knowledge. All this is well documented in Forests Department Annual Reports to Parliament, yet seems to be unknown to those, such as Dr Schultz, who now propose, once more, attempted long fire exclusion from the jarrah forest, and other vegetation types of the south-west. Those who cannot remember the past are condemned to repeat it. History is an essential part of the interdisciplinary study of ecology.

In the early nineteen-nineties, I completed a Master's degree in Human Ecology at Brussels University, under the auspices of WHO, and endorsed by UNESCO's Man & Biosphere Program. It tries to reconcile the needs of humans and nature, through a synthesis of information from both science and humanities. It included biology and statistics, but also psychology, history, philosophy, and anthropology. I tried to introduce the ideas to CALM, but met a blank wall. My supervisor, a biologist, said that he could see no place for such research in CALM. Without support, I looked for a way forward. Bushfire management is a central task of CALM (now DEC), and is of obvious relevance to both nature and humans. I started to investigate bushfire history, and discovered excellent work by scholars such as Dr Sylvia Hallam<sup>6</sup> and Dr Neville Green<sup>7</sup> of WA, Professor Henry T. Lewis<sup>8</sup> of Canada, and Professor Stephen Pyne<sup>9</sup> of Arizona. At the same time, in the bush, I noticed that old grasstrees (*Nyoongar balga*) had interesting marks on their stems.

**David Ward,  
Roleystone, Western Australia,  
August 2006**

Tel: 08 9397 5684

Email: [mumpnpop@iinet.net.au](mailto:mumpnpop@iinet.net.au)

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<sup>5</sup> See Appendix A, section 23.

<sup>6</sup> Hallam, S.J. (1975) *Fire & Hearth*, Australian Institute of Aboriginal Studies, Canberra.

<sup>7</sup> Green, N. (1979) *Nyungar – The People*, Creative Research, Perth.

<sup>8</sup> Lewis, H.T. (1991) *A Parable of Fire: Hunter-gatherers in Canada and Australia*. In Johannes, R.E. (ed) *Traditional Ecological Knowledge: A Collection of Essays*. World Conservation Union (IUCN), Gland, Switzerland. Although completely unstatistical, anyone who dismisses this rich information as mere 'mythology' is a fool.

<sup>9</sup> Pyne, S.J. (1991) *Burning Bush: A Fire History of Australia*. University of Washington Press.

## Background

*“History is not only a valuable part of knowledge, but opens the door to many parts, and affords materials to most of the sciences.”*

*David Hume, 1711-1776*

Over the past decade I have cleaned the stems of hundreds of West Australian grasstrees (various species of the genus *Xanthorrhoea*) in the dry jarrah, tuart, wandoo forests, and the *Banksia* woodland of the south-west. These stems reveal old fire marks, some extending back to the eighteenth century. Consistently, the grasstree record suggests much more frequent bushfire in the south-west before, and for some decades after, European settlement on the Swan River in 1829. In general, a common fire frequency in the dry jarrah, tuart, and wandoo forests from the 1700s up to the First World War was very regular burning every 2-4 years. This is as often as these forests will carry fire, and would have resulted in very mild fires, even in summer.

Such fires would have trickled along, missing moist or shady patches for a number of cycles. Even a termite mound, or a bandicoot digging, would have caused a small unburnt patch. Rocks would also have created fire refuges – rock sheoak (*Allocasuarina huegeliana*) is an obvious example of a species that relied on such protection. The flames would have been under a metre high, easily cleared by a kangaroo. Small animals, such as bandicoots or possums, would have had no trouble in running through gaps in the fire front, and the burnt ground would not have been hot enough to burn their paws off, as happens now. Smoke would have been minimal, as would loss of nitrogen through volatilization, both major problems with recent fierce fires after long intervals of fire exclusion.

Fire intervals of two to four years match very well with reliable observations by early settlers and explorers, and even more recent observations by several Conservators of Forests, including an eminent forest scientist, Dr. T. N. Stoate. In 1938 he said “... it was unusual for any area of jarrah forest to escape periodic burning by at least a light ground fire for more than 3-4 years”. This statement is unequivocal. Some places, especially where there is common sheoak (*Allocasuarina fraserana*) litter, will carry fire every two years, even in winter. I have been told, by a Nyoongar Elder, that this is how Nyoongars managed common sheoak groves. These groves are now, under long fire exclusion, dying in the jarrah forest, and smothering other native plants with dense needle litter. The only plant thriving at these sites is *Banksia grandis*, a known host for *Phytophthora cinnamomi*. There are many other references to frequent fire in southwestern Australia in former days. A few are given in **Appendix A**.

Yet there are those who dispute such fire intervals for the jarrah forest. The Conservation Council of Western Australia is a vociferous environmental pressure group. Dr Beth Schultz is its voice on forests and fire. Her doctoral thesis was not, as far as I can determine, concerned with either forests or fire. Nor was it related to natural science or natural history. Nevertheless, she appears to advise, or want to advise governments, well qualified public servants, and the general community on these topics.

She has put on public record the following comment on my grasstree work:

*“You may have heard the ‘Believing the Balga’<sup>10</sup> hypothesis – that the Nyungars (sic) burnt the jarrah forest every 2 to 3 years – claimed to be proved by the black rings around the balga. That hypothesis hinges on a single sentence – ‘If the balga burnt, then everything else must have burnt’ – but there is no evidence presented to show that everything else burnt. The evidence is that, if the jarrah forest had burnt every two to three years, there would be no jarrah forest, because jarrah trees are fire sensitive for 15 to 20 years. If the Nyungars had burnt the jarrah forest every two to three years, there would be no jarrah forest.”<sup>11</sup>*

Dr Schultz’s claim that jarrah is ‘fire sensitive for 15 to 20 years’ seems to be gleaned from a silvicultural manual of the former Forests Department. In that manual, it is recommended that jarrah saplings be protected from fire for a decade or more. One of the aims of silviculture is to produce the optimum number of unblemished sawlogs. In the early stages, jarrah saplings have thin bark, and can be scarred by fire. The fire kills a patch of cambium, and this can later develop into a hollow, due to fungus and insects. Sawmillers dislike that, but I would be surprised if the concerns of sawmillers were high on the Conservation Council’s agenda. I would expect them to welcome early burning of jarrah saplings, so maximising fire scars, and a later abundance of habitat hollows.

Having no apparent scientific training, Dr Schultz may not understand that although the term ‘fire sensitive’ has a fine rhetorical ring to it, it is scientifically simplistic. All living things are sensitive to fire, depending on intensity and duration. Jarrah can, eventually, be killed by fire, but is, beyond any question, highly fire resilient. Dr Stoate, a recognised scientific expert<sup>12</sup> on the jarrah forest, noted this in 1938, when he said “Jarrah as a species is remarkably resilient to fire ... fires are of little consequence and can even be beneficial ... thanks to the recuperative coppicing powers of the lignotuber.” These facts are well known to anybody who has worked in the jarrah forest. Assuming Dr Schultz has not, she might have been wiser to talk to a professional forester, or even the humblest forest worker, before making a statement on fire and the jarrah forest to a Parliamentary Committee. If the statement was under oath, then there may be serious grounds for concern.

In 1999, I was invited by Professor Byron Lamont (Curtin University) and Professor Neal Enright (Melbourne University) to clean some grasstrees in *kwongan*<sup>13</sup> bush, first at Yardanogo Nature Reserve (near Dongara) and later, in 2004, at Beekeeper’s Reserve, a little further south at Eneabba. I had never worked in *kwongan* before. The grasstrees in both places are generally small and contorted, and I would not use them further south, having access there to tall straight ones. At Eneabba I noted on the field sheets, later passed to Professor Enright’s colleague, Dr Ben Miller, that I was having difficulty determining the growth rate, since it seemed to vary within the same

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<sup>10</sup> An article in Landscape magazine, written by me and Rick Sneeuwjagt.

<sup>11</sup> Commonwealth Hansard, House of Representatives, August 2003. Parliamentary Select Committee on the Recent Australian Bushfires.

<sup>12</sup> His doctorate was a DSc awarded on scientific merit.

<sup>13</sup> Botanically rich heath on dry, sandy country. The term *kwongan* is widely used in the literature, and is presumed to be the Aboriginal name for that kind of bush.

grasstree, with some rapid bursts. I suspect this is due to the peculiar climate and sandy soil of the *kwongan*, as opposed to the southern forest and woodlands.

Eneabba is notable for occasional summer downpours, due to cyclone activity, accompanied by thunderstorms. These could well cause extra growth, since grasstree growth is connected to water availability. I would expect the Eneabba grasstree fire dates to be less accurate than those from further south. Importantly, such occasional summer growth spurts would lead to fire intervals appearing longer than they actually were, not shorter. A paper is in preparation by Dr Miller describing the errors in dating on the grasstrees when compared with Landsat images. It remains to be seen if Dr Miller will discuss possible causes for the discrepancy, such as growth spurts, and the room for error in his own Landsat interpretation, and in my GPS readings of grasstree positions. A brief examination of the Eneabba grasstree data by me suggests that, despite dating errors, it shows informative patterns. When Dr Miller's paper is published, I will, if necessary, submit a reply to the same journal.

At Yardanogo Nature Reserve, which seems not to be subject to such extremes of summer rain<sup>14</sup>, I found a clear and interesting pattern of regular, frequent fire (3-5 years) up to the 1930s, followed by generally longer, more varied fire intervals since 1940, and up to the present day. The last two known fires were in 1984 and 1991, and these showed up on most of the grasstrees, but not all. This should be expected, due to the quirks of wind and flame, and the fact that not all fire marks, past or recent, are visible, due to rot and termite damage. Absence of evidence is not evidence of absence. Again, such undetected fires would lead to an overestimate of fire intervals, not an underestimate. The complaint from critics of the grasstree technique is that it finds fire intervals that are too short, not too long.

I cleaned the first grasstree at Yardanogo in Professor Enright's presence. It showed frequent fires (4-5 year intervals) before the Second World War, and caused Professor Enright some visible consternation. He has, with the help of Dr Juergen Groeneweld of Leipzig, developed a theoretical model of the fire requirements of several *Banksia* species at Yardanogo. As far as I am aware, neither Professor Enright, nor Dr Groeneweld, has any significant field experience of fire behaviour, and this may affect some assumptions they make about fire. For example, they seem not to understand that the more frequent fires are, the milder they are, due to less fuel. Professor Lamont is similarly inexperienced in actual fire behaviour. Nevertheless, these three have, between them, published many academic papers on fire, and attended many international conferences.

Based on seed counts, and some questionable assumptions about seed dispersal, fire behaviour and fire effects, the Groeneweld-Enright model does recognise that these *Banksia* species eventually need fire to open their cones, and shed seed. However, based on computer iterations simulating the passage of centuries, it suggests that fires at intervals of less than 12 years would eventually be fatal to the local populations, due to insufficient time to build up enough seeds. It is worth noting that the model is untested in real time, and is untestable, since it would need centuries to prove, or disprove, using real plants, and real fires. It is based on real plant observations made

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<sup>14</sup> There is no rainfall record for Yardanogo, but I have quickly examined those for Dongara and Mingenew, which roughly bracket Yardanogo. I will do more work on this.

only between 1986 and 1996<sup>15</sup>. The fires involved were, if local opinion is correct, at longer intervals, in heavier fuel, and therefore bigger and fiercer than past fires. We may question the validity of observations of plant survival, flowering, seeding etc. made under conditions that are probably historically atypical.

In keeping with the authors' lack of real fire experience, the Groeneweld-Enright model assumes that all fires are equally lethal to '*fire sensitive woody species*'. The two most recent summer fires at Yardanogo were, indeed, lethal, leaving the site as a blackened moonscape<sup>16</sup>, shown as a slide in Professor Enright's recent colloquium presentation. They completely defoliated the grasstrees. This forces these plants to live on starch reserves until they can replace their green top, which may take a year. If earlier fires were milder, patchier, in lighter fuel, and in winter or spring, then the outcome would obviously have been very different. Such mild fires leave a large part of grasstree tops intact, and able to photosynthesize. Those with real fire experience know this. It is unsound to consider the hypothetical needs of only the '*fire sensitive woody species*', whatever that may mean. For sound management, the whole plant community must be considered. Some plants seem to be '*sensitive*' to long fire exclusion. Likely candidates for this group are zamias (*Macrozamia riedlii*) and grasstrees themselves.

We should also remember that very fierce summer fires in heavy fuel volatilize a lot of nitrogen. This can be seen as coppery tints (nitrogen dioxide) in the thick black smoke. Experienced fire fighters know this sort of smoke well, as a sign of a very intense fire. A recent example is the Karagullen-Pickering Brook fire of 2005. The smoke from that was visible all over Perth. The nitrogen can be replaced after the fire by legumes, and zamias, but the system may still have less nitrogen available than if the fire had been mild. This has potential implications for flowering and seed production. It is rash to assume that the *Banksias* of interest have always taken 12 years to produce enough viable seed. In jarrah forest, a six year study<sup>17</sup> found that 90% of the nitrogen fixation by the common fire weed *Acacia pulchella* occurred in the first four years after a fire. Zamias (*Macrozamia riedlii*) are prolific nitrogen fixers for only about 3-4 years after fire, at least in the jarrah forest<sup>18</sup>. They are now strangely scanty at Yardanogo, and this may be due to brumbies eating them up to the early 1970s<sup>19</sup>. If there were more of them in the past, and burnt often, more nitrogen would have been available. Aborigines ate the fruit of the zamia, which is produced a year after fire. It would have been in their interest to burn them often. Some older Aboriginal women in the area may have information on this, since it was the women who harvested them. Local information, and traditional knowledge, are essential for a sound understanding of bushfire effects.

<sup>15</sup> Enright *et al.* (1998) The ecological significance of canopy seed storage in fire-prone environments: a model for non-sprouting shrubs. *Journal of Ecology* **86**, 946-959.

<sup>16</sup> I believe a few swale patches did avoid the fire, but these were not seen in Prof. Enright's slide. Perhaps he was trying to demonstrate that fires kill all woody shrubs, and burn all grasstrees.

<sup>17</sup> Hansen *et al.* (1988) Potential inputs of nitrogen by seeder legumes to the jarrah forest ecosystem. *Australian Forestry* **51**(4), 226-231.

<sup>18</sup> Grove, T.S., O'Connell, A.M. & Malajczuk, N. (1980) Effects of fire on the growth, nutrient content and rate of nitrogen fixation of the cycad *Macrozamia riedlii*. *Australian Journal of Botany* **28**, 271-81.

<sup>19</sup> Local information is that there were once hundreds in the Yardanogo area, but they were shot out in the early 1970s for pet-food and cray-bait. Some were captured and sold at Walkaway.



Another questionable feature of the Groeneweld-Enright model is the assumption that most *Banksia* seeds travel only a few metres from the parent<sup>20</sup>. It is well known to experienced bush workers that *willy-willies* form readily on burnt ground, and could obviously lift light, winged *Banksia* seeds for hundreds, or thousands of metres. Cockatoos have been seen carrying cones. Recent DNA work<sup>21</sup> suggests seed travel of more than a kilometre. One of Professor Enright's colleagues, Professor Lamont, has described this finding as 'stunning'. Perhaps it is, to some.

Nevertheless, Professor Enright and colleagues have published a paper<sup>22</sup> suggesting that all grass-tree data are unreliable. The main reason is disagreement with their theoretical seed model for a few *Banksia* species in the *kwongan*. The model is untested in the real world of fire management. Another reason is that there is a mismatch between fire records on different grass-trees. Practical fire experience suggests that this would obviously occur if fires were small and patchy, and there were winter lighting of some individuals in isolation, as may well have occurred with kangaroo-shooters, brumby-shooters, and more recent wildflower pickers. The third is the claim that the grass-tree results imply less patchy fires in the past than recently. They simply don't. The underlying logic is blatantly wrong. Replotting of one key figure in the paper suggests it is largely an artefact of 'data cleaning' carried out by Professor Enright. Plotting the original raw data shows a rather different picture. Finally, the claim of grass-tree unreliability is extrapolated to all previous grass-tree results for the south-west, from hundreds of trees, at many places, including the jarrah forest, where the historical evidence of 2-4 year fire in the past is irrebuttable.

With regard to the *kwongan*, it should be mentioned that similar shrublands exist in California (*chaparral*), South Africa (*fynbos*), and around the Mediterranean (*Phrygana* in Greek, *macchia* in Italian, *batha* in Hebrew, but usually known in the literature by the French names of *garrigue* (a short version on limestone) and *maquis* (a taller version). All these shrublands are highly flammable, and fire dependent<sup>23</sup>. They were, in the past, regularly burnt by both lightning and humans. In South Africa, Hottentots burnt patches of *fynbos* to graze their sheep. The Hottentots were practically exterminated in the 1600s by the early Dutch settlers and the incoming Bantu people. In France, traditional burning and grazing (*écobuage*) was banned by King Louis XIV in the 1600s, because he wanted tall forest to supply timber for shipbuilding. In other Mediterranean lands, such as Palestine and Cyprus, British Colonial foresters stopped the burning and grazing, in the belief that this would restore what they imagined to be the 'natural' tall forest<sup>24</sup>. Indians in California were

<sup>20</sup> They have, on advice from South African Professor William Bond, recently modified this to tens of metres.

<sup>21</sup> He, T., Krauss, S.L., Lamont, B.B., Miller, B.P & Enright, N.J. (2004) Long distance seed dispersal in a metapopulation of *Banksia hookeriana* inferred from a population allocation analysis of amplified fragment length polymorphism data. *Molecular Ecol.* 13, 1099-1109.

<sup>22</sup> Enright *et al* (2005) Anomalies in grass-tree fire history reconstructions for south-western Australian vegetation. *Austral Ecology* 30, 668-673. Described by the Conservation Council of WA, in a block email to members, as 'the latest demolition of the Believing the Balga hypothesis'.

<sup>23</sup> There are some (including Mr Angus Hopkins of DEC) who argue that our native plants are fire resilient, but do not need fire, in the same way that they resist drought, but do not need it. Even brief thought and study will show this to be sophistry. For example, see Gardner, C.A. (1957) The fire factor in relation to the vegetation of Western Australia. *The Western Australian Naturalist*, Vol.5(7); 166-173. Even the drought claim is wrong. Kangaroo Paws need drought. They rot if watered in summer.

<sup>24</sup> Probably a version of the now discarded 'monoclimax theory' of F.E. Clements (1916). This was replaced by the 'polyclimax theory' of A.G. Tansley (1939).

killed or driven off by Spanish, and later Anglo-Celtic settlers. In Western Australia a massacre near Dongara in 1854 probably put a stop to fully traditional burning by Wattandee Aborigines<sup>25</sup>, although some kangaroo shooters of the Brockman family continued a form of regular burning up to the 1950s (see Appendix C).

All four shrubland types have a similar history of previous regular patch burning by humans, then a major change due to newcomers or regulations imposed from afar, followed by a current problem with big, uncontrollable fires<sup>26</sup>. It is doubtful if the original inhabitants could have survived current big, fierce fires.

### The 2006 Grasstree Colloquium at Como

*It is generally better to deal by speech than by letter.*

*Francis Bacon, Essays, 1625.*

I am informed that, earlier this year, the West Australian Minister for the Environment had letters from at least two sources, calling for CALM (now DEC) to investigate the conflicting opinions on past fire frequency and the grasstree research. One of these letters was, I believe, from Dr Schultz, who has long opposed CALM's prescribed burning, and long criticised the grasstree findings. If Dr Schultz had approached me personally, I could have taken her out in the bush, cleaned a grasstree in her presence, and answered any questions. I believe the other letter was from the Bushfire Front, a group of experienced fire practitioners, including a former Conservator of Forests, Mr Bruce Beggs AOM; a former General Manager of CALM, Mr Roger Underwood; a former Forests Department Fire Chief, Mr Frank Campbell; a former Director of Research, Dr Frank McKinnell; and a pioneer West Australian fire researcher, Mr George Peet AOM.

Dr Neil Burrows of DEC arranged a colloquium, at which both I and Professor Enright presented our evidence. Dr Malcolm Gill was chosen as chairman<sup>27</sup>, and he was contracted to submit a report on the matter. I was asked to comment on two drafts, and did so. I expressed doubts about the accuracy and balance of the report, noting large omissions. Although I was willing to take part in the colloquium, I do not think it has resolved much. I suspect that both sides in the debate went away believing what they chose to believe, with one side basing their ideas on untested botanical models, the other on real experience of fire, and understanding of fire history.

Since the colloquium I have learnt that Dr Gill and Professor Enright are former working colleagues, in that they collaborated on the official inquiry into the Victorian bushfires of January 2003<sup>28</sup>. This report was severely criticised by the Stretton Group of experienced land managers and fire experts. On behalf of the Stretton Group, Mr

<sup>25</sup> See Irwin Historical Society website.

<sup>26</sup> There are many websites on this topic. There are still botanists who want to exclude fire from these shrublands, possibly following the simplistic beliefs of early foresters like Hutchins, that the end result will be a Clementsian 'climax' of tall forest. In fact it won't. Such a 'climax' is, in those areas, a myth. It will burn, due to lightning alone. Due to former mild fire creating a rich mosaic, the frequently burnt shrublands were (and still are) species rich.

<sup>27</sup> Possibly by Dr Burrows, or possibly on instruction from somebody else.

<sup>28</sup> Esplin, B., Gill, A. & Enright, N. (2003) Report of the Inquiry into the 2002-2003 Victorian Bushfires. State Government of Victoria, Melbourne.

Allan Myers QC examined the report, and found it deficient<sup>29</sup>. It made no recommendations on prescribed burning, which most experienced fire managers and land owners regard as the central issue in the extreme behaviour of the 2003 fires. In his critique Mr Myers noted, under the heading '*Expert input into the Inquiry*', the absence of any evidence of the skills and experience of Dr Gill and Professor Enright with regard to fire management and suppression. I expect Dr Gill has tried to be fair minded. However, in view of his close past association with Professor Enright, I am surprised that he was asked to chair the colloquium. I am even more surprised that he accepted.

Interestingly, the Esplin Report, with Dr Gill and Professor Enright as co-authors, called for the use of local knowledge in both tactical and strategic fire management. This recommendation must have resulted from the great weight of opinion in public submissions to the inquiry, and is in line with previous inquiries back to 1939<sup>30</sup>. It is an obvious need, and can be an astringent reality check on model predictions, or other theoretical beliefs about fire. In his initial draft report on the grasstree dispute, Dr Gill did not recommend seeking local knowledge on the *kwongan*, even though I presented some in my colloquium presentation. The local knowledge I presented<sup>31</sup> supported the grasstree findings of former more frequent fire in the *kwongan*, contradicting the minimum intervals of 12 years estimated by the Groeneweld-Enright model. Possibly due to my comments on his draft, Dr Gill has included local knowledge as his last recommendation.

Dr Gill suggests that the grasstree technique be subjected to independent scrutiny. This is a normal part of science, and I welcome it. Dr Gill says that only I have used the grasstree technique. This is untrue, as two others have used it in my company, and found similar results. Dr Gill says that attempts to reproduce the technique elsewhere have failed. At my suggestion, he has added '*as yet*'. I believe some attempts have been made in the eastern states, but without detailed advice from me. It is not rocket science, but does need a bit of experience in grinding the stem. It took me some time to find the right power tool, the right size and grit of disc, the right pressure, and so on. There were also safety issues in finding effective ear and skin protection, and a workable breathing mask. Rushed attempts are unlikely to succeed, especially if the operator is not greatly interested in success, or perhaps even hoping for failure. It takes patience and persistence, and a physical stamina which some academics may not possess. Not every grasstree will yield a clear record, due to decay, termites, stem contortions, and severe fires which carbonise the leaf bases. Without experience, the fire record, even if present, can be obliterated by the grinder. When, however, a grasstree shows a clear fire pattern, it is very clear. There can be no reasonable doubt about the frequent fires of former days. The reason I did not pass the skill on before I left CALM (DEC) was that, for the last ten years of my service as a Senior Research Scientist, I was without technical support. I had nobody to teach. I am willing to teach others, but will have to charge an appropriate fee.

In my presentation I pointed out serious statistical errors and omissions in Professor Enright's paper, and one serious logical error. These invalidate most of the objections

<sup>29</sup> Myers, A. (2004) Memorandum in the Matter of a Report of the Inquiry of the 2002-2003 Victorian Bushfires. Stretton Group, Melbourne.

<sup>30</sup> COAG National Bushfire Inquiry 2002

<sup>31</sup> See testimony of Mr Rob Gillam, Appendix C.

raised. Dr Gill's report does not mention these errors and omissions, and seems to accept the paper as valid. I must assume that Dr Gill has not carefully examined the raw data and analysis on which the paper is based, and did not follow my reasoning. I also showed a significant temporal and spatial pattern in the Yordanogo grasstree data, which has an intriguing co-incidence with the arrival of rabbits in that area, and would be rather unlikely to occur if the grasstree data were simply random noise. This was unmentioned by Dr Gill.

Trying to reconcile the Groeneweld-Enright model and the grasstree data, I presented a very graphic geometric model of fire spread in a mosaic, showing how unburnt patches (which can be at any scale, from hundreds of hectares down to a few square centimetres), in flammable vegetation, can only survive if their surroundings are frequently, and mildly burnt. This effect is well recognised in Africa.

I am preparing a publication on this geometric model, which explains the survival of long unburnt patches within a frequently burnt matrix, and the need for frequent ignitions to maintain a fine grained, diverse fire mosaic. It shows that inappropriate long fire exclusion inevitably leads to bigger fires, and a coarser, less diverse mosaic. The ground truth of this model has been demonstrated in a recent fire at Mt. Cooke, where fire refuges in the rocks were overwhelmed by very fierce fire<sup>32</sup>. In his report Dr Gill does not mention my model, although his publication record suggests a strong interest in fire modelling. I think it is of central relevance to the dispute, and I am happy to demonstrate it to anybody who is interested.

While the grasstree technique should, like all science, be subject to scrutiny, a balanced approach suggests that the basic assumptions and mathematics of the Groeneweld-Enright seed bank model should also be scrutinised. A model is only as good as its assumptions, and nobody should be overawed by mathematical symbolism. Neither mathematical nor verbal obscurity is a guarantee of validity. It would be embarrassing for DEC to base its fire management of *kwongan* on an untested model, only to find that the assumptions were badly flawed, and disaster resulted. This would be simply a large scale, and risky, experiment in land management, and should be recognized as such. This is where local knowledge, and common sense, can help.

Despite the recommendation of the Esplin Report, of which he was a co-author, Dr Gill seems dismissive of local knowledge. In conversation, he dismissed information on former Aboriginal burning in *kwongan* as 'mythology'. In an early draft of his colloquium report, he referred to 'lay opinion' on fire matters. This was removed when I pointed out that some long term *kwongan* residents might well regard Dr Gill as a lay person with regard to bushfire in the *kwongan*, and that his own Esplin Report recommended that local knowledge be used more. He has described historical observations on fire frequency as 'equivocal'. Some are, but some are absolutely unequivocal, for example those by Dr Stoate and others. At the same time, *kwongan* residents, and other experienced bushfire practitioners, may find some assumptions of the Groeneweld-Enright model equivocal. Dr Gill did not discuss this point.

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<sup>32</sup> Burrows, N. (2005) Burning Rocks. Landscape Special Fire Edition Volume 2, p.26. Department of CALM, Perth.

## A Summary of Practical Suggestions for Resolving the Matter

*If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.*

*Francis Bacon, The Advancement of Learning, 1605.*

I note Dr Gill's recommendations, but find his report unbalanced, with serious omissions, and some unjustified assumptions. Some points I made at the colloquium are simply ignored. On the other hand, Professor Enright's untested model and assumptions seem to be accepted as certainties. I suggest that the following is a more practical, balanced and logical sequence of action to resolve the matter. It may also prove more frugal with taxpayers' dollars.

**Suggestion 1.** As a common sense first step, in line with recommendations in the Esplin Report<sup>33</sup>, local knowledge of bushfire, past and present, in the *kwongan* should be sought and published. This will be relatively cheap, and will provide a rich and stable foundation for further research. The Irwin Districts Historical Society Inc.<sup>34</sup> may be willing to undertake the work. They have evidence of Aboriginal presence (Wattandee people) along the Irwin River up to 1854, when there was a massacre. There are several long resident European families in the area (see Appendices B & C) who may be knowledgeable about fire, and the effects on it of historical events, such as vegetation change due to the arrival of rabbits, horses, goats, beekeepers etc. The records and opinions of the Dongara Volunteer Bushfire Brigade should be sought. Are most *kwongan* fires now due to lightning, rather than human causes? If so, what would have been the past situation, due to lightning alone, when such fires were not suppressed by fire-fighters, or obstructed by roads and railway lines? Would they not have spread much further than recent fires? Unless, of course, their progress was blocked by other recently burnt patches. DEC field officers in the area may have important views on the best way to manage fire in the *kwongan*. Residents' views may be quite different from those of occasionally visiting academics. We should not automatically value the latter over the former. Residents may, in fact, have a more reliable understanding, based on hundreds of fires, rather than just a few recent ones. In scientific parlance, they may be drawing on information from a much larger sample.

**Suggestion 2.** If this local knowledge supports, or at least does not contradict, the Groeneweld-Enright model theory of long (12 years or more) fire intervals in the past, then the grasstree technique should next be subjected to independent scrutiny. I doubt if Dr Gill's suggestion of a formal statistical design is practical, in terms of the time needed to walk through large areas finding suitable old grasstrees. The urge for a structured design probably comes from his agricultural background, but wild grasstrees are notably reluctant to organise themselves in that way. It will be expensive, if several independent operators are used, and large numbers of old grasstrees have to be found.

If cost is no barrier, then I would be very happy for some of the work to be done in the Wungong Catchment, as this would support my current research there, which is of relevance to the Water Corporation's efforts to increase water yield. This would give

<sup>33</sup> Esplin, Gill & Enright, Report of the Inquiry into the 2002-2003 Victorian Bushfires.

<sup>34</sup> [www.westnet.com.au/idhs/](http://www.westnet.com.au/idhs/)

double benefit from taxpayers' dollars. Having walked widely in the catchment, I can save time by showing where old grasstrees can be found. Dr Lachie McCaw of DEC may be interested in a study of the southern mallee-heath, which probably burnt less frequently than the jarrah forest. A very brief grasstree-grinding excursion there (only two trees) some years ago suggested 7-8 year fire intervals prior to 1840. There are old grasstrees at Dryandra which show frequent burning (2 years) near creeks, up to 1860<sup>35</sup>, and much longer intervals (15-25 years) on the bare, stony ridges. This makes sense. At Coolgardie, grasstrees showed an average fire interval of ten years back to the 1890s. All these sites would be worthy of independent study, since they demonstrate that the grasstree technique does not produce the same fire frequencies regardless of vegetation type, as may be alleged by ill informed, or sly critics.

A quicker, more practical, and cheaper approach would be to concentrate on the growth rates of grasstrees, since this seems to be a central issue. This could be done by harvesting a number of old stems, from different vegetation types, including *kwongan*, jarrah, wandoo, and *Banksia* woodland north of Perth. These stems could then be examined in a laboratory, using Professor Lamont's technique of melting off the old leaf bases<sup>36</sup>, and examining the growth bumps along the internal caudex. These should show if growth is more variable in the *kwongan* than in the southern forests and woodlands. It may be possible to match the larger bumps with known fires, or heavy summer rain. Techniques other than melting in an oven should be explored. For example, soaking in a solvent bath of alcohol or acetone, or use of medical technology such as CAT scan or ultrasound<sup>37</sup>. In view of his past experience, Professor Lamont may be willing to undertake such a study, although he is, I believe, presently unwell. Another suitable investigator would be Dr Ian Abbott of DEC, who has an understanding of, and interest in, bushfire history.

**Suggestion 3.** If, on the other hand, local knowledge of the *kwongan* supports the grasstree evidence of frequent, mild fires in the past, and contradicts the Groeneweld-Enright model of infrequent (12 years or more), fierce fires, then that model should be subjected to intense scrutiny by a competent, and fully independent, mathematician<sup>38</sup>. Its basic assumptions should be subjected to a reality check by fire managers, and local residents. For this to occur, Professor Enright (or Dr Groeneweld) would need to produce a simple list, in plain English, of all their assumptions, and the evidence for them. Also the source of their fire and seed data – how many fires, how many sites, how many trees, how many seeds, how many flowering cycles, what are the statistical confidence limits for their basic data? These do not seem to have been carefully examined by Dr Gill, who is usually a stickler for statistical precision.

**Suggestion 4.** Regardless of the above, there is a need, and an opportunity, for DEC to research the effects of microclimate on fire patchiness in the *kwongan*. As far as I know, little has been done on this. It may be more subtle and pervasive than currently realised, and be an essential factor in maintaining a fine grained, diverse mosaic. For

<sup>35</sup> When there was a well known measles epidemic, which killed many Nyoongars.

<sup>36</sup> Lamont, B.B & Downes, S. (1979) The longevity, flowering and fire history of the grasstrees *Xanthorrhoea preissii* and *Kingia australis*. *Journal of Applied Ecology*, 16, 893-899.

<sup>37</sup> I tried an X-ray of a stem ten years ago, without success. Technology may have improved.

<sup>38</sup> Since Australians seem to be polarised on the issue of fire frequency, and prescribed burning, it would be better to find an overseas mathematician, with some knowledge of fire modelling. The USA and Canada are the most likely sources.

example, can a single bush or tree (such as *Banksia hookeriana*) cause enough shade to exclude a very mild fire in spring or winter? My own observations of fire elsewhere suggest it can, and this may explain the survival of a species such as *Banksia hookeriana* in frequently, therefore mildly, burnt heath. There may be other explanations, such as the recent extension of that species, under increasing fire intervals, into areas where it previously could not survive. This would be similar to the rampant extension of ‘native weeds’ such as peppermint in the tuart forest, bull banksia and parrot bush in the jarrah forest, and rock sheoak in some wheatbelt reserves. Recent fierce summer fires (1984 & 1991) at Yardanogo were probably historically atypical.

**Suggestion 5.** In line with local opinion, DEC has a need and an opportunity to test the possibility of burning *kwongan* in winter and spring. This could be safer for all, by avoiding the severe summer lightning fires which currently sweep the area. Professor Enright’s claim that *kwongan* will not burn at four years old, even in warm and windy conditions, is dubious. Perhaps he did not realise it, but his presentation of Dr Miller’s Landsat interpretation, at the colloquium, showed recent fires at two and four year intervals, in Beekeeper’s Reserve at Eneabba (1998, 2000 & 1998, 2002). Wind is an important factor in heath fire spread, and Dr Lachie McCaw of DEC may have ideas on studying this. My suggestion is that DEC try burning experimental strips in winter with the help of garden leaf blowers to simulate different wind speeds. Grasstrees could be used as effective ignition points for narrow strip fires, which would break up the area, so preventing the development of dangerous broad fronted fires in summer. The burnt strips would be ideal study areas for post-fire regrowth.

**Suggestion 6.** In his report, Dr Gill mentions a paper, in preparation<sup>39</sup>, which adversely compares the grasstree fire dates from Eneabba with Landsat imagery over the past thirty years. Dr Gill seems to assume that the Landsat interpretation is certain, even though seemingly by a single operator, Dr Miller. It may be, but, on the other hand, may not. It needs independent checking, since interpretation of Landsat imagery is as much art as science. A number of different operators may arrive at different conclusions. DEC could perform a useful role here, having skilled interpreters, such as Dr Li Shu. A factor which needs to be included is the error in GPS positions for the grasstrees. This may be important where they occur close to the edge of a former fire.

Based on Dr Miller’s interpretation, Professor Enright showed, at the colloquium, a chart of ‘false positive fires’ and ‘false negative fires’, with a temporal trend. The temporal trend is exactly what one would expect if there were cumulative error down the stem, due to even a small error in growth rate estimated at the top. This is likely, due to the mentioned difficulty in finding the true growth rate. I have suggested that growth spurts, due to cyclonic summer rain, may also be a major source of error. As discussed above, this could be checked by harvesting some old stems, and subjecting them to laboratory analysis.

**Suggestion 7.** Although popular, and used in refereed papers, the term ‘*fire sensitive*’ is currently more rhetorical than scientific. Like the popular term ‘*biodiversity*’, its glib use gives an air of expertise, where such may be lacking. DEC has a need and an opportunity to make the term scientifically concise by producing a chart, or table, in

<sup>39</sup> Miller, Walshe, Enright & Lamont (in preparation)

which the axes are fire intensity, and fire duration. Plant species of Western Australia could then be plotted within the framework, according to their degree of fire resilience, or sensitivity. Jarrah, for example, due to thick bark and an underground lignotuber, is able to resist very hot fire, for long periods, and will appear in the top right hand corner. Some plants, probably only a small percentage, are killed by even the mildest and briefest of fires. These will appear in the bottom left hand corner. Most of these will occur in obvious fire refuges, such as rocks, or moist, shady places. Some may be plants that create their own fire refuge through less flammable foliage, or dense shade, or even by creating a bare patch through allelopathy<sup>40</sup>. A close definition of the term '*fire sensitive*' would avoid much tendentious rhetoric.

**Suggestion 8.** I will publish my own interpretation of the Yardanogo grasstree data, subjecting Professor Enright's analysis, and data handling, to careful scrutiny<sup>41</sup>. If, and when, Miller *et al.* publish their paper on the comparison of Landsat data with the Eneabba grasstree data, I will also reply to that in the literature<sup>42</sup>. Although a slow process, this might have been the best way to go in the first place. Pending such publications, DEC should not too hastily accept the Groeneweld-Enright model as a management tool. The ultimate test is the result on the ground, but that may take decades, or centuries, to emerge. On the other hand, depending on lightning or vandalism, the truth may become clear within the next few summers. If DEC gets it wrong, both nature and human society can be harmed.

**Suggestion 9.** I believe that Western Australia made a large contribution (\$5 million from media reports?) to the Bushfire Co-operative Research Council (BCRC). Possibly due to Professor Enright's adverse paper, BCRC has declined to fund my current grasstree research, even though it is of obvious relevance to nature conservation, human safety, and water catchment management. Fire management in the *kwongan*, and elsewhere, is an important matter. The above suggested investigations, including the independent grasstree cleaning and laboratory stem analysis, could, and should, be funded by BCRC, in the interests of both humans and nature.

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<sup>40</sup> Biochemical inhibition of other plants by leaf or root exudates.

<sup>41</sup> Ward, D. (in preparation) A close scrutiny of grasstree fire history records from Yardanogo Nature Reserve, Western Australia.

<sup>42</sup> Ward, D. (in preparation) A close scrutiny of grasstree fire history records from Beekeeper's Reserve, Eneabba, Western Australia.



## Appendix A: Some References to Fire in Earlier Days

1. “*You see, the Natives ...they used to burn the country every **three or four years**... when it was burnt the grass grew and it was nice and fresh and the possums had something to live on and the kangaroos had something to live on and the wallabies and the tamars and boodie rat ... It didn't burn very fast because it was only grass and a few leaves here and there and it would burn ahead and... sometimes there'd be a little isolated patch of other stuff that wasn't good enough to burn the time before, but as it burnt along perhaps there might be some wallabies or tamars ...those animals didn't run away from fire, they'd run up to it and you'd see them hopping along the edge of the fire until they saw a place where the fire wasn't burning very fierce...*”

**Mr. Frank Thompson interviewed in 1975 about his memories of fire near the south coast, before the First World War. (Thanks to Dr Ian Abbott of DEC)**

2. “*The streets are of sand, mixed with charcoal, from the **repeated burning of the scrub**, which formerly covered the ground, on which the town stands...The Natives are now **setting fire to the scrub**, in various places, to facilitate their hunting, and to afford young herbage to the kangaroos...*”

**James Backhouse, Perth, 1837**

3. “*The **whole of the country**, between the Conical Hills (near Augusta) and Cape Naturaliste, has been burnt.*”

**John Dewar & Andrew Smith, 1831**

4. “*I walked along a broad belt of good soil **for one mile**. Fire had recently gone over its surface, and left only enough of wattle shrub to show that this had been the chief production...*”

**Alexander Collie, King George's Sound, 1831.**

[Note: The fact that the wattle bushes were still recognizable is evidence that this was a relatively mild, patchy fire, the sort that occurs in litter a few years old. Current fierce fires leave little that is recognizable.]

5. “*A **large fire** made by the natives **spread rapidly** owing to the dry state of the grass.*”

**Mary Friend, Fremantle, 1830 (In Abbott 2003)**

[Note: This tells us that native grass was more abundant, at least near Fremantle, in the early days of settlement. On sandy country, this would almost certainly have been the short *Austrostipa compressa*, an annual, which will carry rapid spreading, yet relatively mild fire in its first summer. This grass has appeared, after recent fires, at Yardanogo. It seems highly likely that it was part of the fire system there, and in many other places. James Drummond described it, in the 1830s, as the ‘*most abundant of the native grasses.*’]

6. *“That burning was done deliberately is suggested by Threlkeld’s reference to a ceremony performed in the mountains near Lake Macquarie in 1826 which involved burning a ‘large part of the country’ prior to a kangaroo hunt... There is evidence that significant areas were burnt. Thus Dawson ‘on ascending a gentle acclivity we saw the grass had been burnt as far as the eye could reach... in a few moments [we] discovered numerous footsteps of men and children on the burnt ground.’ ”*

**Helen Brayshaw, New South Wales, 1986.**

7. *“It cannot be denied that Western Australia, as far as it is known, is generally of a rather sandy, barren nature, partly owing to the constant dryness and clearness of the atmosphere and climate and to the periodical extensive bush fires which, by destroying every two to three years the dead leaves, plants, sticks, fallen timber etc. prevent most effectually the accumulation of any decayed vegetable deposit... being the last month of summer ... the Natives have burnt with fire much of the country... ”*

**Lt. Henry Bunbury, 1837.**

[Note: A common argument is that Nyoongars were burning with hostile intent, and this only occurred after European arrival. There are clear statements that, on the contrary, they were simply following tradition.]

8. *“When I was a sojourner in England, I never remember to have seen Australian plants in a good state after the second or third years and that, I think, is in a great degree owing to their not being cut down close to the ground when they begin to get ragged; how for the pruning knife and a mixture of wood ashes in the soil would answer as a substitute to the triennial or quaternal burnings they undergo in their native land, I am unable to say, some of our plants never flower in perfection but the season after the ground is burned over... ”*

**James Drummond, Swan Valley, 1844.**

[Note: Drummond was a trained botanist. Why would he suggest a common fire frequency of three to four years if it was not so, or if this was only true for a small part of the country?]

9. *“The absence of fertility is naturally accounted for in a very dry climate by the summer fires passing over a great portion of the surface of the country, and preventing any accumulation of decayed vegetation.”*

**The Inquirer, Perth, 1841.**

10. *“Thickets that ‘...the natives are in the habit of burning ... at intervals of three years’ to drive out Tammar and Banded Hare Wallaby.”*

**John Gilbert, near Northam 1831.**

[Note: Some quote observations of dense thickets as evidence of long fire absence. In fact, some shrubs can grow over 2 metres in a few years. Under long fire exclusion the thickets tend to thin out underneath, as shorter shrubs die, and tall ones self-prune.]

11. *“In December, but more particularly in January and February, the natives burn large tracts of country to catch wallabee, or bush kangaroo. For this purpose they generally go in considerable numbers and select a fine and warm day, and, having fired a portion of thick scrub or grass where they know these animals to live, they watch their being driven out by the fire, and either spear them or knock them down with a short and rather slender baton called ‘toollila’... The fires when thus lighted*

*generally proceed spreading and consuming everything in their progress, and before the coldness and dew of the night repress their fury or intervening barren spots stop their rage, overrun some square miles of surface”*

**Alexander Collie, Albany, 1834.**

[Note: Night humidity will only suppress a fire in light fuel]

12. *“I fear His Excellency will find it a very difficult subject to deal with, and impossible wholly to prevent, it has always been the custom of the Natives to fire the country during the summer season.... It would be hard to debar the Native the food Providence has placed at his disposal, by preventing the use of Fire, without which he cannot procure it.”*

**Revet Henry Bland, Protector of Natives, York, 1846.**

[Note: Bland was one of those who said that there was no malice in Nyoongar burning.]

13. *“...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 Bush fires, the Natives carefully abstaining from their practice until after the harvest is fully accomplished...”*

**Lt Col. John Molloy, Vasse, 1846.**

[Note: Again, no evidence of malice.]

14. *“In those parts of the Territory [York District] a Bush fire will, as has been proved in this season, extend for many miles, not only burning up all vegetation and thereby causing severe damage to the flocks and herds... the major part of the country to the Westward of the range being sandy these districts are only partially burnt, and as a general rule I would remark that the vegetation will only burn once in two years – Further; it seems to be about one half of the sandy land burns over by the fires annually... The fires are never general and if not intentionally lighted by the Europeans... are kindled by the Natives for the purpose of more effectually securing their game; which is captured in extraordinary numbers where a strong wind impels the fires.”*

**Francis Corbett Singleton, Dandalup, 1846.**

[Note: Fast moving headfires in light fuel, with strong wind, have a very brief flame residence time, cause little damage to trees, and may germinate some seeds better by radiant preheating from the long, flattened flames. Some present botanists, who have seen few fires, often have no idea of the extreme diversity of fire behaviour (pyrodiversity?), from benign to lethal. Assuming that a particular species is always killed by fire is simplistic, yet is sometimes an assumption of ‘mathematical models’ of seed production. ]

15. *“This spot was intersected with several small streams of water, yet the same marks of fire were evident on all the vegetable kingdom... it was evident, as far as we traversed the sides of the hills, that the vegetation had recently undergone the action of fire; the largest of the trees had been burnt, though slightly; every shrub had some of its branches completely charred; and the plants lying close to the ground had not escaped without injury.”*

**Commander George Vancouver, near Albany, 1791.**

[ Note: The fact that the shrubs were not completely consumed, and the ground plants were still recognisable, shows that this must have been a mild fire, and therefore the time elapsed since the previous fire only a few years. Fierce fires after long fire exclusion produce a typical blackened moonscape, with hardly any plant matter remaining.]

16. “During my excursions in the bush my interest in bushfires has often been aroused ... Others ascribe them entirely to the blacks ... who light fires all over the place to cook their food but leave them unextinguished. During the hot summer the grass dries out and becomes highly inflammable, and the leaves of the myrtaceous plants, which are full of essential oils, also get very dry. The consequence is that bushfires quickly spread over enormous areas, though without becoming a danger to human beings...”

**Ludwig Leichhardt, 1842, New South Wales.**

[Note: Again, the observation that the fires were no danger to human beings is irrebuttable evidence of low fuel levels, due to a fire every few years. Recent fires in long unburnt National Parks in New South Wales were very fierce and dangerous indeed.]

17. “In our journey to the south I gathered a most beautiful *Stylidium* in flower. For several years I have known the plant by its leaves, but I could never get it to flower. From a careful examination of the plant in various situations I have come to the conclusion that this species **never flowers in perfection but the second year after the ground has been burned over. The leaves which are uncommonly beautiful became after the second year hard and rigid and apparently incapable of supplying the necessary nutrition to enable the plant to bring its flowers and seeds to maturity. I have named this species *Stylidium elegans*.**”

**James Drummond, Colonial Botanist, 1840s.**

18. “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...”

**Baron Von Mueller, 1879**

[Note: If the forest was “all fresh and ever verdant” despite fires, then the fires were obviously milder, and therefore more frequent, than today. After the recent Karagullen fire, for example, there is no way that the bush could be described as verdant.]

19. “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."*

**Joseph Strelley Harris 1882.**

[Note: Joseph Harris was an experienced bushman. He was the first to drive sheep from Albany to Perth, in the 1830s, when the present Albany Highway was a bush track. He was the joint discoverer, with James Drummond, of the poison plants which killed many sheep. Note his comment that there would be no difficulty in stopping bush fires. Obviously such fires were much milder, in 2-4 year old fuel, and could be stopped with hand tools or green branches, since there were no bulldozers, fire-trucks, or helicopters in those days. Today's fires, in 15 or 20 year old fuel, cannot be stopped, even with water bombers, bulldozers, fire trucks, and hundreds of fire fighters. The spread rate of 3 miles per day (5 km/day) is also clear evidence of light fuels. A fire-fighter in the recent fire in old fuel at Karagullen estimated rate of spread at 40 km/hr. in some places. The pine fire in the mountains of Cyprus in 1956 was estimated at 30 mph, or 50 km/hr].

**20.** *"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."*

**Roy Wallace & Alan Harris, both former Conservators of Forests. Undated, but probably in 1960s.**

[Note: An unequivocal statement by two forest experts.]

**21.** *"... 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."*

**Roy Wallace, former Conservator of Forests, President of the Royal Society of WA, 1966.**

[Note: An unequivocal statement on mild, trickling fires by a forest expert. Recent grasstree cleaning in Monadnocks Conservation Park, east of Jarrahdale, has shown fires at 2-4 year intervals from 1750 up to the 1920s]

**22.** *"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."*

**Stephen Kessel, Conservator of Forests, 1924**

[Note: Only mild fires of 500 Kw/m or less (flame <1m) can be controlled by beating. Clearly this was the situation before 1924, with light fuels, due to burning every 2-4 years.]

**23.** *"The jarrah forest, like most of the eucalypt forests, is liable to be burnt every two to three years ... The Jarrah forest is open, so much so as to be generally traversable in any direction, on foot, or on horseback, without paths. The only undergrowth is a sprinkling of young Eucalypts, with some shrubby little Acacias, Banksias, and "Blackboy" trees. They (sic) are said to be more species of Acacias than of Eucalypts in the forest. There is a thin coarse wire-like grass, long enough to burn once in three or four years..."*

**Sir David Hutchins, WA Government Forest Consultant, 1914**

[Note: Due to decades of inappropriate fire exclusion, much of the jarrah forest is now (2006) difficult to penetrate on foot, and would certainly be impossible to ride through on a horse, except along a cleared path.]

**24.** *"... the jarrah country is burnt over regularly every three or four years."*

**C.E. Lane-Poole, Conservator of Forests, in his 1921 Annual Report to Parliament.**

[Note: Unequivocal statement by someone in a good position to know.]

## **Appendix B: Rough Notes on Potential Historical Sources for Yardanogo Nature Reserve**

by David Ward, Senior Research Scientist, Dept of CALM, Western Australia, and Senior Visiting Research Fellow, Curtin University, Perth, Western Australia.

**3rd July 1998**

Telephoned Scott Godley, CALM Reserves Officer at Moora. He was very helpful and gave me several possible sources of information on the history of Yardanogo Nature Reserve. He mentioned that there is an Aboriginal land claim over the area – made by a group which includes the lady (Mrs Martin?) who was evicted by Homes West amid much publicity a while ago. He mentioned the Summers family as knowledgeable about the area. He also recommended contacting the Irwin Shire Council, the Dongara Historical Society, and Ross Bradshaw of the Bushfire Service, Geraldton (Tel. 9964 0777). He mentioned that the Eneabba area was used in the past by north-west graziers to rest and fatten their cattle on the way south to market.

Made contact by telephone with Peter Summers of Dongara (Tel. 9927 1914) of an old Dongara farming family. In addition to the farm, he has a computer shop in Dongara (Tel. 9927 2155). He has blackboys up to 2 metres in his paddocks near the coast, which are falling over due to heavy thatch. Burning in winter killed some of them. They are growing at about 25 mm/yr due to fertiliser. He is willing to let us clean some off to compare growth rates before and after the paddock was established, about 30 (?) years ago. He has some ideas on the history of the Mt Adams area. He did not think it was used much for grazing – too poor. There were possibly brumbies there.

He did not know much about the local Aborigines, but believed they were in quite large numbers at one time. He recommended contacting the Downes family (Robert in Geraldton (9921 7205) & Colin in Dongara – neither in phone book), whose father farmed in the Mt Adams area in the 1920s. At that time large groups of Aborigines used to visit the house.

Contacted Robert Downes (Colin's number not listed, but he is younger anyway). Robert said that up to World War II Aborigines from Mingenew used to go through the Mt Adams area every year "spot burning" and shooting kangaroos. The burning used to bring up native grasses. He also mentioned feral donkeys in the area, and they were very fond of blackboys and zamias – would "eat the heart out of them". This might explain the oddly sparse distribution of these plants now?

Contacted Royal WA Historical Society – they gave Irwin Historical Society (Mrs P Harper 9927 1599 – not in phone book, tried ringing but "not connected", president S. Scotter, Dongara – not in phone book, FAX 9923 1323 – rang but gave normal tone, not FAX whistle, no reply!). Tried Geraldton Historical Society (Mrs Thomas 9921 8505 – no reply!)

Contacted Doug Marmion, a linguist at the Yammatji Language Centre in Geraldton (9964 3550). He was most informative on contacts, both Aboriginal and otherwise. He mentioned an Aboriginal teacher called Nola Bell (9938 2185) in Geraldton whose

grandmother was very knowledgeable about traditional burning and hunting in the area. Also Stan Gratte (late 70s – 9921 2845) who is interested in natural history and Aboriginal matters. Also Barry Dodd (Aboriginal of the Mingenew group – 9921 6817), Chairman of Bundiyarra Aboriginal Resource Centre (9964 2181), Bobby Lefroy (phone?), station owner at Gingin, and Bert Keeffe, retired pastoralist formerly of Mullewa, now living in Perth (9448 3081). Alan Dench, Linguistics Department at UWA may be able to help with language clues to burning traditions.

Bert Keeffe (author of “Eastward Ho: to Mullewa and the Murchison”) doesn’t know much about Dongara area, but recommended F. Wittenoom’s “Memories of the Murchison Pastoral Area”, which mentions traditional burning and disease epidemics in the 1870s (measles?) which killed about a third of the Aboriginal population. He thinks the area was settled about 1850s and traditional burning ceased by the 1860s.

### **6 July 1988**

Rang Stan Gratte (9921 2845), who is in his seventies or eighties. He remembers Aborigines, he thought called Brockman, hunting and burning in the Mt Adams area in the 1930s. He thought they burnt strips, and any place would have burnt about every 4-5 years. They hunted Grey Kangaroo (Euro no good) and also wild horses, which were plentiful in the area. He also mentioned that wild pigs were plentiful in the area between the world wars, and that they were fond of zamias. The wild horses were mostly shot out in the 1970s for crayfish bait. There were also European hunters, names mentioned were Criddle, Parker and Hamersley - brumbies were captured and sold at Walkaway. Ticks were very bad in the area, but he didn’t think that fires reduced them much. He told me of giant zamias in former days, but they were poisoned by cattlemen using kerosene, since zamias are poisonous to cattle. He said that there are still a few big old ones left at Stockyard Gully and Three Springs – up to 4 metres high (compare Fraser’s claim of 18 foot zamias at Guildford in 1826). He worked in the 1960s with Aborigines from the Kalbarri area, who cried when they were taken back to their home areas. They said that trees were dying because the area had not been burnt often enough.

Rang Nola Bell, but she said she does not know the Mt Adams area – she will let me know if she hears of anyone who does.

Contacted the Public Record Office (Alexander Library Building, Francis Street). They have Occurrence Books for Dongara Police Station from 1868-1910, available for public examination. Present Dongara Police Station only keeps records for past seven years. Don’t know where 1910-1990 books went – possibly destroyed.

Linguist (Doreen) at Yammatji Language Centre, Geraldton, will try to find out meanings of Yardanogo, Mingenew, Eneabba & Dongara. (Later information is that Yarganogo means “camping place by big gum tree”, Mingenew “place of ants”, Dongara “place of seals”)

### **Monday 13<sup>th</sup> July 1998**

Will ring Barry Dodd (9921 6817 or 9964 2181)



Contacted Barry Dodd at Bundiyarra Aboriginal Resource Centre, Geraldton (9921 6817 or 9964 2181 or mobile 041 3749 548). Very helpful and interested. Has family links with Mingenew people (*Minga* means 'ant'). He thinks the Brockman family (Aboriginal branch) were involved in kangaroo shooting and burning for grass in the Mt Adams area before WW2, but will try to contact some of the older members of that family for more information. He confirms that horses and donkeys were present previously, also goats. Barry would like to be involved in any research into traditional burning around Geraldton. I will put him in contact with Michael O'Connor, who is doing a PhD on grassland at Greenough.

### **27 July 1998**

Telephone call from Shirley Scotter and Charlie Ellery (9927 1123) of the Irwin Historical Society at Dongara. They had heard that I was interested in the Yandanogo area. Charlie confirmed that kangaroo shooters (Brockmans and others) used to go through the Yandanogo area before World War 2, and they burnt frequently, every 4-5 years. They burnt small strips which ran into previously burnt areas. Recent fires have been less frequent, and hence more damaging in his opinion. Irwin Historical Society has police records from 1904 onward – police trooper used to patrol through Yandanogo, so there may be reports of kangaroo shooters, fires etc.

### **1 October 1998**

Message from Neil Burrows that Ross Boddington, Aborigine (Wadjarri) of Dongara, would be a useful contact. Not in phone book, but will enquire by other means.

Rang Barry Dodd to follow up on Brockman family. He had only been able to contact the younger members, who didn't know much. He recommended contacting Eric Papertalk (elder) of Mullewa through Taffy Papertalk (son?) of the "Yamatji Land & Sea Council" 9964 5645. Spoke to Kyo Metz (anthropologist?), who said she would get Tony Dolman (anthropologist) to call me back. Directory enquiries give G. Papertalk, Mullewa 9961 1506.

### **8 March 1999**

Long talk with Mr Michael Kelly (9390 7703). Michael has a brother farming at Mingenew, and knows some history of the area. He believes that the Yandanogo area was burnt frequently in former days, and has heard descriptions of long thin fires, sometimes with a zig-zag path. These were lit in the morning on an easterly wind, ran towards the coast, then doubled back with the sea breeze in the afternoon. He has noted an increase in mistletoe in the area, especially on Pricklybark trees (*Euc. todtiana*), and believes this is due to infrequent burning. He believes that mild, frequent fire killed mistletoes formerly, and in so doing formed the nucleus of tree hollows, which could be important for fauna.

### **May 2006**

Through Kevin Marshall of CALM, contacted Rob Gillam of Irwin House, Dongara (see Appendix C) and land owner Mr Len Hamersley. The Hamersleys are well known WA pioneers, arriving in the 1830s. By the 1850s one of the family was

established in the Dongara area. Len would be a rich source of information in any future investigation. He mentioned family diaries. He says that the *kwongan* heath has become noticeably taller since the 1950s. He notes that the smoke from recent fires is dark (heavy fuel), compared with white smoke (light fuel) in former days.

## Appendix C: Local knowledge on bushfire in the kwongan

Information on Bushfire History from Mr Rob Gillam, Farmer, Firefighter & Conservationist, Irwin House, P.O. Box 41, Dongara, 6525 (Tel: 08 9927 5026)  
4<sup>th</sup> December 2005.

**Background by David Ward:** This is a response to some questions sent by me, a retired CALM Research Scientist (Tel: 08 9397 5684), concerning the Yardanogo Nature Reserve, near Dongara. This reserve is *kwongan* (sand plain heath), and contains some attractive *Banksias*, including *B. prionotes* and *B. Hookeriana*. An early explorer mentioned ‘clumps’ of *Banksias* in the area. A survey of old fire marks on grasstree stems at Yardanogo (also known as Mt. Adams Road) revealed regular 2-3 year burning from 1860 to 1900; regular 3-5 year burning from 1900 to 1939; and irregular burning at much longer intervals since World War 2.

### Rob Gillam’s Information:

**Question 1:** How long have you and your family known the general area, in particular Yardanogo Nature Reserve?

**Answer:** *Our family came to the Irwin area in 1936. Born in 1948, I have my knowledge from mid 1960s, but have always had a strong interest, been involved with fires, and had a strong interest in the anecdotal knowledge and stories.*

**Question 2:** Do you think CALM is managing fire well there?

**Answer:** *No I believe that they allow the fuel load to build up to too high a level and when we get fires (usually from lightning) they are too big and too hot.*

**Question 3:** If not, how could they be managed better?

**Answer:** *Frequent strip or mosaic burning that is carried out in late winter and spring. This then burns cool and does not kill the trees. The actual scrub will always come back even after a hot fire in 2-3 years but the *Banksia* and *Blackbutts*<sup>43</sup> take many years to grow again after big summer fires.*

**Question 4:** Others have told me that shooters (possibly APB) operated in that area in the 1960s, removing pigs, donkeys, goats and brumbies. Do you know anything about this? Did they camp there? If so, did they camp at any particular place? Did they burn the bush, or individual blackboys for warmth, or signals? Are any of them still around, and might remember where they camped?

**Answer:** *To my knowledge and also a close friend who remembers the 1950s there have never been pigs, goats, or donkeys in the reserve that were in numbers to shoot. There were many (100s) of wild horses, and these used to attract shooters during the 1960s and 70s for pet meat. I don’t believe they established camps.*

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<sup>43</sup> Comment by David Ward: Coastal Blackbutt, or Pricklybark, is *Eucalyptus todtiana* – many dead trees of this species, plus *Banksias*, can be seen along the Brand Highway, where recent hot fires, after long fire exclusion, have occurred. Had such fires been the norm in the past, there would probably no longer be any *Banksia* or Pricklybark. Mistletoe may have a role in these deaths too. Local information from another source, suggests that previous light, frequent fires kept the mistletoe down, but recent long fire exclusion allows it to grow to the point where it kills the host tree.