39 *Tours from Eastern States to W.A. arranged by W.A. Tourist and Publicity Bureau,* PROWA, WAGR AN 262/1 Acc. 1240/5490/39; 'Spring Tourists Arrive' *The West Australian,* 28 September 1939.
40 Tourist Bureau, 1931: *State Shipping Service – Tours,* PROWA AN 75/1 Acc. 924/51/31.
41 Tourist Bureau, 1925: *Parlour Coach Tours – Details and Policy,* PROWA AN 75/1 Acc. 924/55/25.
42 *The West Australian,* 17 August 1939.
43 Summers, *Favoured by Nature...*, pp. 677-93.
44 *The West Australian*, 22 September 1930.
45 *The West Australian,* 14 January 1938.
46 *The West Australian,* 2 December 1937; 26 July 1938.
47 *The West Australian,* 24 November 1937.
48 *The West Australian,* 2 December 1937.
49 Tourist Bureau, 1922: *Estimates,* PROWA AN75/1 Acc. 924/43/22. Tourist Bureau, 1941: *Administration*, PROWA AN 75/1 Acc. 924/44/41.
50 Tourist Bureau, 1922: *Estimates,* PROWA AN75/1 Acc. 924/43/22. fol. 85: fol.192.
51 WAGR AN/261 Acc. 1240/R1543/38 fol.73.
52 *The West Australian* 20 December 1939, 17 December 1940.
53 Tourist Bureau, *Administration,* 1941, fol. 4-20.

Peopled Landscapes in Southwestern Australia in the Early 1800s : Aboriginal Burning Off in the Light of Western Australian Historical Documents

Sylvia J. Hallam

In 1968 both Duncan Merrilees,[1] of the Western Australian Museum, and the late Rhys Jones,[2] working on Tasmania, independently showed that Europeans around 200 years ago did not enter pristine untouched *terra nullius*, but landscapes created by their Aboriginal developers over thousands of years. In 1975 I gathered evidence for Aboriginal shaping of southwestern landscapes as European newcomers first encountered them.[3] Here I review implications of recently published contact literature to recent controversies over the effects of Aboriginal firing; and to the very practical issues of control-burning today (issues raised acutely by this summer's wildfires).

Overview and debates

I would argue that Aboriginal Australian people, through a long prehistory, used fire as a tool to create, conserve, and exploit *fine-grained habitat mosaics*; thus increasing bio-diversity and developing a raised carrying capacity; allowing increased human numbers; leading to further diversified and intensified usage, in a positive feedback spiral; and/or to mechanisms of demographic restraint. Firing had a crucial role in the initial spread of people through the continent, in its more intensive peopling, and in creating the habitable Australian landscapes which greeted initial European settlers.

Humans. throughout their past, have reshaped world landscapes, decreasing woodland, and increasing open country. It is obvious that, as farming spread across the world in recent millennia, forest and woodland were cleared for cultivation. Keeping domestic stock had a similar effect, by preventing sapling growth. But surely non-farmers had negligible effects? On the contrary, before farming, our prehistoric forebears had already transformed landscapes on every continent, over hundreds of millennia, using the powerful tool of fire. The same is true of Australia.

Worldwide, firing opened up landscapes to the advantage of flocks and herds, whether they were horses and bison overwhelmed by a tide of trees at the close of northern glaciation, or kangaroos in semiarid Australia. 'Firing is for kangaroos', said Mick Kubarkku of Arnhem Land.[4] Firing in the 'top end' was done primarily to attract kangaroos to new grass regrowth; and for hunting drives, which would support (and be enabled by) great ceremonial gatherings.

But while men's hunting was more prestigious, women's garnering of plant staples and small game was more reliable. Burns open up easier access to the varied plant and small creature resources in swamps, thickets or yam-patches; encourage forest-edge plants storing carbohydrates in edible tubers, bulbs and corms; and promote new growth of seed-bearing grasses. Forests have very high biomass – but most of it is wood, and only termites can eat lignin! Open country often has a higher edible biomass.

Turning to Australian controversies, Merilees maintained that Aboriginal use of *fire* was disadvantageous in the long term.[5] Fire, not hunting, was critical for large mammals, leading to megafaunal extinctions. Rhys Jones argued that Aboriginal burns improved resource capacity. Tasmanian Aborigines had used fire, systematically and consciously, to open up corridors for movement; to create pastures attracting and confining marsupial grazers; and to maintain fine-grained mosaics of woodland and open country with diversity of plant and small game[6]. (Twenty years later Hank Lewis would write about 'Yards, corridors and mosaics')[7]. In the light of his experiences, along with those of Betty Meehan, in the Northern Territory where Aborigines were still using fire as a management tool, Rhys extended this argument to Australia as a whole. [8] In 1975, I argued that mosaic burning might be advantageous in the short term, but disadvantageous in the longer. And for over twenty years David Horton has dismissed what he calls the Tindale-Jones-Hallam hypothesis, and seen effects of Aboriginal burning as necessarily trifling.[9]

The demise of the megafauna was a result of Aboriginal firing, argued Merrilees. Conversely, Tom Flannery saw Aboriginal burning as the result of the demise of the megafauna![10] (His hypothesis is that, lacking large herbivore browsing, thick and tangled vegetation had to be burnt to make movement possible).

Thus Merrilees sees Aboriginal firing as deleterious in the long term, Jones as advantageous, Horton as negligible. David Bowman, in a magisterial review, concludes that Aboriginal burning *did* produce 'substantial changes in the geographic range and demographic structure of many vegetation types'.[11]

In the context of these Australian and world debates, we need to focus on the south-west. David Ward is using burn records in the annual growth of blackboys to address the periodicity of burning, in different ecological zones, before and after Aboriginal regimes yielded to European regimes.[12] Can south-west **historical** data provide comparable insight into the occurrence, purposes, context, personnel, seasonality, intensity, scale, numbers, frequency, and effects of Aboriginal burning?

McBryde and Nicholson saw historical observations as inherently inferior to ethnographic observations.[13] On the contrary, the careful records of navigators, naturalists, and surveyors, trained in the skills of meticulous observation provide our best evidence, glimpsing burning regimes before observers influenced what they observed.

Identifying bush burns

Many people continue to ask: 'Can we be *sure* that "smokes" and "fires" observed by mariners from the sea, or land explorers from a distance, were necessarily humanly lit; and necessarily bushfires'?[14] My response is: 'No, we can't be *sure* that *all* the "smokes" were from *humanly* lit fires, but we can be certain that *most* were.' And: 'No, not *all* "smokes" were from *bush* fires - but again, *most* were'.

Meteorological observations by mariners and naturalists often eliminate lightning as causing observed fires. Also, they often distinguish domestic 'fireplaces' from wider firesand sometimes watch 'burns' being lit. In sampling the anecdotal and numerical evidence, I shall not always confine myself to the south-west.

In September 1791, Captain George Vancouver surveyed King George Sound. Landing parties saw neither Aborigines nor fires around Princess Royal Harbour and Oyster Harbour, but deduced their previous presence from deserted huts and the ubiquitous evidence of low intensity burns. Vancouver concluded that these could not have been lightning fires, which would have had a much more devastating effect.[15]

In December 1792, Bruny D'Entrecasteaux, commanding *La Recherche* and *L'Espérance*, searching for La Perouse, sailed eastward along the south coast.

The naturalist, Labillardière, aboard *La Recherche*, notes on 9 December: 'We had not seen the least indication of inhabitants', until 'the smoke of two fires, which they had kindled, convinced us of their presence'. He seems to have seen the fires start. On the 10th, 'three fires, successively kindled, convinced us that the natives were on that spot.' In the afternoon, 'other fires lighted along the coast, sent up large columns of smoke'[16]. A clutch of fires was seen to start, for no meteorological reason.

From 11 December both ships anchored in what is now Esperance Bay, where the dune vegetation 'seemed to have suffered the recent effects of fire'. On 16 December a party from *L'Espérance* landed, and 'moved closer to some fires that were lighting up suddenly from place to place'. And 'On following days we saw some natives . . . They had probably set the bushes on fire'.

From 16 to 18 December, the naturalist of *L'Espérance*, M. Riche, became separated from his companions, and was left ashore. He penetrated some distance inland, where – 'whirlwinds of smoke' had been sighted in various parts of the interior. Riche continues 'I walked towards one of these smoke columns, which did not seem very distant'. He soon 'realized . . . appearances had been deceptive'. Walking for three hours he 'saw many places where the natives had made fires, and there were several columns of smoke rising around me. I approached one of these fires, which seemed to have been crowded with activity; but when I arrived the natives had gone'. We shall return later to his description of a whole series of fires being lit by people.[17] Clearly Riche saw multiple small ignitions, not one all-consuming front of flame.

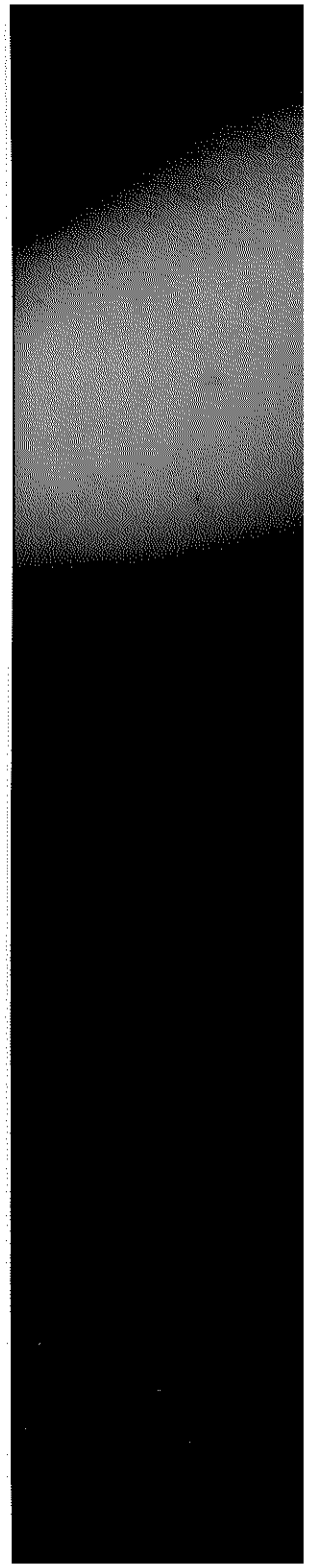
When Labillardièrre joined the search for his lost colleague he had no doubt that it was 'the natives' who 'had recently made fires in many places which we passed'. The search party passed 'many [burnt] places' in the space of a few hours, so each must have been quite small, a *fine-grain mosaic* of controlled burns, not a countrywide conflagration lit by summer lightning.

In 1801-3 both the French and the English were surveying our south-western shores. Peron, who wrote the official account of the Baudin expedition,went off on his own, in his usual impetuous fashion, to explore the hinterland of Geographe Bay, in June 1801. He found everywhere 'burnt trees and extinguished fires', thus distinguishing between the traces of bush fire and domestic fire. On Bruny Island, off Tasmania, they saw in January 1802, 'a man with a lighted firebrand, setting fire, here and there, to the bushes which covered the land'; and a day or so later – 'multiplicity of fires . . . In every direction immense columns of flame and smoke . . . burning for several leagues . . . destroyed these ancient and venerable forests'.[18]

These are bush fires, and man-made. Matthew Flinders, in the *Investigator* surveying Australian coasts from 1798 to 1803,[19] concluded that bush burns were lit by Aboriginal people to renew forage. When the *Investigator* anchored at King George Sound from 8 December 1801 to 5 January 1802, the botanist, Robert Brown, was not only able to observe distant 'smokes . . . a great way inland', but also saw Aborigines starting bush fires, as well as camp fires. At Brown's first encounter with Aboriginal people, on 14 December, a 'tall bony figure with [a] skin . . . loosely thrown about his shoulders . . . began to set fire to the long grass which soon began to blaze with violence'.[20]

I cannot examine in detail the observations of Phillip King's four journeys around Australian coasts in the years 1818 to 1822, [21] concentrating on the 'top end', but including King George Sound; nor those of D'Urville (1826-9), of Wilson (1835) or of Stokes (1837-43). These all include descriptions that must refer to bush fires rather than camp fires.

King talks of 'country lately fired'; 'large fires burning on the hills, made by the natives'; 'whole woods burnt down by the natives'; and fires 'made by the natives,



for the double purpose of burning off the dry grass and of hunting the kangaroos'. McBryde and Nicholson doubt King's implied deduction of a 'custom' of setting the grass on fire. But King actually observed several times a series of 'fires being lit'. On the west coast of Tasmania 'the country behind the beach was lined with native's fires, kindled as we passed.' On the Kimberley coast, four Aborigines sat on the beach 'watching the progress of a fire they had just kindled, which was rapidly spreading through the dry and parched up grass', and soon 'the fires that had been lit in the course of the day by the natives, had rapidly spread over the summit of the hills.' This is good evidence by a careful observer. At King George Sound, plantings made by Flinders' expedition had disappeared, and King explains that – 'whole woods may have been burnt down by the natives' in the sixteen years since Flinders' visit.

Numerically, observations are remarkably consistent between these different expeditions, and between maritime and initial land observations (e.g. Barker's at King George Sound)[22], in proportions of observations ascribable to bushfires, to domestic fires, or not firmly assignable to one or other category. Examples are tabulated below:

	Bush:	Domestic:	[Subtotal]	Uncertain:	Total
SEA					
D'Entrecasteaux (1791)	11	4	[15]	3	18
Peron (1801)	13	5	[18]	9	27
Flinders (1801-2)	10	6	[16]	14	30
King (1818-22)	30	13	[43]	19	62
D'Urville (1826-9)	5	6	[11]	3	14
Subtotal:	**69**	**34**	**[103]**	**48**	**151**
LAND					
Barker (1828-31)	20	6	[26]	10	36
Total: SEA & LAND	**89**	**40**	**[129]**	**58**	**187**

Combining these samples of early maritime and land observations, around a third of records cannot be allocated to either bush fire or camp fire category. Overall bush fires comprise almost half of all mentions of fire, and about 70% of those which can be allocated to a category. Conservatively, *two-thirds* (most), of observed fires are bushfires.

The laborious work of controlled firing

Pre-colonial accounts of south-west Aborigines burning small patches successively imply regimes of controlled, sequential burning, inviting comparison with recent Arnhem Land practice.

Hank Lewis describes 'top end' Aborigines using fire with fine control, showing sophisticated ecological and meteorological knowledge.[23] Fires set in the middle of the day, when wind direction and strength were reliable, could be directed towards previously burnt patches, with flames bent forward, and low scorch height. Patches of monsoon forest, which gave cover for game and provided fruit, yams and other tuberous plants were guarded against hot fires by burning around them early in the season. Where there are yams, said Big Bill Birriyabirriya, 'They don't burn. They dig them up'. He went on to say, 'It is good to burn country early in the dry season before fruit trees flower. If you burn when the flowers are already on the trees the flowers get burnt and no fruit will appear.'[24] To protect patches of closed forest from hot fires, adjacent fires had to be of low intensity, doing minimal damage, lit early in the season.[25]

Similar cautious controlled burns are described in the south-west. On 16 December 1792, M. Riche tells us,'I approached one of these [Aboriginal] fires, which seemed to have been crowded with activity, but when I arrived the natives had gone'. He explains, 'They set fire to a field covered with bushes, and spread the flames until everything has been consumed, [and they] leave the fire to extinguish itself during the night and transport themselves to another place next day.'[26] He implies deliberate, laborious, systematic firing, each patch limited in extent and part of an ongoing coverage.

Riche obviously interrupted the planned schedule, but the workers returned to the normal business of the day when he got out of the way. 'Next day I saw several natives, who from morning to night were busy poking their fire; when I approached them they went away, and when I retired, they again returned to their fires'. Riche later writes of 'the natives, whose fires I could see in the distance, spending the whole day . . . occupied with reviving their fire', the group 'always standing windward and in the smoke'.[27] Similarly, in 1840, J. Lort Stokes, ashore from *HMS Beagle* at the Sound, observed northward 'a party of natives engaged in burning the bush, which they do in sections every year. The dexterity with which they manage so proverbially a dangerous agent as fire is indeed astonishing. Those to whom this duty is especially entrusted, and who guide or stop the running flame, are armed with large green boughs, with which, if it moves in a wrong direction, they beat it out'.[28] They would have to stand to windward to do this. Both Riche and Stokes saw numbers of Aborigines lighting, spreading, maintaining, restraining, and guiding, *working* long hours with knowledge and skill.

In the 1820s surgeon Scott Nind concluded that King George Sound Aborigines avoided the potential violence of fire 'by their burning in consecutive portions'.[29]

In 1836 Lieutenant Bunbury described the country between the Murray and the Vasse as 'having the character of an open forest through most parts of which one can ride freely', and wondered how thick and impenetrable it would become without burning. 'It is true', he concluded, 'that we might ourselves burn the bush, but we could never do it with the same judgement and good effect as the Natives, who keep the fire within due bounds, only burning those parts they wish, when the scrub becomes too thick, or they have any other object to gain by it.'[30] Firing of a patch missed in previous years is contained by neighbouring ground burnt too recently to carry a fire in a later year. Riche, Nind, Stokes and Bunbury, all show how much planning, skill, and sheer hard work go into Aboriginal regimes of sequential, controlled, burning of limited patches by low-intensity fires, insuring against the ravages of wild fire.

Sir Thomas Mitchell, in the east, saw native burning as 'a work of considerable labour', leaving 'tracts in the open forest which had become green as emerald with the young crop of grass', and 'undertaken by the natives to attract these [kangaroos] to such places'. 'How natural,' Mitchell added, 'must be the aversion of the natives to the intrusion of another race of men with cattle: people who recognise no right of the aborigines to either the grass they have thus worked from infancy, nor to the kangaroos they have hunted with their fathers.'[31] 'Fire is for kangaroos,' said Mick Kubarkku to David Bowman, 'just like when we plant a vegetable garden, the new grass comes up . . . and the kangaroos crawl across, eating the grass.'[32] Right of tenure, that is ownership, applies as much to worked pastures, as to worked gardens.

The purposes and effects of burning

Burning has many purposes besides driving large game, herding great mobs of kangaroos towards the spears of hunters. ***Small game*** was the objective of women's small-scale burns (and a by-product of men's large-scale drives), both in the 'top end', and in the south-west.[33] Women would kindle small grass fires and 'walk over the ashes in search of lizards and snakes, which are thus destroyed in great numbers', reports Nind, in the 1820s.[34]

Fire drives for large game were memorable events. In 1833, Charles von Hugel described 'burning of the scrub' outside Fremantle - 'the deliberate burning of a large tract of forest, so as to force game to flee the flames, and kill them as they escape.'[35]

In the 1840s, Landor watched 'natives' in the Avon valley 'hunting in a large party, driving the game before them.' He said, 'as I stood in the midst of a large plain which they had surrounded on three sides, multitudes of kangaroos – I believe I might say thousands – of all sizes came rushing past me.'[36] About fifty native ***men*** visited him, implying that the drive provided sustenance for, and was made possible by, a gathering of over a hundred men, women and children. That night they 'danced a corrobery' [sic].[37] Sociability and ritual were both the cause and the outcome for the drive.

Major drives provide much of the wherewithal to sustain a ***large ceremonial gathering***; but conversely a large assemblage of people is necessary in order to carry out a wide fire drive, and/or a programmed sequence of control burns. Large aggregations of people always have a ritual aspect.

Land-ownership, in the centre and north, carries the responsibility and the right to plan and host the activities and the ceremonies necessary to keep the land in good heart. Drives require competent, authoritative, pre-planning and direction. To burn casually, without the land-holder's permission, does him an economic injury (a drive is not repeatable at a particular location until vegetation has regrown). It also injures his ability to undertake the ritual obligations and privileges of ownership. The fire drive itself is regarded as a sacred and very serious act, often first enacted by the major local creative being.[38] Similarly, Landor's fifty visitors indicate a considerable ritual gathering. In the Jarramungup region, the *man carl* ceremony was the necessary concomitant of the coming together of several groups for bush firing.[39]

This ***conjunction of ecological and ceremonial purposes*** goes back as far as our records. In January 1830 Captain Collett Barker, commandant of the military detachment at King George Sound, tells of 'a great assembly at King River from all parts of the country, from Will's country [to the north], and other places at a great distance', provisioned by 'plenty of fish and kangaroo'. Barker's Aboriginal friend, Mokare, knew the visitors were coming 'by the appearance of distant fires', and told Barker, 'the blacks had plenty of kangaroo . . . killed by the fires'. There would be 'plenty of black fellows and plenty of women', clearly a socially desirable happening, but relatively rare. The 'great assemblage' continued through the last week of January into the first days of February. [40]

In November 1830, the King George Sound men again began to think of burns and gatherings. They set a 'huge fire' in the morning, then 'go about joking, each with a small piece of fire', and later sit in a ring while some 'grand scene' or ceremony is enacted.[41] In early January 1831, the fires of the northern Wills' men once more approached. Mokare's companions hoped, 'to burn for Wallabi, which they begin on a grand scale tomorrow'. Next day there was 'much burning in different parts', but for the expected grand drive they had to await one particular individual, Coolbun, 'whose ground it was'. He had the unquestioned prerogative of initiating all burns and drives, and could thus protect his terrain by pre-emptive burn-offs, yet retain enough un-burnt ground to support and host drives and ceremonies. Late January saw 'large fires', and the natives 'had taken abundance of Wallabi and some fish (from stone and brushwood fish traps on Oyster Harbour and the Kalgan River, providing a necessary auxiliary food – even though some men had clubbed as many as six 'roos apiece!). Later Mokare burnt without permission, causing much resentment.[42]

The timing of gatherings could be decided by the appropriate elders in the light of their ritual responsibilities (Law), and their knowledge (lore) about the dryness of the vegetation and the availability of auxiliary resources. Storable plant staples like processed zamia fruit, plant gums, harvestable yam tubers and reed rhizomes, and fish supplies from 'weirs', were all more reliable than large game, and so prerequisites for a great assembly.

In the Perth area also, large assemblies were necessary for large-scale firing and vice-versa. In 1834, Migo and Monday told the Lieutenant-Governor that the 'general assembly of the tribes' he desired 'would not be possible until the yellow season', when banksia blooms, from December to February, 'when the country is generally fired'.[43] In February 1849, some three hundred Aborigines (probably males) assembled near Perth to hold 'grand corroberees'.[44]

'Fire is for kangaroos' in two ways, directly, as a weapon of the hunt and indirectly, ***to encourage new growth,*** particularly of grasses.[45] Selective early season burns (John Wollaston records burns as early as November in 1841),[46] ensured prolific forage in particular areas, making it easier to predict where game would pasture.

Another general reason for burning was simply to ***open up*** vegetation and provide access. In October 1826, Dumont D'Urville, anchored in King George Sound, encountered an Aborigine carrying a glowing banksia cone, 'a portable fire, to keep his belly and the front of his body warm,' and 'to set fire to the undergrowth and dry grass.' He adds, 'this is what makes these New Holland forests so open and easy of access',[47] very different from unvisited offshore islands. A landscape made 'untidy' by thickets presents a danger of fierce wildfires, and an encumbrance to movement. Owners had a duty to ***clean up*** the countryside. Areas most frequented were most consistently burnt; and areas most meticulously burnt were most frequented; giving open corridors for movement between nodes of occupation, like the valley of the Woorooloo Brook, or some Tasmanian valleys. Fires which escaped into the surrounding backwoods ensured that very little remained unburnt and dangerous for decades.

Campsites must be burnt to clear them of insects and snakes, and their surrounds of threatening regrowth. Near King George Sound, Vancouver saw one long-abandoned settlement with some huts much decayed and others fresher; and another group altogether more recent; but neither affected by the ubiquitous firing.[48]

Protection, of camping spots and patches of cherished plant and animal resources, was one purpose of early season burns. Chris Haynes describes, in Arnhem Land, several light burns per season around valued resource patches, contrasting with several seasons between burns over the 'rubbish country', relatively unproductive eucalypt woodland.[49] Lewis also observed controlled pre-emptive burns around the margins of northern wetlands, later protecting their abundant reed tubers, frogs, and fresh water 'tortoises'. On the Swan coastal plain Grey reported reed rhizomes harvested after dried out swamp surrounds had been burnt off.[50]

Burning regimes aimed to ***keep parts of the landscape unburnt.*** Many animals need not only forage but also *shelter* in the heat of the day, and coverts for their young. Burnt patches with new growth need to be near unburnt patches of sheltering undergrowth. Particularly valued, and/or vulnerable, plant resources (monsoon rain forest in the north, yam thickets in the south) may remain 'islands in a sea of fire'.[51]

In late January 1831 at King George Sound, several young men, 'cut the bush down all around to prevent the fire from reaching' saplings 'not yet ripe', needed for making 'wanera' (spear-throwers).[52] Un***burnt*** reserves were among the objectives of Aboriginal firing regimes.

Within any one terrain, fires for different purposes, of differing extent and intensity, at different seasons, set by different subgroups (male or female, few or many), in different habitats, differently frequented, produce patchy 'mosaics',[53] some fine-grained and some coarser. Spectacular fire drives are the most prestigious, but numerically only a minor component, of Aboriginal bushfire regimes.

Property, lore and law

'The blacks,' explains Barker in 1830, 'to express home or resting place . . . say such a one's fire.' [54] A family may make their 'fire' under a rock or a bush or near to water, and it is the fire, rather than any structure, which constitutes 'home'.

George Fletcher Moore, of the Swan valley, wrote more precisely in his *Vocabulary 'Kalla* – Fire: a fire; (figuratively) an individual's district; a property in land. *Kallip*: Denoting a knowledge of localities; familiar acquaintance with a range of country . . . also used to express property in land'.[55]

Bishop Rosendo Salvado also lists '*cala*' as meaning 'fire, hearth, native district'.[56] When Salvado surveyed a track from New Norcia to Perth, his Aboriginal companions negotiated formally with the land-holders, sitting thigh to thigh for long minutes, 'the most profound silence reigning throughout the entire ceremony'. Then the oldest Bindoon leader addressed his New Norcia counterpart: '*Nichia n'agna cala*.. . . Here is my *fire*, now it is yours too. I stay here; you come and go, then you come back to go away and come again'. *Cala* was land held in sacred trust. An *easement* giving access to any part of that *tenement* was ceded only with the utmost solemnity. [57]

That close attachment to land (which Europeans call 'property', 'ownership' or 'tenure'), under Aboriginal lore and law involved knowledge, rights, and responsibilities. The right to hold ceremonies was linked to the right to hold fire-drives that made those ceremonies possible, and to retain unburnt areas ready for fire drives. Fire was an important component in funerary, cleansing and increase rituals, and itself a sacred activity.[58]

Seasons, patterns, numbers, extent and frequency of burns

Burning was necessarily confined to the 'dry' winter in the north, summer in the south. South-west burns were recorded between November and March. Vancouver, visiting King George Sound in September, sees the effects of firing, but no fires. The pages of the *Perth Gazette*, show the same pattern continuing.[59]

Patterns (location, intensity, control, extent and numbers) of burns changed through the burning season. Lewis, and also Haynes,[60] describe contemporary Aboriginal firing in the 'top end', illuminating the south-west records. Firing was very controlled and ignitions frequent early in the season, around valued resources. Burns became much more casual later along access routes and their hinterland of backwoods; what George Fletcher Moore calls '*Mundak* – the bush; the wild country; the woods'[61] the 'top enders' dismiss as 'only desert'.[62] At King George Sound in 1826, Quoy, D'Urville's naturalist, remarked on 'the native habit of starting fires wherever they pass through'.[63] The eventual outcome is described by Vancouver – 'we did not see a spot which had not . . . felt its [fire's] effects'.[64] A *fine*-grain mosaic, around swamps, etc., may be set within a *coarse* mosaic encompassing less frequented and less frequently burnt woodlands.

Questions about frequency have caused enormous dispute, but there is no single answer. Not only are the answers different for different localities, but the word has been given different meanings. Jones asserted that Aboriginal advent increased

burn frequency tens of thousands of times.[65] David Horton countered that any patch of land would support only a certain 'frequency' of burning, and no more. Nowhere does each define what they mean by 'frequency'.

Published data are few on numbers and extent of fires in a given area, and their average over a total region and a span of seasons. In the north Haynes mapped the extent of burning within an eight km by twelve km area, fortnight by fortnight over one dry season. In May and early June brief conflagrations cleared a dozen or so pocket-handkerchief-sized blobs, each less than 100m in diameter. By late June dozens of burns had affected patches from 200 m or 300 m to two or three km across. The three or four dozen blocks burnt in early July averaged perhaps one km across. In late July to August recently burnt areas were fewer and more extensive, and almost half the area had been burnt. The latest fires affected a large block of rough country on top of the escarpment. 'It's only desert' said the Aborigines. [66] Over a ten-week season hundreds of fires must have been lit, many burning on most days, some minute and most less than one sq. km A few bits were burnt more than once; some not at all that year, left ripe to burn next year, or the next.

Average frequency of firing could be calculated as once per '**n**' years, where '**n**' is the total area divided by the sum of areas burnt per year, averaged over a run of years. About half the total area got burnt in the year of Haynes' investigation, so the average frequency is likely to be around once every two years. Calculated results would differ for different sub-areas, depending on area location and dimensions.

Jones observed one Arnhem Land group producing tens or hundreds of ignitions per day, perhaps 5,000 ignitions in the burning season, over an area around 30 by 30 km; [67] compared with perhaps one great conflagration every ten years before humans arrived. He calculated 'Aboriginal man's influence on the frequency of natural fires over such an area would be to increase it by a factor of tens of thousands to one.'

Jones uses the word 'frequency' to mean numbers of *ignitions* per year in a given band area. What does this imply for the average number of times any one bit is burnt over a span of years? One enormous blaze from a lightning strike after decades with no burning might cover the entire 900 sq km Aboriginal burns, in a countryside already regularly burnt, might average one km across, taking 900 ignitions to cover the same area; 3,600 if they averaged 500 m across; 90,000 if only 100 m. across! Hundreds, thousand or even tens of thousands of ignitions might burn only the same total area as one great uncontrolled wild fire.

Jones' 5,000 ignitions would cover nearly half the 30 by 30 km area, if the resultant burns averaged 300 m across, Rhys assumed a pre-Aboriginal lightning giving a total burn once every ten years.[68] Over those years, 50,000 Aboriginal ignitions would cover *five* times the full area. Frequency would be increased *five* times; but ignitions *50,000* times. Rhys' proposed great increase in *ignition* frequency is not inconsistent with a vastly smaller increase in the *average frequency of burns per unit area*. Aboriginal people probably had far less effect on the number of times a particular spot would be burnt than Jones implies – perhaps one order of magnitude rather than four! Nonetheless, Rhys is right in asserting that Aboriginal people made a vast difference to the *patterns* and *effects* of burning, and Horton is wrong in averring *no* effect.

Do *south-western* explorers' journals and logs help to elucidate the numbers, extent, and consequent frequency of Aboriginal burns?

In December 1792, the D'Entrecasteaux expedition observed in Esperance Bay, 'some fires . . . lighting up suddenly from place to place'. M. Riche, 'saw many places where the natives had built fires' and 'several columns of smoke' rising around

him and stated rather strangely – 'I have not counted more than thirty fires' in an area 'at least ten leagues [50 km] in diameter'. This resembles Jones northern estimate of tens to hundreds of ignitions per day for an area 30 km across. The mean spacing of these burns works out one per patch 5 km or 6 km across on average,[69] clearly not confluent, countrywide fires, but discrete small burns. Most burns can have measured only hundreds of metres (or at most a kilometre or so) across, as in Haynes' northern study.

In January 1802, Flinders' *Investigator* anchored in the same general area, and the naturalist Robert Brown observed 'the country set on fire in nine different places by the natives', suggesting possibly fewer larger burns later in the season.

'Fires' and 'smokes' observed from the sea are almost always plural, and often 'several', or 'numerous'. Many accounts depict a sequence of small fires lit in rapid succession, implying high ignition frequencies, perhaps ten or more of ignitions per day, comparable with the Jones and Meehan observations in the north. Flinders saw, in 1798, in north east Tasmania, one man, 'setting fire to the grass in different places', obviously very closely spaced. Typically 'smokes' are noted in clumps – 'several smokes' level with the Nuyts Archipelago, 'smokes rising' at Streaky Bay, a great 'number of smokes' at Smoky Bay, and 'many smokes' around Coffin Bay, all in January and February 1802.

Barker records, on 21 January 1831, the 'appearance of distant fires' by which Mokare 'seemed to know the movements of the natives'. In October Mokare had 'to look for blackfellows' fires', to determine whether a group had set out towards Kojonup [70] to a gathering for ceremony and exchange, a sort of market and feast day, tracking their progress by a line of fires. In January 1831, before their great fire drive, Mokare and his companions engaged in 'much burning in different parts',[71] again, a *series* of limited fires.

South-west Aborigines habitually carry a glowing banksia cone, so that a hearth or a burn can be ignited almost instantaneously. In the 1870's, Mrs Millett, of York, observed, 'In wet weather it is usual to carry in the hand, beneath the kangaroo skin, a piece of smouldering wood, which compensates in some sort for the want of a flannel waistcoat, and enables Aborigines to light a fire at a moment's notice.'[72] Thus 'firestick farming' comprises rapid sequences of small, closely set, fires quite different from either natural or European fire regimes.

Fire regimes – wild, Aboriginal and European

Without human ignitions, wild fire regimes allow heavier fuel accumulation between less frequent lightning ignitions; fires burn more fiercely, extensively, and for a longer time; with a higher scorch height and more canopy destruction; extending across ecological zones; and producing wide areas of one age growth. [73]

Aboriginal fire regimes ensured that much of their terrain was burnt earlier in the season, in a more controlled fashion, and with less destructive and more productive effects – lower scorch height, lesser canopy destruction, lesser extent, more control, so that some vegetation was preserved unburnt; and a much finer-grained mosaic resulted, particularly over productive, frequented areas.

Despite Horton's assertions to the contrary, Aboriginal firing management certainly could and did change many characteristics of Australian fire regimes, and their effect on vegetation.

Seasonality was changed. Under Aboriginal regimes, selected patches were burnt as early as they will stand fires, giving 'firebreaks' around treasured resources.

Climax vegetation was changed. Once open zones through south-west jarrah and wandoo forest and woodland became clogged with undergrowth when they ceased to be tended with the 'judgement and good effect' the Aborigines brought to their work. Peppermint clogged the tuart forest.

The scale of the mosaic, of patches at different stages of growth, was changed. Everywhere Aborigines set lots of little fires, controlled by burning towards patches already burnt earlier. Occasionally wayward fires were actually beaten out. A more diversified landscape, produced diversified resources. Where most frequented it was most diverse, and least liable to catastrophic fierce and extensive burns.

Intensity of fires was changed and catastrophic fires largely avoided.[74] Aboriginal burning did change vegetation composition, distribution, and flammability. Aborigines, over tens or hundreds of millennia, developed skills in controlling the intensity and spatial scale and location of landscape fires, and conservation of vegetable resources in a way which, in David Bowman's words, 'developed negative feed back which promoted ever smaller and lower intensity fires'. By contrast Europeans have, 'produced a positive feedback cycle increasing size and intensity of landscape fires.'[75] In two hundred and fifteen years we have managed, disastrously, to reverse the long process by which the original Australians developed peopled, and people-friendly, landscapes.

Endnotes

1 D. Merrilees 'Man the destroyer: late Quaternary changes in the Australian marsupial fauna', Journal of the Royal Society of Western Australia, v. 51, 1968, pp. 1-24.

2 Rhys Jones, 'The geographical background to the arrival of man in Australia and Tasmania', Archaeology and Physical Anthropology in Oceania, v. 3, 1968, pp. 186-215; 'Fire-stick farming', Australian Natural History, 16:7, 1969, pp. 224-228.

3 Sylvia J. Hallam, Fire and Hearth; a study of Aboriginal usage and European usurpation in south-western Australia, Australian Institute of Aboriginal Studies, Canberra 1975.

4 David Bowman, M. Garde and A. Saulwick, 'Kunj-ken Makka Man-wurrk. Fire is for kangaroos: interpreting Aboriginal accounts of landscape burning in Central Arnhem Land', in A. Anderson, I. Lilley and S. O'Connor eds, Histories of Old Ages: Essays in honour of Rhys Jones, Pandanus Books, Canberra 2001, pp. 61–78.

5 D. Merrilees, 'Man the destroyer . . . '

6 Rhys Jones, 'The geographical background . . .'

7 H. T. Lewis and T. A. Ferguson, 'Yards, Corridors and Mosaics: how to burn a boreal forest', Human Ecology, v. 16, 1988, pp. 57-77.

8 Rhys Jones, 'The Neolithic Palaeolithic and hunting gardeners', in R. P. Suggate and M. M. Cresswell eds, Quaternary Studies, The Royal Society of New Zealand, 1973, pp. 21-34

9 David Horton, 'The burning question: Aborigines, fire and Australian ecosystems', Mankind, v.13, 1982, pp. 237–51; The Pure state of Nature: Sacred cows, destructive myths and the environment, Allen and Unwin, Sydney, 2000.

10 Tim Flannery, The Future Eaters, an ecological history of Australasian lands and people, Reed Books, Adelaide 1994, pp. 217–236, especially p. 230, where defunct megafauna leave 'vast amounts of uneaten vegetation' piled on the landscape. Even megafauna did not eat wood! He ignores microfauna, particularly termites, as disposal mechanisms.

11 David Bowman, 'The impact of Aboriginal landscape burning on the Australian biota', *New Phytologist*, v. 140, 1998, pp. 385–410.

12 David Ward, Fire, Flogging, Measles and Grass: Nineteenth century Land-Use Conflict in South-Western Australia, Dept of Conservation and Land Management, Perth 1998.
David Ward, The Past and Future of Fire in John Forrest National Park, Western Australia, Curtin University, Bentley WA, 2001; David Ward and Rick Sneeuwjagt , 'Believing the Balga', *Landscope*, 14:3, Autumn 1999, pp. 10–16.

13 I. McBryde and P. Nicholson, 'Aboriginal man and the land in South-western Australia', *Studies in Western Australian History*, v. 3, 1978, pp. 38–42.

14 David Horton, 'Fire and human societies.' Paper delivered at the CALM symposium on 'Fire in Southwest Australian Eco-systems', April 2002.

15 George Vancouver, A Voyage of Discovery to the North Pacific Ocean and round the World, performed in the years 1790, 1791, 1792, 1793, 1794 and 1795 in the Discovery, sloop of war and armed tender, Chatham, under the command of Captain George Vancouver, John Stockdale, London: 1801, p. 56.

16 M. Labillardière, Voyage in Search of La Perouse 1791–1794, [trans. from the French; Stockdale, London 1800]; facsimile De Capo Press, New York & Amsterdam 1971, pp. 253–5.

17 E. and M. Duyker, trans and ed, Bruny d'Entrecasteaux, *Voyage to Australia and the Pacific, 1791–1793*, Melbourne University Press, 2001, pp. 113–114; 119–124.

18 M. F. Peron, *A Voyage of Discovery to the Southern Hemisphere*, performed by the order of the Emperor Napoleon during the years 1801, 1802, 1803, and 1804 [Trans. from the French, Phillips, London 1809]; Walsh, Melbourne 1975 edition.

19 I have based my count on the selection made by Tim Flannery, ed, Terra Australis: Matthew Flinders' Great Adventures in the Circumnavigation of Australia. Intro. Tim Flannery, Text Publishing, Melbourne 2000.

20 T. G. Vallance, D. T. Moore and E. W. Groves, *Nature's Investigator: The Diary of Robert Brown in Australia, 1801–1805*, Australian Biological Resources Study, Canberra, 2001, p. 96.

21 Phillip P. King, *Narrative of a survey of the Intertropical and Western Coasts of Australia* . . . 1818–1822 Murray, London: 1827.

22 John Mulvaney and Neville Green, *Commandant of Solitude: The Journals of Captain Collett Barker*, 1828-1831, Melbourne University Press, 1992.

23 Henry T. Lewis, 'Burning the "Top End": kangaroos and cattle', in J R Ford, ed, *Fire Ecology and management in Western Australian Ecosystems*, Western Australian Institute of Technology [now Curtin University], Bentley WA, 1985, pp. 21-31.

24 Bowman, Garde and Saulwick, ' . . . 'Fire is for kangaroos . . .'

25 C. D. Haynes, 'The pattern and ecology of munwag : traditional Aboriginal fire regimes in north-central Arnhemland' *Proceedings of the Ecological Society of Australia*, v.13, 1983, pp. 203- 214.

26 Presumably translated from the French word, champ, which can also mean prairie, meadow, open countryside.

27 Duyker, ed, *Bruny d'Entrecasteaux* . . .

28 J. L. Stokes, *Discoveries in Australia; with an account of the coasts and rivers explored and surveyed during the voyage of H. M. S. Beagle in the years 1837–38–39–40–41–42–43*, T & W Boone, London 1846, v. II, p. 228.

29 Scott Nind, 'Description of the natives of King George's Sound (Swan River Colony) and adjoining country' *Royal Geographical Society Journal*, v. 1, 1831, pp. 21-31.

30 W.S.P. Bunbury & W.P. Morrell, *H. W. Bunbury, Early Days in Western Australia*, Oxford University Press, London 1930, p. 105.

31 Sir T. L. Mitchell, *Journal of an Expedition into the Interior of Tropical Australia, in search of a route from Sydney to the Gulf of Carpentaria*, Longman, London 1848, p. 306.

32 Bowman, Garde, and Saulwick, 'Fire is for kangaroos . . .'

33 Rhys Jones, 'The Neolithic Palaeolithic and hunting gardeners. . . '

34 Nind, 'Description of the natives . . .'

35 Baron Charles von Hugel, *New Holland Journal:* November 1833–October 1834. Trans. and ed, Dymphna Clark, Melbourne University Press, 1994.

36 E. W. Landor, *The Bushman; or, life in a new country*, Richard Bentley, London 1847), pp. 262.

37 ibid.

38 Bowman, Garde, and Saulwick, 'Fire is for kangaroos . . .'

39 Ethel Hassell, 'Notes on the ethnology of the Wheelman tribe of south-western Australia. Selected and edited by D. S. Davidson', *Anthropos*, v. 31, 1936, pp. 679-711, especially pp. 698, 700.

40 John Mulvaney and Neville Green, *Commandant of Solitude* . . ..pp. 249–254.

41 ibid, p. 350.

42 ibid, pp. 377–386.

43 *Perth Gazette*, 7 September 1834.

44 *The Inquirer*, 3 February 1849.

45 I shall not repeat the material documented in *Fire and Hearth* .

46 Geoff Bolton and Heather Vose, eds, *The Wollaston Journals : 1840-1842*, v.1, University of Western Australia Press, Perth 1991, p.136.

47 Jules Dumont D'Urville, *Two Voyages to the South Seas . . . to Australia, New Zealand and Oceania, 1826-1829, in the corvette Astrolabe* . . .v. 1: Astrolabe, 1826-1829. Trans. from the French and edited by Helen Rosenman, Melbourne University Press, 1987, p. 30.

48 Vancouver, *A Voyage of Discovery*. . ., pp. 33–39, 54-56.

49 Haynes, 'The pattern and ecology of munwag . . .'

50 George Grey, *Journals of two Expeditions of Discovery in North-West and Western Australia, during the years 1837, 38, and 39, T. and W. Boone*, London 1841, v.2, p. 292

51 D. M. J. S. Bowman, *Australian Rain Forests: Islands of Green in a Land of Fire*, 2000.

52 Mulvaney and Green, *Commandant of Solitude* . . . p. 390. Were they using steel axes?

53 Lewis and Ferguson, 'Yards, Corridors and Mosaics. . . '

54 Mulvaney and Green, *Commandant of Solitude* . . . p. 307.

55 The most accessible version is that published along with his Diary in 1884, and reprinted by UWA press at the sesquicentenary: George Fletcher Moore, *Diary of ten years in the eventful life of an Early Settler in Western Australia; and also a Descriptive Vocabulary of the Language of the Aborigines* [Wallbrook, London, 1884]; facsimile, University of Western Australia Press, Perth: 1978, ed, Tom Stannage, p. 39.

56 Dom Rosendo Salvado, *Memorie Storiche dell'Australia,* Society for the Propagation of the Faith, Rome, 1851; published as *The Salvado Memoirs. Historical Memoirs of Australia and particularly of the Benedictine Mission of New Norcia and of the Habits and Customs of the Australian Native,* trans. and ed, E. J. Stormon, University of Western Australia Press, Perth, 1977, p. 257.

57 ibid, p. 66.

58 Hallam, *Fire and Hearth* . . . chapters 12–14.

59 Some instances include – February 1833: continuous blaze on banks of Melville Water; and fire over Mount Eliza after natives had meal nearby (Perth Gazette [PG] 23/2/1833); March 1833: several house of reeds burnt to the ground in Perth itself, natives suspected but cleared (PG 16/3/33); William Shaw's hay-ricks on fire at Upper Swan (PG 23/3/33); December 1833: native fires; Mount Eliza burnt for 2 days (PG 20/12/33); February 1834: fire at Shaw's at Upper Swan lit by natives; alsoin bush on the opposite side of the river (PG 22/2/1834); March 1834: fire on flats [by present Causeway] attributed to natives, destroyed considerable property of Wm. Tanner (PG 15/3/34); March 1835: 'inflammable state of the bush at this season of the year . . . ignited by the natives – caused usual havoc' (PG 7/3/1835); March 1836 'native fires around us' (PG 5/3/1836); February 1838: native bushfires very destructive near Perth, near Peninsula Inn on Guildford road, and on opposite side of the river (PG 10/2/1838); April 1838: 50 pigs destroyed by 'their running bush fires' (PG 28/7/38); January 1841: property on Mount Eliza destroyed by bushfire spread from native huts (PG 18/1/1841); December 1843: bushfires around Perth (PG 28/3/1843); Mr Bayley's house, crops and [farm] premises burnt to the ground (PG 30/1/1849); December 1845: native fires continue to do considerable damage in the York district (PG 23/12/1843); January 1847: native practice of setting fire to the bush, described by York's Resident Magistrate, R. H. Bland, in his 1846 Annual Report, advocating legislation (PG 30/1/1847).

60 Haynes, 'The pattern and ecology of munwag . . .'

61 Moore, *Diary of Ten Years* . . . p. 57.

62 Haynes, 'The pattern and ecology of munwag . . .'

63 D'Urville, *Two Voyages to the South Seas* . . . p. 46.

64 Vancouver, *A Voyage of Discovery* . . . p. 56.

65 Rhys Jones, 'The Neolithic Palaeolithic and hunting gardeners'.

66 Haynes, 'The pattern and ecology of munwag . . .'

67 Rhys Jones, 'The Neolithic . . .'

68 Rhys may under-estimate the likely frequency of lightning burns if no humans had ever been present. The flammability of present vegetation had been exposed to tens of thousands of years of negative feedback through Aboriginal burn-offs.

69 Probably not evenly spread. If Riche overestimated distance the burns were closer, perhaps one to each two or three km patch.

70 Mulvaney and Green, *Commandant of Solitude* . . . 0pp. 249, 341.

71 ibid, p. 378.

72 Mrs Edward Millett, *An Australian Parsonage., or, The Settler and the Savage in Western Australia,* Stanford, London, 1872, p.77 ; facsimile edition University of Western Australia Press, Nedlands WA, 1980.

73 On uninhabited Kangaroo Island Flinders saw burnt trees '...nearly of the same height, and the same progress towards decay', an extensive one-age stand, burnt in one go, implying a universal conflagration; and at least one previous total burn. In January 1802, Flinders ' expedition visited Mondrain Island, unfired and covered in brushwood. The landing party 'set it on fire; and there was a general blaze all over the island'. If people had been around, their continual burn-offs would have protected the landscape against such destructive fires. The southwest Aborigines had no canoes to reach these offshore islands. On Rottnest and Garden Islands, thick bush awaited the next lightning ignition

74 In 1791, Vancouver observed very carefully the evidence for intensity of the Aboriginal firing for the area around King George Sound.
He observed 'Where the country was well-wooded, the loftiest timbers had the topmost of their branches burned; yet none seemed totally destroyed by it [fire]', Vancouver, A Voyage of Discovery . . . p. 56)

75 Bowman, Garde, and Saulwick, 'Fire is for kangaroos . . .