



Aboriginal fire management in south-eastern Australia: aims and frequency

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ABSTRACT

Aim To examine the purpose of burning by Aborigines of south-eastern Australia.

Location South-eastern Australia.

Methods A survey of the ethnography and ecology relating to Aboriginal fire.

Results Ecologists have only recently acknowledged the past history of Aboriginal burning. Its purpose was to maximise plant and animal food resources.

Main Conclusions The seasonal timing and frequency of Aboriginal burning is embedded in various ecosystems.

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INTRODUCTION – THE INVISIBLE PEOPLE

Aborigines entered the Australian continent at least 40,000 years ago at a conservative estimate (Mulvaney & Kamminga, 1999), carrying with them the knowledge of how to make and use fire. As they penetrated the diverse regions of the continent their continued survival came to depend upon their ability to exploit the food resources without depleting them. Fire became their most important tool in creating landscapes which ensured the maintenance of these resources (Flannery, 1994; Kohen, 1995). Major climatic changes, such as glacial periods, have produced long-term vegetation changes that flowed slowly over the continent, but despite this, the Aborigines were always faced with the same survival challenge. Their long history in Australia is evidence that they surmounted the challenge.

The landscapes encountered by the first European settlers in the temperate climate of south-eastern Australia had a long history of Aboriginal intervention, but this went largely unrecognized. One of the few perceptive pioneer settlers in Victoria was Edward Curr, who described the Aborigine thus: 'living principally on wild roots and animals, he tilled his land and cultivated his pastures with fire' (Curr, 1883). Hallam's series of studies in south-western Australia (Hallam, 1975, 1987, 1989) emphasized Aboriginal cultivation of the tuberous staple yam (*Dioscorea hastifolia*), and the controlled use of fire to create open forest. Yet to the majority of Australian ecologists, Aboriginal people remained invisible; indeed by using the European-encountered ecosystems as biodiversity benchmarks, professional botanists of the nineteenth and at least half of the

twentieth century seem to have implied that they were pristine. In 1981, in the collected articles in *Fire and the Australian biota* (Gill *et al.*, 1981), despite a chapter by an anthropologist describing the Aboriginal use of fire (Nicholson, 1981), there was virtually no recognition by contributing fire ecologists of the past Aboriginal history of Australian vegetation. In the second edition of the introductory volume to the *Flora of Australia*, Aboriginal fire rates a passing mention in only a palynological context (Hill *et al.*, 1999).

The formative effect of many thousands of years of Aboriginal occupation on the nature of the flora and fauna and the structure of ecosystems has only recently been taken into account. Kohen (1995) considered that in the last 5000 years, Aboriginal land management practices would almost certainly have affected the vegetation. Bowman (1998) in a comprehensive review, has recognized the long history of Aboriginal burning, and has described its impact as 'one of the most complex and contentious issues in Australian ecology', adding:

'fire was a powerful tool that Aborigines used systematically and purposefully over the landscape' ... and that there is... 'little doubt that Aboriginal burning was skilful and was central to the maintenance of the landscapes colonised by Europeans in the 19th century... This issue is not only important for the development of a comprehensive understanding of the dynamics and evolution of the Australian biota, but is central to the formulation of appropriate strategies for the conservation of the nation's biota'.

In *Flammable Australia* (Bradstock *et al.*, 2002) there is a real change – an acknowledgement that ‘Aboriginal land management has left a major signature on Australian environments’ (Keith *et al.*, 2002).

ABORIGINAL RESOURCES – PLANTS

If fire was used ‘systematically and purposefully’ to what system and what purpose was it used? Anthropological accounts of burning are biased towards its role as a hunting tool, and this bias has persisted in the popular view. ‘Hunting, path-clearing and communication’ was given as the purpose of firing on the Australian Broadcasting Commission Science News Web Site on 14 May 1999. Certainly fire was used as a hunting tool, but the major effect of fire is on the vegetation, and both Aborigines and animals depended on plants. What was the role of fire in the maintenance of vegetable food, the dietary importance of which is usually overlooked?

When Europeans arrived in Victoria, and before the spread of introduced disease, the reports described the Aborigines as healthy and well-fed: ‘strong and athletic, often 6 ft tall, very intelligent and quick in their perceptions, with exceptional eyesight and particularly fine teeth’ (Gellibrand in Bride, 1898); and ‘in almost every part of the continent...I have found that the natives could usually, in 3 or 4 hours, procure as much food as would last for the day, and that without fatigue or labour’ (Eyre, 1845). The people had inhabited the land for thousands of generations, had endured major climatic changes, yet they were still living well. Populations were highest in those areas where animal and plant food was abundant (Goodwin, 1854; Campbell, 1987) and plant food, gathered by women and children, was estimated to make up at least 50% of the diet (Winter in Bride, 1898; Latz, 1995). When hunting was unsuccessful it was the fall-back food. George Augustus Robinson, the Protector of Aborigines, in 1840 noted that the basalt plain known as Spring Plains was covered with ‘millions of Murnong’ (*Microseris lanceolata*), the tubers of which were a major staple food (Clark, 1998, VI; Gott, 1983). Major Thomas Mitchell in 1836 described the view south and east from the Grampians as ‘a vast extent of open downs...quite yellow with Murnong’ and ‘natives spread over the field, digging for roots’ (Mitchell, 1839). Overall it seems clear that the plant resources had been exploited in such a way that their abundance was maintained.

What were the plant food resources? In south-eastern Australia it was underground plant storage organs which were the staple foods. ‘They depend for food almost entirely on animals and roots’ (Dawson, 1881); ‘their natural food consists of the meat of the country when they can kill it, but chiefly roots’ (Winter [1840s] in Bride, 1898; Gott, 1982; Clarke, 1985). Seeds were hardly used at all, although they were staples in the arid regions of Australia. Roots have the advantage of being available year round, unlike the seasonal seeds and fruits. Of the 940 species recorded as used for food in Victoria, 296 (32%) were used for their underground parts (Gott 2002, VICUSE data base, unpublished). Robinson, in 1841, described women ‘spread over

the plain as far as I could see them, collecting [roots] – each had a load as much as she could carry’ (Clark, 1998, V. 2.).

In the lowland climate of southern Australia, the major period of stress for small perennial herbaceous plants is high summer, when water becomes scarce. They die back and rely on food reserves and water stored in underground organs for survival and to provide for new growth when temperatures fall and the autumn rains arrive. They produce leaves during the autumn and winter, flower in the spring and early summer, seed and die back in high summer. Although tolerant of some shade, they thrive best in open forest and on the plains. The plains areas of Victoria were a major source of tuberous roots. Taking either the general checklist for the whole of the Western Victorian Plains, containing 550 species (Willis, 1964), or the list for the Keilor plains area (Sutton, 1916), c. 20% of the plants are actually recorded in the literature as used by the Aboriginal people for food, and half of these come from underground organs. Notable among the species used were the many native perennial lilies and orchids, as well as Murnong, *Microseris lanceolata* (Gott, 1982, 1983, 1993).

APPLICATION OF FIRE

There is little detail in the early observations that enable us to reconstruct the burning regimes applied by the Aborigines. The early European descriptions of what might broadly be called dry sclerophyll forest emphasized its open nature:

‘where a man might gallop without impediment and see whole miles before him..., the omission of the annual periodical burning by natives of the grass and young saplings has already produced in the open forest lands nearest to Sydney thick forests of young trees...Kangaroos are no longer to be seen there, the grass is choked by underwood; neither are there natives to burn the grass, nor is fire longer desirable among the fences of the settlers’. (Mitchell, 1848)

The effect of the cessation of the Aboriginal burning regimes was noted by others – Walker (1898) in Tasmania and Howitt (1890) in Victoria. Lunt (1998) has examined the history of land use on the Bellarine Peninsula, southern Victoria – in the early 1800s there were less than 20 trees per hectare, that area now has 3000 trees per hectare. Fire was controlled, and patch burning was recorded:

‘On our way we met 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 the wrong direction, they beat it out’. (Stokes, 1846, South-western Australia)

‘About 6 pm [the Aborigines] doused their fire at once, although it must have covered near an acre of ground’. (Murray, 1802; Westernport, Victoria, Australia)

Observations place burning in high to late summer (Thomas, 1840, early March; also Field, 1825, 15 February 1817, Cape Bridgewater, Victoria, Australia) and it is notable that at this season the small herbaceous food plants have already shed seed and are dormant underground. Baird (1977) in a study of King's Park, south-western Australia, showed that autumn burns favoured the herbaceous species, while winter and early spring fires favoured shrub growth. Edward Curr was of the opinion that there was an average interval of 5 years between fires (Curr, 1883). When and where to burn was presumably a matter of local knowledge and observation, as it is in Northern Australia to this day. Thomson (1949) in Arnhemland, Northern Australia, said burning 'is not a random business...[it is] carried out in a restricted and controlled manner...directed by the old men of the tribe, or by others who have an hereditary right'. Recent work in Arnhem Land shows that Aboriginal management of fire preserves the ecological integrity of sites, and produces 'abundant and diverse animal and plant foods' (Yibarbuk *et al.*, 2001).

THE ECOLOGICAL CONSEQUENCES OF ABORIGINAL MANAGEMENT

Given Aboriginal burning in open forest and grassland over thousands of years, it seems reasonable to enquire how much this has determined the ecological character of those areas. The benchmarks for biodiversity are those first recorded by Europeans and that is the biodiversity created by Aboriginal management.

Fire in 'dry sclerophyll' forest

In discussing the responses of open forests to fire regimes, Christensen *et al.* (1981) have pointed out that vegetation is adapted to particular patterns of fire involving frequency of burning, fire intensity and season of occurrence.

The 'Ash Wednesday' fire of February 1983 at Anglesea, Victoria, was an autumn burn, and in the following spring there was a phenomenal flowering of tuberous perennials. In the unburnt areas the flowering was by contrast quite sparse.

A recent 10-year study of recovery from this fire by Wark (1996) showed that most of the species which flowered in the first year after the fire were herbaceous, and that 'the early herbaceous phase declined in cover and density of flowering during the second and third years as shrub and canopy cover increased'. Species richness decreased after the third year; the number of herbaceous species present decreased by year 10 to c. 40% of the year 1–3 level. The results of firing were the return of nutrients to the soil and the removal of shading, creating clear areas favourable to seed germination and the regeneration of plants from underground organs; the new green growth also attracted grazing animals. The Aborigines depended on herbaceous species for food, so that burning at 3-year intervals – in effect the maintenance of the forest in an arrested stage of fire recovery – would have ensured optimal supply. Without referring to Aboriginal burning, Christensen *et al.* (1981) stated

that 'there is a natural maximum fire frequency of 3–4 years in dry sclerophyll forests'. Lunt (1998) considered that fires at something like 5-year intervals would help to maintain open woodland, and added that 'no details of Aboriginal burning regimes are available'. Yet the ecosystems studied by ecologists have evolved under a long history of Aboriginal burning and still contain the patterns of those regimes.

Fire in grasslands

Curr (1883) described the original appearance of the native grasslands:

'In the greater portion of Australia, indeed nearly all over it, the grass originally grew in large tussocks'.

'One begins of late to miss on our clayey plains the calcined and barren appearance of thirty years ago, the result no doubt of the grass being fed off by stock, instead of being periodically burnt, as it used to be'.

The tussock habit is well adapted to survive fire. In the absence of fire, tussocks will in time grow in size and eventually form a continuous ground cover of both living and dead material. The grasslands were also characterized by the presence of numerous herbaceous species with perennating tubers (Willis, 1964), which were staple foods for the Aborigines. Stuwe has noted that long unburnt sites are poorer in the number of non-grass species. *Themeda* grassland unburnt for 3 years has been shown to provide few gaps in which non-grass species can germinate or thrive (Stuwe, 1994). A grassland study by Morgan (1998) said:

'If seedling recruitment events are to be optimised for the herbaceous dicotyledons which characterise this community, disturbance to the canopy is required at intervals of 1–3 years'.

Lunt (1998) suggested intervals of burning of *Themeda* grassland of 3–4 years to maintain species diversity. The introduced tuberous perennial common onion grass, *Romulea rosea*, disappeared from long unburnt grassland (Lunt & Morgan, 1999). Lunt & Morgan (2002) highlighted 'the importance of disturbances such as fire for preventing competitive exclusion [of herbaceous species] by the dominant grasses'. Thus, regular burning by the Aborigines was necessary to maintain a supply of the required food plants.

The effect of digging

A consequence of the collection of roots as staple foods was the continual digging by Aboriginal women. Over the yearly round, most areas productive of tuberous species would be covered. Since most of these species are found growing in locally abundant patches, gathering thinned out the plants and made room for further growth (Gott, 1982, 1993). In an experimental plot cleared of *Pterostylis nutans*, nodding greenhood, a common tuberous food plant, 75% of the

pre-clearing density was restored within 14 months (B. Gott, unpublished data). The benefits of this cultivation are that the soil was aerated, and litter and ash were turned into it. Early settlers remarked on the loose absorbent nature of the soils, contrasting it with the compaction produced by the hard hoofs of sheep and cattle (I. Batey, unpubl. data). There is one report from Victoria of what appears to be deliberate gardening:

‘the soil [on a sloping ridge] is rich basaltic clay, evidently well fitted for the production of myrnongs [*Microseris lanceolata*] On the spot are numerous mounds with short spaces between each, and as all these are at right angles to the ridge’s slope, it is conclusive evidence that they were the work of human hands extending over a long series of years. This uprooting of the soil, to apply the best term, was accidental gardening, still it is reasonable to assume that the Aborigines were quite aware of the fact that turning the earth over in search of yams, instead of diminishing that form of food supply, would have a tendency to increase it’. (I. Batey, unpubl. data)

Aboriginal management as a selective factor

Those plant communities where burning and gathering of food plants occurred for many thousands of years became adapted to the Aboriginal regime. Species and communities were selected which thrived with certain patterns of fire, both in frequency and seasonal application. Thus modern studies of such communities with the perspective of their long evolutionary history can reveal the intervals and seasons at which they were burned before European alteration of the landscape, and can illuminate the results of research. Benson & Redpath (1997) have pointed out the importance of studying post-fire recovery times in order to deduce the intervals at which the Aborigines burned various areas in the past.

Native animals are also dependent on appropriate vegetation patterns. A study on the conservation of the New Holland mouse in south Gippsland (Quin & Williamson, 1996) recommended: ‘a burning regime in the heathy woodlands which is appropriate...small scale fires implemented at intervals which produce a mosaic of habitats with differing ages’. This surely represents the Aboriginal burning history of the area. Hallam (1989), and Archer (1997) in Western Australia, and Latz (1995) in Central Australia have pointed out the advantages of a mosaic burning pattern for the survival of both animals and plants. Latz has also shown that important food plants in Central Australia act as ‘fireweeds’ – yields peak after fire, but decline rapidly in successive years. *Solanum vescum*, one of the kangaroo apples, was an important fruit for the Kurnai in Gippsland. In the first year after a fire, it is abundant, arising from long-held seed stores in the soil, but it thrives for only 2 or 3 years, and regular burning is necessary for continued fruit production (B. Gott, unpubl. data).

I must emphasize that most of these studies come from those parts of southern Victoria where staple vegetable food

was abundant. The aquatic food species *Typha* was subject to a specific fire regime (Gott, 1999). In other areas burning practices would have varied according to climate, season and the nature of the vegetation (Kohen, 1995; Benson & Redpath, 1997). In south-western Australia gardens of *Dioscorea hastifolia* were protected from fire, at least in some seasons (Hallam, 1989). Frequency and timing of fires in the tropical north would have been quite different (Bell, 1988) and Ashton’s long series of studies of *Eucalyptus regnans* forest at Wallaby Creek, Victoria, would indicate that deliberate burning of wet sclerophyll forests was highly unlikely (Ashton, 1976). This is not surprising in view of the fact that these mountain forests provided little in the way of food plants for the Aborigines.

CONCLUSION

If we manage for biodiversity, we need to realize what the benchmarks are, and how that biodiversity was selected by thousands of years of Aboriginal management. Burning for fuel reduction at the same times and intervals as the Aborigines will preserve biodiversity, burning at other times and intervals can have unintended consequences.

Many Australian landscapes have been irreversibly changed from those of European times, and not only by the cessation of Aboriginal burning. Yet there are some areas which have escaped major change. Roadsides and railway reserves were regularly burned by Europeans, and if they escaped recent treatment with herbicides, they have often preserved diversity. Firing can be an invitation for the invasion of introduced weeds and we can only hope to conserve the original diversity in selected areas.

Although I have interpreted the Aboriginal treatment of the landscape in material terms, this is not to gainsay the attachment which existed between the people and the land. Land management cannot be carried out without the deep sense of responsibility which was conveyed by the totality of Aboriginal culture. It was this close identification with the land that enabled Australia’s indigenous people to manage their environment in a way that enabled them to survive and prosper on this most difficult continent. We need to take account of Aboriginal management of the ecosystems and its long evolutionary history if we are to succeed in our own management. Deborah Bird Rose (1996) has summed it up well:

‘Only rare individuals in the past, and today still a minority of people, have taken seriously the knowledge of indigenous people. In so doing, some have learned to listen to what Aboriginal people say about country. More daringly, perhaps, some have learned to listen to what country says about itself.’

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BIOSKETCH

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