Use of Fire to Improve Native Forest Ecological Health

Introduction

Australian Aborigines hold the world record for sustainable development. They occupied Australia about fifty thousand years ago and developed the most durable culture the world has ever seen. Initially they created havoc, changing the pattern of vegetation across the landscape. After a few millennia they had established a new balance of nature that endured for 40,000 years through extreme climate change including massive rises in sea level and volcanic upheavals. European explorers, settlers and naturalists including Watkin Tench, Matthew Flinders, John Oxley, Charles Sturt, Thomas Mitchell, Charles Darwin, Edward Curr and Alfred Howitt described in great detail how that balance operated and what happened when Europeans disrupted it.

For example Mitchell wrote:

> *Fire, grass, kangaroos, and human inhabitants, seem all dependent on each other for existence in Australia; for any one of these being wanting, the others could no longer continue. Fire is necessary to burn the grass, and form those open forests, in which we find the large forest-kangaroo ; the native applies that fire to the grass at certain seasons, in order that a young green crop may subsequently spring up, and so attract and enable him to kill or take kangaroo with nets. In summer, the burning of long grass also discloses vermin, birds' nests, &c., on which the females and children, who chiefly burn the grass, feed. But for this simple process, the Australian woods had probably contained as thick a jungle as those of New Zealand or America, instead of the open forests in which the white men now find grass for their cattle.*

What we now know as woodland was called forest land by European pioneers. Fig. 1 is an example of a natural landscape created by Aborigines and maintained for the last 150 years by grazing and burning. NRC described this as a "a stand of healthy river red gum forest" and recommended that it be protected from grazing and burning.

Figure 1

Curr was the first squatter on the Murray in 1842. He described firestick farming:

> *there was an instrument in the hands of these savages which must be credited with results which it would be difficult to over-estimate. I refer to the fire-stick; for the blackfellow was constantly setting fire to the grass and trees, both accidentally, and systematically for hunting purposes. Living principally on wild roots and animals, he tilled his land and cultivated his pastures with fire*

Curr attributed to the firestick:

> *many important features of nature here; for instance, the baked, calcined, indurated condition of the ground so common to many parts of the continent, the remarkable absence of mould which should have resulted from the accumulation of decayed vegetation, the comparative unproductiveness of our soils, the character of our vegetation and its scantiness, the retention within bounds of insect life*

Howitt also recognised that Aboriginal burning prevented irruptions of pests in eucalypt ecosystems:

> *The influence of these bush fires acted, however, in another direction, namely, as a check upon insect life, destroying, amongst others, those insects which prey upon the eucalypts.*
>
> *Twenty-five years ago I noticed that during the course of three years all the White-gums (E. viminalis) in part of the Omeo district died …*
>
> *I have said that in my opinion the increased growth of the Eucalyptus forests since the first settlement of Gippsland has been due to the checking of bush fires … and to the same cause we may assign the increase of the leaf-eating insects which seem in places to threaten the existence of the Red-gum.*
>
> *The ravages of the larvae are greatly aided by the sickly state of the forests. The trees are wanting in vigour, and thus unable to withstand the attacks of insect pests.*

As well as the grassy woodlands sought by pastoralists, Aborigines also maintained rough country with the firestick. Mitchell described the journey from The Cumberland Plain to Wisemans Ferry:

> *… no objects met the eye except barren sandstone rocks, and stunted trees. With the banksia and xanthorhaea always in sight. The horizon is flat ...*

He surveyed the continuation of the road through to the Hunter Valley and recounted that:

> *... the whole face of the country is composed of sandstone rock, and but partially covered with vegetation. on many a dark night I have proceeded on horseback amongst these steep and rocky ranges, my path being guided by two young boys belonging to the tribe who ran cheerfully before my horse, alternately tearing off the stringy bark which served for torches, and setting fire to the grass trees (*xanthorhaea*) to light my way.*

Today, Mitchell's Aboriginal assistants would not be able to run "cheerfully before" his horse, lighting grasstrees because the vegetation is too thick and mature grasstrees and stringybarks are rare. Its virtually impossible to ride a horse cross-country, even in broad daylight. Fig. 2 shows woody thickening and loss of mature trees on the Old northern Road.

Figure 2

Mitchell watched the process on the Cumberland Plain:

> *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, where, formerly, a man might gallop without impediment, and see whole miles before him. Kangaroos are no longer to be seen there; the grass is choked by underwood; neither are there natives to burn the grass.*

Howitt saw the changes in the Snowy Valley:

The results were twofold. Young seedlings had now a chance of life, and a severe check was removed from insect pests. The consequences of these and other co-operating causes may be traced throughout the district, and a few instances will illustrate my meaning.

The valley of the Snowy River was very open and free from forests. the mountains on the western side were, in many parts, clothed with grass, and with but a few large scattered trees of [white box].

The immediate valley was a series of grassy alluvial flats, through which the river meandered. After some years of occupation, whole tracts of country became covered with forests of young saplings of [white box, snow gum, white gum, various peppermints and black sallee], *and at the present these have so much increased, and grown so much, that it is difficult to ride over parts which one can see by the few scattered old giants were at one time open grassy country.*

See the following link for more detail: http://southeasttimberassociation.com/wp-content/uploads/2015/02/Howitt-Influence-of-Settlement-on-the-Eucalyptus-Forests-1890.pdf

The same process occurred in the Murray Valley (Fig. 3).

Figure 3

The large tree in Figure 3 had Aboriginal bags and nets hanging from the branches and a fire smouldering underneath when Curr explored the Moira in 1843. With the two in background and one other branch in the right foreground you can see the original shape and spacing. The tree on the left grew up later and the others are nearly all new growth. Curr described a sea of reeds on the low banks of the river that are now covered with trees (Fig. 4).

Figure 4

During the 1890s and 1930s depressions, foresters used unemployment relief gangs to thin river red gum and cypress scrubs. They restored biodiversity, grazing and timber production (Fig. 5).

Figure 5

These post-European forests have now been ‘protected’ in National Parks. They’re chronically declining, plagued by pests, parasites, diseases and megafires (e.g. The 54,000 ha Wambelong Fire of 2013). They’re also unnaturally sensitive to drought. Fig. 6 is a chronically declining river red gum forest protected from grazing and plagued by a native cherry which is parasitic on the eucalypt roots.

Figure 6

At the time of European settlement, 85% of New South Wales' mammals that were destined for extinction, lived in the Western Division. Forty percent of mammals that lived there were extinguished. But the Western Division was virtually untouched by clearing or logging, and the extinct mammals were medium size 10 g – 5 kg eaters of seeds, herbs and grasses. Disruption of Aboriginal burning favoured a few robust native trees and shrubs that choked out the great diversity of delicate herbs and shrubs that had sustained these native animals over many millennia.

Conventional Ecological Wisdom

A reader of modern environmental literature would be excused for thinking that European settlers killed all the animals for meat and hides, felled all the good trees for timber and turned wilderness into rangelands using the axe, the tinderbox and the plough. In 1966, celebrated pioneering green, A.J. Marshall, wrote *The Great Extermination – A guide to Anglo-Australian Cupidity Wickedness & Waste*. He claimed that:

> *It was the emergent skin hunters and timber traders who would be the first to do real damage. Soon, however was to come the Great Extermination. For this, the sheep farmer is almost entirely responsible. In order to get more sheep to the acre two things had to be done. First, Dad and Dave (and often Mum and Mabel too) set about ring-barking every tree on 'the place'. Secondly, the thing to do was kill all the bigger native animals on 'the place'.*

Marshall was the foundation Professor of Biology at Monash University. Lands Minister, Tom Lewis, who set up the National Parks and Wildlife Service, was very impressed with his book, and referred to it when introducing the legislation in Parliament. This pseudo science, wilderness belief still pervades academia and drives our conservation bureaucracies and land management legislation. For example, renowned author of *Environmental Conservation*, Raymond F. Dasmann, wrote that:

> *In Australia, the Old Stone Age cultures of an isolated primitive people had endured over thousands of years. The early impact of man in this region had been essentially benign. Australia, most secure in its isolation, in some ways was most drastically affected by the 'fatal impact' of the western world. Introduced livestock,*

logging, uncontrolled fire, and escaped rabbits played havoc with Australia's vegetation and animal life.

Reality

Curr saw it as it really was: "it may perhaps be doubted whether any section of the human race has exercised a greater influence on the physical condition of any large portion of the globe than the wandering savages of Australia". He made the point that: "this country possessed from the first, over a great portion of its area, the inestimable advantage of being ready for immediate use without the outlay of a sixpence". Curr's *Recollections* also made it clear that the larger native animals (kangaroos and emus) proliferated as a consequence of pastoral development and provision of dams and ground tanks.

According to AUSLIG, Australia still retained about 90% of its original area of woodlands and forests 200 years after Europeans arrived. Greens' obsession with trees and forests is remarkable given that forests comprised less than 10% of the pre-European landscape and that there have been no extinctions or loss of biodiversity as a consequence of forest management. Areas actively managed in a similar way as Aborigines managed, retained their biodiversity, resilience, health and safety.

For example, in 1966, CSIRO Scientist J.H. Calaby wrote of the upper Clarence and Richmond Rivers in northern New South Wales:

The mammal fauna is the richest in species so far reported from any area of comparable size in Australia. It is of considerable significance to mammal conservation in Australia that such a rich and varied fauna can still be found in an area with a long history of European economic exploitation, and there is no doubt that this situation is largely accounted for by the combination of State Forests and the local form of management of private and leasehold land for beef production.

Fire Suppression, Pestilence, Megafires and Erosion

Unfortunately, areas maintained in a healthy, open and diverse condition are disappearing from our landscapes. For example, the history of our High Country provides a cameo of forest management in Australia. Deputy Surveyor-General Townsend explored the Alps in 1846:

The blacks had visited the Snowy Mountains, a short time previously to us, for the purpose of getting "Bogongs," a species of moth, about an inch long, of which they are particularly fond; to obtain them they light large fires, and the consequence was, the country throughout the whole survey was burnt, leaving my bullocks destitute of food. During the time I was on the range the lower parts of the country were burning, and I was prevented, in almost every instance, from getting angles on any distant points, by the dense masses of smoke obscuring the horizon in all directions.

Townsend referred to alpine ash as black gum. In the natural system, mild annual fires burnt the grass, blackened the fibrous bark on the trunks of alpine ash and maintained a suitable environment in which seedlings could establish when an old ash tree burnt down or was blown over. Modern ecologists claim that alpine ash is a fire sensitive species that grows in even-aged stands regenerated by high intensity fires occurring on a cycle of centuries. In fact, dense, young, fire-sensitive even-aged stands are a consequence of post-European megafires caused by disruption of regular low intensity burning.

Around the late-nineteenth and early-twentieth centuries, foresters gazetted timber reserves, and silviculturally treated alpine ash stands. Concerned about damage to timber resources, they attempted to restrict burning by graziers. In 1925 the River Murray Commission also

raised concerns about erosion attributed to grazing and deliberate burning. Extensive wildfires affected most of the Alpine Region in 1926 and 1939 destroying nearly all the Victorian alpine ash stands and causing severe erosion. However, some stands that had been illegally burnt by graziers escaped serious damage.

Kosciusko State Park in NSW was gazetted in 1944, and by the time the Snowy Mountains Scheme commenced in 1949, 12,000 hectares had been withdrawn from grazing. At this time Alec Costin carried out investigations for the Soil Conservation Service of NSW (SCS) and claimed that burning by graziers had destroyed woodlands, triggered insect plagues that were destroying grasslands, promoted shrub invasion and caused massive erosion. His prejudice against prescribed burning was such that he suggested using persistent organochlorine insecticides to control the insects that had irrupted after burning was prohibited.

Meanwhile, plagues of stick insects in long unburnt forests were defoliating alpine ash and other species right along the Great Dividing Range (Fig. 7).

PLATE XI. Severe defoliation by *D. violescens* in 1954-55 at Bago S.F.

PLATE XII. Death of Eucalypts following repeated defoliations by *D. violescens* and *P. willcoxsei* at Kosangaroo S.F. (near Jenolan)

Figure 7

Thousands of hectares of hydroelectric catchments were aerially sprayed with dangerous insecticides in diesel oil to control the insects. Megafires in 1951/52 temporarily alleviated the insect problems and exacerbated the erosion problems. Costin revisited the country on the Main Range that he had ‘saved’ from grazing and burning. He found it worse than before, but instead of revising his disproven hypotheses, he claimed that a tipping point had been passed and he intensified his campaign against active management.

By this time foresters had, in the school of hard knocks, learned lessons that should have been obvious from the historical ecological narratives of explorers, settlers and naturalists, as well from the history of megafires after Aboriginal burning was disrupted. Forestry managers aligned with graziers and bushfire brigades to set up the Hume-Snowy Bushfire Prevention Scheme, which aimed to protect lives, infrastructure and natural resources across eight hundred thousand hectares of New South Wales by prescribed burning. Unfortunately, foresters under Baulder Byles’ influence still thought that they could protect timber values by excluding fire from alpine ash stands.

More than 10% of the Hume-Snowy Fire District was burnt by wildfires between 1965 and 1968. It was considered that the existing fire protection arrangements were not capable of keeping damage to regional values at an acceptably low level because fuel reduction had only been carried out along roads and fire trails. By this time, a new technology of aerial burning had been developed in Western Australia. Large areas could be treated, under very precise prescriptions, at low cost, taking advantage of very small windows of opportunity in terms of seasonal conditions. It was recognised that exclusion of fires from sensitive areas such as subalpine bogs could only be practically achieved by burning in the surrounding landscape at times when the bogs were not flammable.

A new plan was initiated for Hume-Snowy including strategic burning in the south and southwest, fuel reduction right through the forests, and protection of small areas of special value using burning by ground crews. It proposed aerial burning in autumn at about five year intervals and ground burning of special value areas at about three year intervals. An annual target of about 60,000 hectares was proposed, comprising about 25,000 ha strategic and 35,000 ha general fuel reduction burning.

Another extreme fire season occurred in 1972/73 after a dry winter. There were 25 days of very high and extreme fire danger including three days of severe lightning storms that started many fires. Forty nine wildfires burnt 68,000 ha including 48,000 ha in Kosciusko National Park. No substantial damage occurred to assets or infrastructure, and there was no loss of life or even serious injury. The cost of firefighting operations in Hume-Snowy was relatively low compared to other fire districts that faced similar circumstances. But some catchment areas were damaged by high-intensity fires where scheduled prescribed burns had been cancelled in response to concerns by CSIRO, the Soil Conservation Service (SCS) and NPWS.

Three large fires burnt in the park. The Welumba Creek fire of 4,000 ha was controlled by limited manpower aided by the fuel reduction benefits of the strategic burning program. The Jacobs River fire of 30,000 ha escaped control in an area that had been scheduled for aerial burning in the previous year but was withdrawn following objections from CSIRO, SCS and NPWS. The Byadbo section of the Park had been burnt the previous year and presented no problems. Control of the Grey Mare fire of 13,000 ha was hampered by a lack of fuel reduction burning in alpine ash stands.

As a result it was suggested that prescribed burning should be routinely carried out in these stands using more sophisticated prescriptions, closer monitoring of fuels and weather, and more precise ignition (from helicopters) than in the general burning program. In fact, prescribed burning was reduced after 1974 when a new National Parks and Wildlife Act was passed. Ecologists from CSIRO, SCS and NPWS increasingly influenced land management, and the Scheme was finally disbanded in 1986. Severe wildfires in 1978, 1983 and 1988 burnt similar areas as previous fires, but at much higher intensities, causing substantial soil erosion, destroying high quality timber resources, and causing large economic losses to neighbouring graziers, aside from the impacts on biodiversity values.

Fig. 8 shows the impact of the 1988 Byadbo Fire in Kosciuszko National Park.

Figure 8

In 2001 the NSW Government determined to review the plan of management for Kosciuszko National Park, and appointed an Independent Scientific Committee (ISC) to assess the values of the park. The ISC had what appears to be a very ill informed view of its fire management history: *Fire management in the park has developed from a very simplistic approach with an annual program of fuel reduction to an approach based on ecological principles that provide for sound nature conservation, catchment stability and the maintenance of an acceptable level of risk from wildfire impacts on infrastructure, neighbours and park users. The Aboriginal tribes did light fires but only small areas would have been burnt The [Hume-Snowy] fuel reduction program never reduced the fire hazard if one ever existed.*

They reported that "the number of trunks per tree has increased in regularly burnt areas, from one to three trunks per tree up to 40, with the number of trees per hectare having increased from under 50 to 6000-7000 per hectare". In effect, they attributed the damage caused by wildfires, to mild burning by graziers and foresters. Also they claimed that dangerous fuel loads of up to 25 tonnes per hectare of "litter etc." were required to protect slopes from erosion. Furthermore, they stated that trees such as snow gum and alpine ash needed to be protected from burning more often than once a century, and prescribed burning should only be carried out in "approximately 7%" of the park.

After the 2003 alpine megafires, a supplement to the ISC report explained that multiple lightning ignitions, which eventually culminated in Canberra's fire disaster, were unexpected. In fact multiple lightning ignitions during severe fire seasons have occurred repeatedly over millennia, but rareley had such severe consequences as in 2003. Multiple lightning strikes in State forests and private lands to the west of the park at the same time caused little damage, and were all controlled within three days. The ISC report and supplement illustrate the danger inherent in following the advice of scientists such as Costin who have no relevant expertise or experience in fire management.

Costin said that:

> *hazard reduction burning ignores one of the most fundamental resource equations that exist with respect to our natural and near natural lands: fuel = catchment protection = habitat. Hazard reduction burning is absolutely inappropriate in most of our back country. Firstly, it never achieves what it is supposed to achieve, the reduced occurrence of devastating wildfires such as we've had. They are absolutely under the control of prevailing meteorological conditions combined with a preceding year or more of incredibly dry weather. If any fire starts under those conditions, let alone fires that are started by 20 or 30 or 50 almost simultaneous lightning strikes, there is no chance of doing anything with it until either it burns itself out – in other words, there is no more to burn – or there is a change in weather conditions. This has been the history of wildfires in Australia and it will continue. So some of these areas are going to get burnt anyway, but at nowhere near the frequency with which they are being burnt at the present time.*

The 2003 fires caused loss of human life, unprecedented erosion and siltation of water supply catchments, killed many rare and endangered plants and animals and CSIRO estimated 370 million birds, reptiles and mammals were killed across 2.4 million hectares. Retired CSIRO scientist, Noeline Franklin said it would take up to 100 years to recover the number of animals lost. The fire destroyed hundreds of houses, thousands of stock, thousands of kilometres of fencing and tens of millions of dollars in public infrastructure. Two hundred tonnes of soil per hectare washed off some hillslopes in Canberra's water catchment. The vast majority of snow gum woodlands were reset to age zero (Fig. 9).

Figure 9

The wildfires in 1978, 1983, 1988 and 2003 damaged or destroyed most of the habitat of the critically endangered corroboree frog. There is no doubt that they were the primary cause of the severe decline that threatens to extinguish this frog in the wild. There is also no doubt that the megafires were a consequence of human fire management, not climate change as asserted by green academics and bureaucrats, because surrounding well-managed lands under the same climate did not suffer extreme fires despite multiple ignitions at the same time.

Fig. 10 shows a mature alpine ash killed by high-intensity fire in unnaturally heavy fuel, Kosciuszko 2003.

Figure 10

So it's not mining or clearing or logging or grazing or brumbies that have virtually eliminated open woodlands, old trees, corroboree frogs and pygmy possums from Kosciuszko. It's management by neglect in accord with the wilderness belief. Ecologically, things are no better or worse in our National Parks and World Heritage Areas, as they are in multiple use forests, travelling stock reserves and other passively managed lands. Costin unintentionally pinpointed the problem. Fuel = catchment protection = habitat is **wrong**, but it is the basis for all the rules and regulations and prescriptions and guidelines that apply to our land management. It also underpins the myth of permanent protection, which is promoted as a reason to transfer healthy biodiverse state forests into national parks.

Fig. 11 shows how the officially endangered ecological community – White Gum Moist Forest – is protected in the World Heritage Area at Tooloom National Park.

Figure 11

In the early 1980's, this area was Beaury State Forest. It was grazed and burnt, open and grassy. The trees were all healthy and there were some huge old trees that have since died and fallen after the area was permanently protected. This was the core of the biodiversity hotspot that Calaby identified in the sixties. NPWS still advertises that there are 10 different

macropods living there. Without evidence to support this assertion, their ongoing existence in the area is highly doubted, because their grassy forage has been choked out by scrub and lantana.

According to NPWS:

> *White Gum Moist Forest is threatened by forest eucalypt dieback associated with over-abundant Bell Miners and psyllids (Wardell-Johnson et al. 2006, DEC 2007). This complex process is associated with substantial changes in community composition and structure, including the defoliation and eventual death of canopy eucalypts, increased densities of mid-stratum plant species and decline in diversity of small forest birds.*

In fact it's a very simple process that has been observed and documented on site. Forestry Commission botanists resurveyed some plots 10 years after the original surveys in 1992. Ten plots had been classified as a group typified by grassy understories and frequent burning. Unfortunately, it was suggested that these areas of dry forest should remain unburnt for periods of ten to fifteen years or more to promote biodiversity. By 2002, four of the plots had developed dense shrub understories and were then classified in different floristic groups compared to the original survey. Two of these plots were heavily infested by lantana, and the eucalypts in all four shrubby plots were already showing signs of moderate to severe decline.

Since then, the process of forest decline, following cessation of regular low intensity burning, has been observed and documented right around Australia and soil scientists have measured the soil changes at the root of the problem. Researchers have confirmed that essentially the same process occurs in alpine ash in Tasmania and tuart forest in Western Australia.

Mulch builds up, sunshine and air circulation are reduced. Nitrogen in litter, seedlings and herbage, that had previously been volatilised by fires and returned to the atmosphere, or mineralised by fires and taken up by the flush of new growth, now accumulates in the soil and the developing shrubby understorey. Topsoils become cooler, damper, softer and deeper. Carbon to Nitrogen ratios of soils are reduced, they become more acid (except in the case of some calcareous soils), and microtoxins such as aluminium and manganese are released.

These inhibit tree roots and mycorrhizae. The trees become more susceptible to droughts and soil pathogens such as phytophthora cinnamomi. The deteriorating soils and roots cause nutrient imbalances and physiological changes in the trees. Their sapstreams and foliage become more attractive and nutritious to arbivores – that is anything that derives nutrients from any part of the tree including roots, sapwood, sap and leaves.

So-called bell miner associated dieback (BMAD) is but one example of this process. Psyllids breed up on the nutritious and abundant food produced by the declining trees constantly resprouting young foliage. Bellbirds breed up on the abundant food in the form of psyllids. It's caused by management neglect, not by bell birds. Fig. 12 shows that, in 2002, the problem was severe in a 'protected' State Forest and absent from an adjoining grazed and burnt private property.

Figure 12

NSW taxpayers recently provided funding of $100,000 for another independent scientific literature review of so-called BMAD. The terms of reference appear to have been driven by the theory that 'disturbance' promotes bellbirds, which 'farm' psyllids causing 'dieback'.

In the Urbenville forests in 1985, there were a few small patches of declining forest, no more than a hectare or so in size. Koalas were rarely sighted. Within a decade, there were at least fifteen known patches of declining forest averaging nearly forty hectares in size, and koalas had become a common arboreal mammal in the region, occurring at one out of every two survey sites.

Paradoxically, burning was further restricted from that time, on environmental grounds. Within the next decade, the area of declining forest had increased to twenty thousand hectares and koalas had become abundant.

A Different Approach to Landscape Ecological Management

We can improve forest and woodland ecology by restoring frequent mild fire. In areas where mild burning is no longer feasible, grazing or slashing is the ecologically sustainable alternative. Lock it up and neglect doesn't work (Fig.13).

Figure 13

Fig. 14 shows the extreme contrast between a neglected, dying, weed infested reserve and a managed rest area at the gateway to our national capital.

Figure 14

We make improvements relatively quickly, with a scientific approach, that recognises the role of fire in the ecological development of the Australian biota and through the application of active and adaptive ecological management.

The "precautionary principle" and concerns about climate, should not be used as an excuse to do nothing.