

FIRE MANAGEMENT IN THE ALPINE REGION.

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Abstract

The Alpine Region of Australia contains a very extensive tract of native ecosystems that remains largely intact. Paradoxically it also boasts a rich cultural history extending back before European settlement. Diverse values supplied by the regions' ecosystems include food, minerals, timber, recreation, energy, water, nature conservation, and cultural history. Some of these alpine values are particularly vulnerable to climate change. There are different opinions about the relative impacts of human management, compared to climate, on fire regimes. The fire history of the region and future management of fire to protect regional values are discussed in the context of climate change scenarios.

History of land use and fire

Aboriginal period

Aboriginal people were permanent residents of the Monaro when it was settled by Europeans in the early 1800's and there were groups living at Mowamba and Yarrangobilly (Wesson 2000). Early settlers commonly saw hundreds of Aboriginal people gathering in alpine areas to feast on bogong moths, conduct trade, perform rites of initiation and facilitate intertribal marriages (Wesson 2000). By the late 1800's the Aboriginal population of the region had declined dramatically due to disease, displacement or extermination. Surveyor Townsend (16th March 1846) saw in the Snowy Mountains that Aboriginal people "light large fires, and the consequence was, the country throughout the whole survey was burnt" (Clarke 1860). Costin (1954) considered that Aboriginal fires in the Monaro were mild and did little damage. Early settlers found no extensive dense stands regenerated by high intensity fires in alpine woodlands. Some ecologists (e.g. Leaver and Good 2004) downplayed the role of Aboriginal burning and lightning fires in the region, and Banks (1989) selectively quoted Townsend to suggest that there was no Aboriginal burning in the alpine tract. Aboriginal people used fire for hunting and gathering, warmth and cooking, to maintain easy access, and for ceremonial and spiritual reasons. They lived in the alpine region and used all parts of it at various times. There is no evidence that they suppressed fires ignited by lightning.

Graziers

Howitt (1891) observed the changes that occurred after European settlement of Gippsland: *The influence of settlement upon forests has not been confined to lands devoted to agriculture. From the day the first pioneers drove their herds down the mountains any cause which would lessen the force of annual fires would alter the balance of nature, and thus produce new and unexpected results. The annual crop of grass was burnt off by aborigines, this tended to keep forests open and prevent open country from being overgrown. Sheep and cattle lessened the annual crop, and settlers (protected) their improvements. The valley of the Snowy River and the mountains were in many parts clothed with grass and but a few large scattered trees. After some years of occupation whole tracts of country became overgrown by forest and arborescent shrubs.* The Black Thursday fires of 1851 followed from and reinforced these changes, "open forest" that had been occupied by aboriginal people became "dense scrub", and red gum woodlands declined and died (Howitt 1891).

Blair (circa 1950) described a similar history, and referred specifically to the high country: *In the 1880's cattle grazed the foothills in parklike country with large trees. "About every three years fires crept about for weeks burning the grass and leaves. Disastrous fires were unknown". About the turn of the century, droughts and rabbit plagues followed by wet years triggered scrub development. Restrictions on burning imposed by the Forests Commission favoured dense timber, scrub, blackberries and severe fires. Concerns about erosion in the early 1900's prompted authorities to ban grazing by sheep and restrict numbers of cattle on the Bogong High Plains. The first severe fire in 1901 scorched snow gum stands to the north and damaged about 800 ha of ash forest. Another wildfire in 1914 caused little damage, whilst a severe fire in 1925 burnt peat bogs on the high plains and caused severe erosion. Summer fires were the major cause of soil erosion and loss of timber in the region, and autumn and spring burning as well as grazing were the best protection for its natural resources.*

Pulsford *et al* (1993) referred to the foothills of the Snowy River: *Settlers introduced grazing in the 1830's. Cypress pine scrubs established and rabbit plagues occurred around the turn of the century. In the early twentieth century there*

were less frequent and more severe fires. By the 1940's the old trees were in decline, stressed by drought, insect plagues and competition from the understorey. They claimed that burning caused erosion and triggered dense cypress scrubs, but this interpretation was inconsistent with the earlier, direct observations and with the general pattern that has been observed in Australian woodlands. Droughts and rabbit plagues removed groundcover so that there was nothing to graze or carry a fire, and therefore no control of dense regeneration of 'woody weeds' (e.g. Noble 1997; Burrows 2002).

European settlers moved stock into the high country during summer and lit fires as they removed the stock in autumn. Their activities in NSW were not regulated until 1889. George Weston used Mt. Buffalo for summer grazing between 1888 and 1923, and burnt in autumn whenever it was dry enough (Weston 1991). Wildfires near Mt. Buffalo in 1914 and 1918 were easily controlled by few men. Skiing commenced at Mt. Buffalo and Bogong High Plains in the 1920's and some grazing licences were cancelled in 1923. Mt. Buffalo was damaged by severe wildfires in 1926 and 1939 (Weston 1991). Banks (1989) reported "a marked increase in fire frequencies with the arrival of European pastoralists and prospectors and recent decline with the ascendancy of the conservationist". However there was no evidence of frequent fire scarring during the first 40 years of pastoralism, and the first bushfire in the historical record was not until 1858 (Banks 1989). An alternative interpretation is that fire scars and historical documents did not record most low intensity fires (e.g. Jurskis *et al.* 2003), but that the frequency of severe fires increased from the 1860's as a result of prospecting and mining (Banks 1989). For all comparable sites, the average interval between fire scars from 1760 to 1860 was constant, at about 7 years (Banks 1989). There was no evidence that the fire regime in the high country changed with the arrival of graziers.

Graziers discovered gold at Kiandra in 1859. At the height of the 'rush' there were 15 hotels and 30 stores. Norwegian miners introduced skiing in 1861, and a skiing club held competitions in the 1870's. Three mile dam was built by Chinese miners in 1882 and connected to the goldfields by miles of water race. Sluicing and dredging continued until 1905. There were other diggings at Four Mile, Nine Mile, Grey Mare, Snowy Plain, Lobbs Hole, Ravine and Quartzville (Anon. 1986; Moriarty 1993).

Foresters and Soil Conservationists

Alpine ash was used for buildings and infrastructure, and some areas of ash in NSW were gazetted as forest reserves by 1900. Stands at Bago were silviculturally treated by 1917 (Anon. 1986). Trial plantings of exotic trees were established at Jounama during the 1920's. Foresters attempted to restrict burning because it was seen as a threat to timber values (Anon. 1986, Moriarty 1993). In 1925 the River Murray Commission raised concerns about erosion in the region, and with increasing recognition of the water values there were increasing concerns about erosion attributed to grazing and burning (e.g. Costin 1954; Edgar 1969). Severe fires affected most of the region in 1926 and 1939, and destroyed nearly all the ash forests on the Victorian Alps. Some areas that had been illegally burnt by graziers escaped serious damage (Blair circa 1950). The fires in 1939 entered New South Wales from Victoria on broad fronts and killed most of the subalpine woodlands in New South Wales (Good 1978). The Royal Commission inquiring into these fires reported that the principal cause was the dense shrubby condition of the forests, and that the amount of controlled burning done by the Forests Commission was "ridiculously inadequate" (Stretton 1939).

Kosciusko State Park was declared in 1944, and 4000 ha in the Summit Area were withdrawn from grazing in 1946. After the Snowy Mountains Scheme commenced in 1949 another 8000 ha in the Mawsons Hut area were withdrawn (Edgar 1969). Between 1946 and 1950, Costin (1954) investigated the Monaro Region for the Soil Conservation Service of NSW (SCS). He claimed that burning by graziers had destroyed woodlands, triggering insect plagues that were destroying grasslands. He also claimed that burning promoted shrub invasion and caused massive erosion. He provided no evidence of the causes of fire damage and erosion, and his experimental data showed that a grazed and burnt plot had a much greater cover of grass and herbs than its unburnt and grazed counterpart (Costin 1954, Fig. 123). Burning also controlled the pest insect, but Costin (1954) recommend that control with insecticide was preferable. Minister Enticknap endorsed Costin's conclusion that burning by graziers was the most destructive human influence in the region. Neither recognised that extreme wildfires and mining operations had caused erosion. During the late 1940's and early 1950's tree decline, plagues of pest insects and extensive severe fires occurred in the high altitude forests as a result of fire suppression (Campbell and Hadlington 1967).

Tourists shared the Kosciusko area and its huts with graziers until the graziers were expelled (Moriarty 1993). In 1958 about one third of 323 grazing leases in Kosciusko State Park were withdrawn and in 1959 grazing was restricted to a

maximum altitude of 1400 metres, reducing the number of leases to 145. Edgar (1969) recommended to the Minister that grazing be prohibited, that freehold properties be acquired, and that rabbits, brumbies and blackberries should be controlled. He concluded that hot fires within the preceding decade caused much destruction of snow gum stands in the park, however he did not distinguish between the impacts of prescribed burns and wildfires. The Snow Lessees and Occupiers Association pointed to many shortcomings in the Edgar report and in the approach of Government Agencies to land management in the region (Anon. 1969): *There was no consideration of data showing better water yields from grazed catchments. The severe impacts of wildfires compared to grazing were not considered. Shrub invasion, wrongly attributed to grazing, was promoted by fire exclusion, and increased fire hazards in 'protected' catchments threatened human life, property and stock in areas from the southern Monaro to the ACT. Costs of pest and weed control, formerly borne by graziers were being transferred to taxpayers.* Antagonism between 'dispossessed' graziers and conservation authorities was a longstanding feature of the region's cultural history (Blair circa 1950; Anon. 1973).

The Snowy Mountains Hydroelectric Scheme was constructed between 1949 and 1974 by more than 100,000 people from over 30 countries (Anon. 2006). Sixteen dams, seven power stations and hundreds of kilometres of tunnels and aqueducts supply power to all capital cities from Brisbane to Adelaide, and water for irrigation in the Murray Basin (Anon. 2006). An enclosed viewing platform with associated facilities (The Queen's Lookout) was constructed for an official opening of the Scheme by Her Majesty Queen Elizabeth II in 1963.

Multiple Use Management

Hume Snowy Bushfire Prevention Scheme was established in 1951 as a response to "the devastation by fire of large portions of the Hume/Snowy catchment areas in 1939" (Hudson 1957). It included SCS, Snowy Mountains Hydroelectric Authority, Lands Department, local graziers, Bush Fire Brigades, Forestry Commission and Kosciusko State Park Trust (later National Parks and Wildlife Service [NPWS]). It was responsible for fire management in the Hume Snowy Fire District of 800,000 ha. The original fire plan aimed to rehabilitate catchment areas and forests damaged by the 1939 fires, and protect Snowy Mountains Scheme infrastructure, private property, stock and tourist developments. It recognised that wildfires could be controlled in fuel reduced areas and that complete fire protection was impractical. Prescribed burning was to be excluded from some areas such as alpine bogs. The plan detailed the fire history for the first 6 years of operations (Hudson 1957). In the very severe 1951/52 fire season 60 wildfires burnt a total area of about 50,000 ha. In 1953/54 24 wildfires burnt 8000 ha. The remaining four seasons had few wildfires that burnt small areas.

The next severe fire season occurred in 1965 when 66,000 ha including about 3% of subalpine woodlands were burnt by wildfires (Good 1978). Prescribed burning had mostly been effective and caused minimal damage to regional values, but some burning had been too hot, caused unnecessary damage and aroused controversy (McArthur and Free 1968). 1968 was another severe fire season in south eastern Australia. More than 10% of the Hume Snowy Fire District was burnt by wildfires between 1965 and 1968. McArthur and Free (1968) suggested that the existing fire protection arrangements were not capable of keeping damage to regional values at an acceptably low level.

Much of the catchment degradation attributed to grazing and prescribed burning (e.g. Costin 1954; Edgar 1969; Leaver and Good 2004) was actually cumulative damage from severe wildfires in 1926, 1939, 1952, 1965 and 1968, and any damage from prescribed burning was relatively insignificant. McArthur and Free (1968) considered that extensive wildfires were causing unacceptable damage because fuel reduction had only been carried out along roads and fire trails. They noted that aerial burning can treat large areas, under very precise prescriptions, at low cost, and can take advantage of very small windows of opportunity in terms of seasonal conditions. They recognised that exclusion of fires from small areas such as subalpine bogs could only be practically achieved by burning in the surrounding landscape at times when these areas were not flammable. A trial burn of 5000 ha in April 1968 caused minimal damage and less than 5% crown scorch. McArthur and Free (1968) outlined a strategy for fire protection in Hume Snowy including strategic burning in the south and southwest, fuel reduction in all forested areas, and protection of small areas of special value using burning by ground crews. They recommended aerial burning in autumn at about 5 year intervals and ground burning of special value areas at about 3 year intervals. They considered that about 60,000 ha should be burnt each year (comprising 25,000 ha strategic and 36,000 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 (\$180,000) compared to other fire districts that faced similar circumstances (Anon. 1973). However there was damage to catchments by high intensity fires as a consequence of the “dilution” of prescribed burning in response to objections from NPWS and SCS (Anon 1973). Three large fires burnt in the park. The Welumba Creek fire of 4000 ha was controlled by limited manpower aided by the strategic burning program (McArthur and Free 1968, Anon. 1973). The Jacobs River fire of 30000 ha escaped control in an area that had been scheduled for aerial burning in the previous year but was withdrawn following objections from CSIRO, NPWS and SCS (Anon 1973). The Byadbo section had been burnt the previous year and presented no problems (Anon 1973). Control of the Grey Mare fire of 13,000 ha was hampered by the absence of fuel reduction burning in alpine ash stands. As a result it was suggested that prescribed burning should be introduced into alpine ash stands using more sophisticated prescriptions, closer monitoring of fuels and weather, and more precise ignition from a helicopter (Anon 1973).

Nature Conservation

In fact, prescribed burning was progressively reduced from the mid 1970's as NPWS policies increasingly restricted the annual programs, and the Scheme was disbanded in 1986 (Leaver and Good 2004). Severe wildfires in 1978, 1983 and 1988 caused substantial soil erosion. Some high quality timber resources were destroyed in 1983 by fires that burnt similar areas as the 1965 fires at much higher intensities. Neighbouring graziers suffered large economic losses in 1988 (Moriarty 1993). An alternative fire control plan was included in the plan of management for the park in 1998 (Leaver and Good 2004).

After grazing was eliminated, the Snowy Scheme completed, and private property acquired, NPWS restricted public access to most of Kosciusko National Park and destroyed much of its cultural heritage. Nearly all the historic buildings at Kiandra were demolished, as was the Queen's Lookout, and the Jounama arboretum was clearfelled. At the same time adequate resources were not available to control escalating weed and pest problems (Moriarty 1993). However some large developments associated with downhill skiing continued. The 'Skitube', a nine kilometre underground rail system, was completed in 1988. In 2001 the NSW Government determined to review the plan of management for Kosciusko National Park, and appointed an Independent Scientific Committee (ISC) to assess the values of the park. The following paragraph summarises their views on fire management (Leaver and Good 2004).

Fire management in the park has progressed from simplistic fuel reduction burning to a sound ecological approach providing for nature conservation, catchment protection and maintenance of acceptable risk. Aboriginal people burnt small areas, whereas grazing and burning caused erosion, shrub invasion and increased fire hazards. “The (Hume – Snowy) fuel reduction program never reduced the fire hazard if one ever existed”. Large tracts of the park are at a “primary state of succession”, and fire should be excluded from most ecosystems for long periods, for example, alpine ash requires one high intensity fire every 150 years. All species of plants in the park are adapted to high intensity fire. Heavy fuel loads are required to stabilise steep slopes. Only about 7% of the park should be burnt. Increased prescribed burning is a serious concern. After the 2003 fires, a post script to the ISC report explained that the multiple lightning ignitions, which eventually culminated in Canberra's disaster, were unexpected. In fact multiple lightning ignitions during severe fire seasons have occurred repeatedly in the past, but have not 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 2003 fires caused loss of human life, unprecedented erosion and siltation of water supply catchments, killed many rare and endangered plants and animals, destroyed hundreds of houses, thousands of stock, thousands of kilometres of fencing and tens of millions of dollars in public infrastructure. The firefighting operations in NSW involved 1600 people, 36 dozers and 40 aircraft. It is clear that general exclusion of fire with limited burning around assets cannot produce acceptable fire management outcomes even with huge financial and technological investments in fire suppression. Good (1978) argued for this management because the majority of subalpine woodland was only 39 years old and should have been allowed to develop to maturity. The majority of subalpine woodland is now three years old.

Alternative views of the interactions between management and fire regimes

Early naturalists, foresters and soil conservationists imported a 'European view' that promoted suppression of fire throughout the landscape (e.g. Pryor 1939). Disastrous fires across Australia in the middle of the 20th century were recognised as a consequence of fire suppression, and forest managers adapted by introducing broadscale prescribed burning (Florence 1994; Hurditch and Hurditch 1994). The Hume Snowy Bushfire Prevention Scheme was an example

of this adaptive management. Some ecologists continued to hold the 'European' view (e.g. Costin 1954; Banks 1989; Leaver and Good 2004). They downplayed the role of Aboriginal burning, ignored the role of fires ignited by lightning in shaping our ecosystems, and failed to consider the relative impacts of intense summer wildfires compared to mild autumn burns (Moriarty 1993; Pyne 2003; Jurskis *et al.* 2003). They did not consider the ecological role of fire in maintaining the natural balance between trees, grasses and understorey shrubs (Pyne 2003; Jurskis 2005a, b).

Graziers had to live by their management. Sometimes they were beaten by droughts and rabbit plagues. Then there was no grass to graze or carry a fire, and scrubs developed (e.g. Pulsford *et al.* 1993; Noble 1997; Burrows 2002). In subalpine woodlands and forests, they successfully maintained the open grassy ecosystems that they took from the Aboriginal managers, and thus came into conflict with foresters who preferred dense stands without any signs of fire (e.g. Pryor 1939; Banks 1989). After foresters learnt from their mistakes they aligned more closely with graziers, whilst ecologists who believed that grazing, burning and timber-getting were unnatural and destructive activities became increasingly opposed to multiple use management (e.g. Anon. 1977). Since the 1970's the non-intervention approach has increasingly prevailed and conservation reserves have expanded at the expense of multiple use forests. The widespread perception that prescribed burning has increased is false. Prescribed burning has declined in response to pressure from 'environmentalists', and extensive severe fires are becoming more commonplace (e.g. Banks 1989; Jurskis *et al.* 2003; Burrows 2005; Scherl 2005).

Science doesn't support the current approach to management (e.g. Fire Ecology Working Group 2003; Pyne 2003), and Costin's (1954) objections to grazing and burning were ill founded. A natural process of erosion (nivation) occurs under semi-permanent snowdrifts in the high country (Costin 1954). His suggestion that nivation was accelerated by burning and grazing is unlikely given that there is no flammable or edible vegetation under the snowdrifts (Moriarty 1993). Similarly unlikely is his suggestion that burning by graziers had damaged alpine heaths. Nivation has continued unabated since grazing was withdrawn from the summit area, and heaths have been repeatedly devastated by intense wildfires (Moriarty 1993). Fire-sensitive plants which were supposedly eliminated from alpine areas by burning (Costin 1954) are associated with rock outcrops, bare ground or wet areas (Harden 1990) that are unlikely to burn in autumn. These places are more likely to be affected by severe fires and shrub invasion following exclusion of fire and grazing. Leaver and Good (2004) claimed that shrub invasion was promoted by low intensity fires, however fire exclusion and high intensity fires promote shrubs whereas low intensity fires favour established trees and grasses (Blair circa 1950; Costin 1954; Anon 1969; Jurskis 2005a, b; Cary *et al.* 2006).

Current management fails to distinguish between the different causes and impacts of mild and severe fires and ignores the inevitable consequences of attempting to exclude fires from large areas. Ecologists were perplexed when a fire killed alpine snow gum stands with 2 metre high shrub understorey but didn't kill adjoining stands with grassy understorey (Anon. 1977). They also thought that devastating wildfires "quite possibly" wouldn't recur because there were new regulations, bushfire brigades, burnt buffers outside the park and improved access within. Recently, extensive severe fires across temperate Australia have caused extreme erosion in water supply catchments, affected fire 'refugia' across whole regions and killed many rare and endangered plants and animals (Good 1981; Burrows 2005, Mitchell 2005). General exclusion of fire and limited burning around assets cannot achieve the ecologists' objectives of keeping ecosystems free of fire for long periods. They are increasingly looking to climate change to explain the frequent and extensive severe fires that are a consequence of their influence on land management. However the link between land management and fire regimes is well established in both Australia and North America where Aboriginal managers have been recently displaced (Florence 1994; Hurditch and Hurditch 1994; Jurskis *et al.* 2003; Pyne 2003; Cheney 2005; Hessburg *et al.* 2005; Scherl 2005). High intensity fires are more frequent and extensive now than at any time since current vegetation patterns were established in the region.

Climate change scenarios

Hennessy *et al.* (2003) produced two scenarios for the alpine region between 1990 and 2050. Their 'low impact' scenario had an increase in temperature of 0.6 °C and an increase in precipitation of 2.3%, whilst their 'high impact' scenario had an increase in temperature of 2.9 °C and a decrease in precipitation of 24%. They were confident that their low impact scenario would be exceeded and their high impact scenario would not. Snow cover will be much less, of shorter duration and earlier in the season. The models suggest that recreational values will decline with reduced snow (Hennessy *et al.* 2003). NSW Scientific Committee (2000) determined that climate change is likely to threaten alpine vegetation communities, mountain pygmy possum and corroboree frog because their particular habitats are expected to contract. The predicted changes will reduce the water and hydroelectric power values of the region and reduce

recreational values (e.g. fishing, boating) associated with streams and lakes. Grazing and timber values will be reduced by increasing drought and declining health of trees. All values including cultural values such as historic buildings and mature stands of trees have been severely affected by extreme wildfires.

Summer fire danger is likely to increase. The history of the alpine region indicates that reintroduction of extensive hazard reduction burning will be necessary to mitigate the risk of wildfire to the regions assets. Extensive burning may directly enhance values such as water yield, nature conservation and timber production by restoring more stable hydrological and ecological processes (Jurskis 2005a, b). Improved access will be necessary to support the hazard reduction operations and to enable quick response to lightning ignitions during dangerous periods.

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