FIRE HISTORY
OF THE
AUSTRALIAN ALPS
Prehistory to 2003
P. Zylstra
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Australian Alps Liaison Committee
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Cover photograph: Firefighters during the
Black Friday fires of 1939.
Photos courtesy of Department of Sustainability and Environment, VIC.
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http://www.abc.net.au/blackfriday/home/default.htm
FIRE IN THE MOUNTAINS

“Brother,” he said, “do you not think we should offer up a prayer?”

“What for?” asked Peter, standing in his shirt sleeves, a rope in his hands and mud from head to foot.

“For? Why for rain, brother,” replied the parson, a bit surprised.

Peter held up his finger and said “Listen!”

Now, with a big mob of travelling stock camped on the plain at night, there is always a lowing, soughing or moaning sound, a sound like that of the sea on the shore at a little distance; and altogether, it might be called the sigh or yawn of a big mob in camp. But the long, low moaning of cattle dying of hunger and thirst on the hot barren plain in a drought is altogether different, and, at night, there is something awful about it – you couldn’t describe it. This is what Peter McLaughlin heard.

“How do you hear that?” he asked the other preacher.

The little parson said he did. Perhaps he only heard the weak lowing of cattle.

“So you think that God will hear us when He does not hear that?” asked Peter.

Henry Lawson, ‘Shall we gather at the River’

Natural disasters such as droughts and bushfires could be seen as something core to the way Australians view themselves. As a young nation of people discarded by the British Empire, there was perhaps a kind of inevitability about the idea that God himself would occasionally torment them with such evils. The idea that they were not necessarily freak catastrophes but more the natural order of things for this dry continent was a long term perspective that would take many generations to gain. Today, with two centuries of history, there is still a widespread expectation that with certain simple management practices the risk of bushfires can be permanently done away with. In the words of Judge Leonard Stretton referring to the settlers and land managers of Victoria prior to the 1939 “Black Friday” fires,

“Men who had lived their lives in the bush went their ways in the shadow of dread expectancy. But though they felt the imminence of danger they could not tell that it was to be far greater than they could imagine. They had not lived long enough. The experience of the past could not guide them to an understanding of what might, and did, happen.”
Whilst the effects of a fire (or a severe drought for that matter) are often disastrous, better understanding of the scale of what is ‘normal’ for an area may be very beneficial in improving planning to reduce unnecessary loss, both in a social and environmental sense. Collating the fire histories of the Australian Alps provides an opportunity to give a sense of scale and patterns to both planners and researchers.

![Figure 1](image.jpg)

*Figure 1. Effects of a landscape scale fire event, the “Black Friday” fires of 1939. “Such was the force of wind that, in many places, hundreds of trees of great size were blown clear of the earth” (Stretton 1939). Photo courtesy of DSE Victoria.*

**DATA COLLECTION**

**Information Sources**

The primary source of information for fires was taken directly from the GIS databases of Environment ACT, DSE Victoria and the NSW NPWS. Supporting information was collected from numerous sources including scientific reports, interviews with individuals having experienced an event and historical documents such as newspapers published at the time. All references including interviews and conversations are given in the ‘References’ pages at the end of the document.

**Methods of Data Collection**

Where maps were not already available, most data was collected as quotes or comments mentioning specific points in the landscape. In the case of the Black Friday fires, the many points collected were considered sufficient to produce a map filling the gaps between Victoria and the ACT.
Due to the nature of anecdotal evidence (recorded from interviews, books and newspaper articles), many references were too general to use for mapping and such references were simply recorded in the history table. References useful for mapping consisted of specific points or edges remembered or recorded by individuals, eg a house that burnt down. For this purpose, a series of maps were made from black and white satellite images so that individuals could record specific burnt edges of fires they had observed, using terrain they recognised from the images.

Once specific points and edges had been mapped, the remaining unknown edges were completed in one of two ways. Where nothing was known of points or fire behaviour in the area and fire spread could not be discounted beyond the mapped area, the edge was mapped with a straight line or arc. If sufficient evidence existed to indicate that the fire had not burnt beyond a certain area, the edge was approximated by known fire behaviour, although at a low scale. In the case of fire burning in low fire conditions or through sparse country, natural firebreaks such as rivers were used for this purpose. Where rain was known to have put fires out, the limit of spread was placed at the approximate edge of the timbered country. This was chosen due the fact that fine grassy fuels very quickly become unavailable as fuel after rain. Forest fine fuels have a delayed reaction as a) many of the fuel strata have a lower surface area: volume ratio causing them to uptake moisture more slowly, and b) the canopy captures a percentage of the precipitation preventing it from reaching the lower fuel strata. The coarse fuels in many forest types (logs, standing trees etc) also have a high flame residence time despite rainfall, some trees being known to burn for weeks or months after the main fire front has passed and re-igniting the surrounding area when weather conditions are favourable.

In keeping with these principles, individual records in the fire history tables were classified according to the level of accuracy they represented as given in table 1 below.

Table 1. Accuracy of Records

1. General – general verbal or text reference to the event, site not specific or discrepancies exist  
   1a. General Assumed – a straight connecting line between two known areas  
   1b. General Estimated – a connecting line between two known areas that shows the likely edge based upon general fire behaviour (eg edge of timbered country)

2. Specific – based around direct known points, may be mapped from the account

3. Mapped – historic maps produced at low scale

4. Precise – mapped using skilled mapping techniques, also including GPS, aerial photography, satellite or other precise technology
1. The Period of Aboriginal Fire Management
ABORIGINAL BURNING PRACTICES

Prior to a period of change beginning in approximately 1830, fire management through the montane and higher areas of the Australian Alps was carried out by 5 distinct groups as recorded by Tindale (1974). The eastern parts of the NSW Alps were the land of the Ngarigo people, extending from about Kiandra south to the upper Buchan river in Victoria. The Walgalu or Wolgul managed the western areas from about Kiandra to the northern end of the mountains. The area south from Kiandra to Tom Groggin was Djilamatang land, and the area south of this to the Omeo plains and westward over the Bogong High Plains was Jaitmathang country. The southern part of the Victorian Alps was Brabiralung country. Aboriginal fire management probably disappeared from the mountains in the first couple of decades after contact as the numbers of Aboriginal people dropped very quickly and their introduction of any fire was likely seen as interference with the grazing industry.

Consistent with practice throughout the rest of the country, small patches of certain forest types were possibly burnt through the area of the Australian Alps at varying intervals. Burning was carried out for various reasons – to encourage regeneration and the increase of certain animals, as fire drives, for religious reasons or to clear ceremonial pathways. The following chapter examines the use of fire in Aboriginal management of the Alps, then supports this with the historical and scientific record.

Non–Aboriginal perceptions

“The natives were about, burning, burning, ever burning; one would think they were of the fabled salamander race, and lived on fire instead of water”

Ernest Giles, Central Australia.

“…and they are seldom seen without fire, or a piece of wood on fire, which they carry with them from place to place, and in their canoes…”

Governor Phillip 1788

To the European settlers that encountered Aboriginal burning practices throughout Australia, the practice of burning the bush initially came as an impressive shock. The widespread image of these “manly” men walking through the bush with firesticks very quickly became folklore, although the philosophy and wisdom behind it was very rarely understood. “Firing” of the vegetation was frequently observed through the coastal sandstone country, inland grass and woodlands and many dry sclerophyll forests of the plains and lower mountains.

“…there was another 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.”

E. M Curr (Victorian grazier, mid 1800’s)
It is probably fair to say that to many who for the first century of settlement saw all the Australian bush as being much the same, the Aboriginal burning practices were assumed to be a simple formula developed by “savages”. Folklore has developed that the Aborigines simply burnt anything they could at any time they were able, expressed more recently in the following words:

“Consequently, the Aborigines did not just burn now and again, or only in autumn, or when the birds were not nesting. They burnt all the time.”
(Ryan, Ryan & Starr, ?)

Cheney (1993) developed this idea to state that:

“…Aborigines burnt landscape continually and, when there was sufficient fuel to carry fire, fires burnt unchecked. Fire intensities were relatively mild even on extreme days because the fuels were light.”

There was some clarification to this statement, with the recognition that this was probably not the case in all environments:

“Areas of tall wet forests such as *E. regnans*, which are sensitive to fire and are easily killed, were burnt at infrequent intervals of perhaps around 200 years or more.”

Fire was used for many purposes and has often been misinterpreted by observers, as Lunt, Barlow and Ross (1998) pointed out,

“…careful analysis of early explorers’ accounts suggest that many of the reported fires supposed to be burn-offs were probably camp-fires or signals to other groups warning of the explorer’s whereabouts”.

Nicholson (1978) explains:

“…European culture tends to emphasise the dangers of burning and the destructiveness of fire to its material possessions. It is from this cultural background that the early navigators and explorers mentioned the presence of great ‘smokes’ and numerous fires so frequently in their reports. Apparently they assumed that the number and volume of the smokes seen was a measure of the amount of destruction being caused by the ‘savages’ who lived in this country.”

These cultural differences were compounded during the 19th century by the rise of “social Darwinism”, a school of thought that was to have effects on Aboriginal people across the country that cannot be underestimated. The concept of social Darwinism was at the time, an almost unquestioned application of Darwin’s theories to the future development of the human race. Just as natural selection favoured the stronger, more ‘fit-to-live’ members of any non-human species, it was said to have promoted the evolution of human races at different rates, dependant upon the selective pressures involved. Around the same time, Darwin’s cousin Francis Galton developed an applied version of the same theory called “Eugenics”, in which he proposed the
selective breeding of humans to expedite the loss of what he saw as inferior strains, facilitating the overall improvement of the race. In Galton’s words:

“The feeble nations of the world are necessarily giving way before the nobler varieties of mankind…”

Galton 1864-5

Galton ranked various “races” of the world, placing the Aboriginal people as one of the lowest or least evolutionally advanced (Galton 1869).

Although the average European migrant to the Alps was no doubt unaware of this school of thought, its influence permeates attitudes of the time in the writings of many in the scientific community, and some of its overtones were heard from the lips of men and women in the street when they talked about what they saw as the inevitable decline of the Aboriginal people. This thinking was carried to its logical conclusion in the early 20th century, when the Australian government legislated the removal of “half caste” Aboriginal children from their families for the purpose of “biological absorption” into the white community (Lavarch 1997). It was in such a climate that much of the European attitude to Aboriginal fire management was developed, with the conclusion that these were a simple people – the “children of the forest” (Bombala Herald, Sept. 18, 1875, cited in Young 2005), “…they have the minds of children and the bodies of adults” (Howitt 1869) and that their fire management was also a simple thing readily understood from cursory observations. There is an irony in this view when we consider the fact that communication between Aboriginal and European people was only possible due to the ability of the Aboriginal people to learn new languages. Had communication been dependant upon the language skills of the Europeans, we may have learnt even less of their culture than we did.

As many Aboriginal communities were scattered over time and taken both from their own lands and their own histories, much of the lore of the firestick has been lost in many areas. The paucity of knowledge in non-Aboriginal hands has at times tempted some individuals to fill in the gaps themselves with assumed knowledge, or to ignore or discount the knowledge that has been retained. The frustration this causes some of the Elders who still retain the traditional knowledge is clear:

“Today fire is not being well looked after. Some people, especially younger people who don’t know better or who don’t care, sometimes just chuck matches anywhere without thinking of the law and culture of respect that we have for fire.”

Yibarbuk (1998)

Organisation and Practice of Aboriginal Fire Management

A matter that has confused many from a non-Aboriginal background has been the fact that traditional land managers do not always give a detailed explanation of fire management when requested. This has reinforced the perception in many cases that Aboriginal fire use is simplistic – simple enough to learn from one or two quotes or a quick anecdote. The issue that has been misunderstood here is the fact that along with many other areas of life, the knowledge of fire is privileged information given to those
that have been suitably trained and initiated. An example from Arnhem Land illustrates some of the level of planning utilised in traditional burns carried out today:

“But there is one kind of burning which is men’s business alone – and it is dangerous work. This is the fire drive mainly for macropods (the larger ridge dwelling species like kalkberd, djukerre, kandakidj, karndayh) rather than the agile wallabies (kornobolo) which favour monsoon jungle and thicker forest. Emus (wurrbbarn or ngurrurdu) may also be a target for this specialised hunting technique.

“…When the most senior landowner from the area where the fire drive (kunj ken manwurrk = fire for kangaroo) is to be held sees that the time is getting close, he will talk with his senior djunkay. They sit down and discuss how the djunkay will organise the drive – where it will be held, when it will be held (expressed by reference to floral seasonal indicators and moon phases) and who will be invited.”

Yibarbuk (1998)

Far from the early view that Aboriginal fire management was simplistic, the above quote alone demonstrates consideration of the following factors for a routine fire drive:

1. **Suitability of those conducting the burn.** Not everyone takes part in such a burn; those involved have been hand picked.

2. **Chain of command.** This fire requires the work of the senior djunkay under the authority of the most senior landowner

3. **Consideration as to whether the vegetation community should be burnt.** “Monsoon jungle and thicker forest” were not burnt to capture kornobolo, other methods than fire were preferred

4. **Consideration as to where the burn should happen.** There was no sudden decision resulting in burns taking place everywhere. The reasons for this are not given but may involve the locations of other camps, the distribution of wildlife and threats to areas they did not want to burn

5. **Consideration as to the timing of the burn.** Environmental indicators were used to specify the best time for the burn.

This fits well with the conclusions of many who have studied the Aboriginal use of fire such as Nicholson (1978), who described them as displaying “expert control” of all fire operations.

The concept given at point 3 above relates to the appropriate fire regime for certain vegetation. Far from applying a “one size fits all” approach such as the common
views of many non-Aboriginal people given in the previous section, traditional fire management was very precise as to the correct and necessary fire regime of a given vegetation type. This is seen in the experience of the Anangu people in their efforts to restore traditional fire management in parts of central Australia. In order to protect vanishing populations of the Nganamara or Mallee Fowl, patch-burning regimes were re-introduced to spinifex areas specifically to protect fire-sensitive Mulga thickets so that these could provide critical habitat for the birds (Baker, Davies & Young, 2001).

Jones (1975) explained in this context that some areas were to be deliberately and forcibly protected from fire. In one area of jungle, it was taught that there were beings living in the forest that would blind someone that burnt it. Similarly, Gould (1971) described an encounter with some men who were deeply distressed upon finding that part of a totemic trail in South Australia, and that there would be serious punishment for whoever burnt the area.

The Wongkonguru people of Lake Eyre name their fire lore Ularaga (Elkin 1938). The Ularaga contains a set of prescriptions that must be followed for even the simplest use of fire, these include particular songs and rites to be performed when fire is being generated by ‘twirling’ or even carried on the fire stick. Only one initiated to the Ularaga had the right to deal with fire. As Professor Elkin explained:

“…the myth and rite do not merely provide an explanation for the making and appearance of fire, as though mere friction were not sufficient of itself; they also witness to its great social importance and to the necessity of guarding it most carefully, on the one hand against its careless use, lest bushfires should be caused, and on the other hand, against loss.”

Elkin (1938)

The way in which fire itself was managed (and still is in some areas of the country) demonstrates a keen understanding of fire behaviour. Finlayson (1936) described an expedition in which he employed the services of a local Aboriginal group to assist him in capturing various wildlife. In one instance, animals were flushed from their hiding places by lighting fire in an arc surrounding the area, such that the direction of the wind and the convective activity of the fire caused it to draw inward around the target rather than spreading. Jones (1975) in his observation of Gidgingali fire management in the Northern Territory said:

“People used their fires accurately, aiming them into a natural break such as an old fire scar or swamp, timing the fire so that predictable wind changes later in the day would blow them back onto their own track, or so that the evening dew would dampen them down.”

Thompson (1949) also explained:

“This is not a random business, it is well organised, and is carried out by the men as a communal enterprise, although in a restricted and controlled manner with ‘drives’ for kangaroos, wallabies and other game. The actual burning of grass is directed by the old men of the clan, or by others who have an hereditary right.”
Although these examples are taken from areas outside of the Australian Alps, they demonstrate a consistent theme across the country. The situation is well summarised by Rod Mason of the Monaro Ngarigo people.

“For non-Aboriginal people, the most difficult challenge in appreciating Aboriginal knowledge and use of fire is that it is intimately linked with some of the most central and important tenets of Aboriginal lore, common throughout Australia. Unless an individual passes through the various stages of learning, the detail of these spiritual beliefs is not accessible.”

 “…Given the significance of these beliefs and the Aboriginal people’s detailed knowledge of plants and animals, it is clear that they did not burn the country haphazardly, or at a whim”

Mason (2003a)

**Ngarigo Fire Lore**

Whilst this source of information should obviously receive the greatest respect, we are limited in what information has been gathered, and by what is accessible to non-aboriginal people for the reasons already stated. The record given here is a very cursory introduction to some of the knowledge retained by the present day Ngarigo people.

In a brief summary, Mason (2003b) wrote:

“Aboriginal people use fire to access remote areas or favoured camp areas, to keep warm, to cook and to clear ceremonial pathways. Fire is used in toolmaking. Heat is used to straighten tree saplings for spear making, to soften grass tree resin to make a strong glue used to help attach sharpened rocks to hatchet handles, spear heads and more.

Fire is used in hunting to chase animals into the open and to promote the growth of new grasses and other plants which attract animals to hunting grounds.”

In speaking of his family’s traditional fire management of their Wadbilliga (Ribbon bark) country at the eastern fall of the Monaro plateau, Mason (2005a) described targeting specific stands. The stands were burnt under very mild conditions, specifically on days of low cloud with approaching rain. Burns were lit as soon as possible after flowering of the Matruk (a Wattle) as the plants are understood to be more resistant to low intensity fire at this time of the year. The light up pattern was a single point ignition at the top of a hill:

“They sing out on top of the hill up there, and they said ‘hey, booderee dyillagamo’, and they’d chuck a fire-stick into the bush and burn it, then they’d go. And next year when they’d come back, they’d sing out ‘hey, booderee dyillagamo’, and they’d come back into the area.”

Mason 2005a
The example describes an ignition pattern and prescription that produces small patchy burns. The areas burnt were campsites that had a high concentration of hard-seeded food plants such as Geebung (*Persoonia sp.*), that responded favourably to fire, and the outcome of the burning was effectively the cultivation of these plants close to the campsites. The focus is on management of that particular plant stand – a principle very similar to the earlier example given for management of Nganamara in central Australia.

The burns described also serve as a ritual interaction with Dyillagamberra, the Rainmaker, and were carried out on an annual basis when the Ngarigo were leaving that country. The burns were ignited in such a way as to burn downhill under mild conditions, so that only small patchy areas were affected. It is interesting to note that the Matrruk is often the species in an area with the longest primary juvenile period – a term used by Noble and Slatyer (1980) to define the age at which a plant first sets seed. “Vital attributes” such as these are used to determine the ideal temporal spacing between fires, with the most frequent fire desirable to maintain species diversity being equal to the longest primary juvenile period.

In contrast to this burning ritual in Wadbilliga, the corresponding ritual used by the same people when leaving Tidbilliga (the “Old Country”, today’s Snowy Mountains) is described below.

“When the old men went up to Tidbilliga, they’d throw the pebbles in the lake up there. They’d throw three pebbles each, they’d say ‘booderee dyillagamo, Dyillagamberra’”

Mason 2005a

It is significant that reverence for the same being is expressed in such different ways. This may relate to the understanding of some such as Mitchell (1981) that the main reason for Aboriginal people to visit the high country was not out of necessity for food, but out of religious devotion. Accordingly, the focus was less on managing food and more on an appropriate form of respect for the deity being reverenced.

Deliberate introduction of fire to the alpine area itself appears to have been non-existent. The use of fire for collection of Bogong Moths from the rocky peaks was described by Helms (1895):

“Our method of catching the insects was both simple and effective. With a burning or smouldering bush in the hand the rents in the rocks were entered as far as possible, when the heat and smoke would stifle the thickly congregated moths, that occupied nearly every crack, and make them tumble to the bottom of the cleft. Here an outstretched Kangaroo skin or a fine net made of Kurrajong fibre would receive most of the stupefied and half-singed insects, which were then roasted on hot ashes.”

The description makes it clear that fire was used only for cooking and in hand-held brands. Visits to the Bogong peaks were excluded from the highest peaks, as Mason (2005b) explained:
“…for spiritual reasons they rarely went to the highest tops, closest to the stars, where the spirits dance.”

Rod Mason (Pers. Comms. May 2006) is of the opinion that the bush was almost only burnt in Tidbilla to clear travel routes. This was achieved by an advance party, which would enter the mountains weeks ahead of the main groups and select the best pathway following the general traditional routes, burning selected thickets that would hamper travel.

Current Aboriginal knowledge of fire management is an area that has been very much under-explored, and it would be of immense value to study this in greater detail.

**Bushfires and Aboriginal Lore**

Contrary to much public perception, bushfires are a large part of Aboriginal lore held in tandem with beliefs regarding their own use of fire. Some language groups had specific words for bushfires, the Gidjingali for instance use the word *bol* for a domestic fire and *mindjongork* for a bushfire. (Jones 1975). The Ularaga lore of Lake Eyre (Elkin 1938) describes a figure called Yigauara who secretly lit fires to burn certain enemies. The stories describe the sudden starting up of bushfires and

“*the fierce but insidious manner in which such fires travel*”.

The fire lit by Yigauara is said to periodically disappear beneath the ground and appear again at unexpected moments, so

“*whenever fire breaks out suddenly and unaccountably, it can be referred to as the fire started by Yigauara*”.

Such phenomena are comparable to the way high intensity fires have been observed to burn up a ridge line and stop at the top where the convection column at the leading fire edge collapses (figure 2). Under such conditions spot fires often start many kilometres ahead of the main front.

A common theme in Aboriginal myth is the rescue of fire from the secret keeping of 1 or 2 individuals so that it can be given to everyone for the use of all in cooking, toolmaking etc. In the case of the Wongaibon in NSW, this was achieved when Girriki the Sparrowhawk set fire to the forests, spreading it with whirlwinds so that fire was put into every tree to be released again by rubbing the timber together (Mathews 1994). Tales from Western Australia and from the Kamilaroi of NSW also describe the Sparrowhawk setting the forests alight, again for the purpose of distributing fire for the use of others. In such a context it appears that bushfires were seen in the way Mason described – gifts to the land and thereby to its people.

Explorers entering country still under the management of its Aboriginal owners frequently encountered bushfires, often attributing them to Aboriginal work when no other explanation was clear. George Evans (Assistant Surveyor) commented on one such bushfire as he crossed the Blue Mountains in December 1813 (Ryan, Ryan & Starr (?))
“The Mountains have been fired; had we been on them we could not have escaped; the flames rage with violence through the thick underwood, which they are covered with...”

Considering these factors, it is reasonable to deduce that bushfire events did occur through the Alps before Europeans entered the area. Contrary to perceptions such as Cheney (1993) cited earlier, the aboriginal lore and sitings of early explorers describe some behaviour consistent with high intensity fires. It appears however that before the imposition of the European fire regimes, bushfires were rarely large enough to cover 2 of the tree-scar sites at a time.

**HISTORICAL EVIDENCE**

In a study by Flood (1980), a list is made of 100 ethnohistorical references to the observation of possible aboriginal burning in the “Southern Uplands”. Further to this, Ryan, Ryan & Starr (?) list 37 references to observation of possible aboriginal burning across Australia, and Clarke (1860) provides more extensive text from the visit to the mountains by Townsend in March 1846. Young (2005) also produces a transcript provided by the archaeologist P. Boot of Howitt’s observations taken in 1866. There are some important words that are missing from the transcript, as these were illegible. Of these observations, only the following 4 as recorded by Flood (1980), Clarke (1860) and Howitt (1866) took place in the vicinity of the Australian Alps.

“Saw Kangaroos on the ranges where the grass having been recently burnt, the young herbage was springing up”.

Bennett, observation on the Bogong Ranges near Tumut, Dec. 1832

“The lower parts of the country were burning, dense masses of smoke obscuring the horizon in all directions”.

Townsend, observation from the Snowy Mountains, Mar. 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...”

Townsend, observation from the Snowy Mountains, Mar. 1846

“... a very old mark made by the blacks who used this very track in going to Maneroo – it was a piece of bark taken off a tree. A little beyond was a new mark – evidently Harry’s and we then found ourselves on the old black’s trail – a dim half obliterated track through the grass and bushes such as would be made by bare feet. Crossing the
Leatherjacket [Leatherbarrel Ck] by a very steep descent we found that [?] had fired the opposite ranges and to such purpose that everything had been burned but the [?] trees. We slowly ascended the steep hillside and again on the summit of the ridge found the old track and the tree marks.”

Howitt, on a trip to Mt Kosciuszko in 1866

Further to these, Mooney (2004) refers to an incident where Dr Ferdinand Mueller retreated from the mountains to the coast due to bushfires in the Cobberas Mountains south of the NSW – Victoria border during February 1854.

The following information can be drawn from these, possibly the only historical observations of pre-European fire in the Alps areas.

- The first quote refers to fire on the Bogong Ranges near Tumut. These ranges rise from a series of foothills near Blowering to the Bogong Peaks, some of which top 1700m. There is no information given as to whether the country had been burnt in the lower open areas of the montane forests which comprise the majority of the area or the higher subalpine areas.

- The second quote refers only to fire in the tablelands and low montane tracts – “the lower parts of the country”

- The third quote describes the entire survey area of Townsend as having been recently burnt, but does not provide observational evidence of the source of the fire, assuming it was connected with the moth hunting practices. Direct observation of fire use in moth hunting was provided by Helms (1890, 1895), who described the use of flaming brands to collect moths from aestivation sites. The use of fire localised to the aestivation cave is supported by the observations of William Jardine (Young 2005). This latter explanation describes a technique that makes far more sense than the idea of igniting massive bushfires throughout the area of feasting, so it is likely that the cause of fires was due to other factors.

- The fourth quote establishes that a moderate to high intensity fire had burnt part of the western fall of the Main Range near Leatherbarrel Ck. The party Howitt believed responsible for the fire was not distinguishable, however it is clear that Howitt did not observe the action, only its effects. Howitt believed the track he was following to have been formed by bare feet, and as an experienced bushman his opinion carries some weight here. It is possible that the burn was Aboriginal in origin for the purposes of opening the travel route, however the fact that the fire caused the party to lose the track and destroyed the tree markings suggests that it was not the type of burn intended. A more likely scenario relates to the fact that the 1860’s were well into the period where European fire management greatly dominated the mountains, and that the fire was actually European in origin.

- The statement referred to by Mooney (2004) is again not specific as to what altitude the fires were burning in the Cobberas
None of the quotes provide any evidence that the fire was of aboriginal origin, although observers having come from countries where bushfire was almost unknown commonly made this assumption.

It is noteworthy that A. W. Howitt, despite his extensive first-hand studies into the Aboriginal practices and beliefs across the mountains does not appear at any time to have directly observed an Aboriginal burn taking place, and so cannot confirm anywhere that burning the bush was a local practice.

Given this paucity of historical evidence, two conclusions can be drawn:

1. There is direct observational evidence that fire occurred in the tablelands and montane areas before settler occupation, and the possibility that it was observed in higher areas as well.

2. There appears to be no direct observational evidence that any of the Australian Alps areas were burnt by Aboriginal people

To clarify this, point 2 does not state that Aboriginal burning did not take place, only that there is no direct observational evidence to make this claim. Flood (1980) concluded similarly in her statement:

“…there is no evidence of Aboriginal burning in the sub-alpine or alpine tracts of the mountains.”

**SCIENTIFIC EVIDENCE**

Scientific evidence of pre-European fire regimes can be gathered from the study of:

a) broad changes in vegetation composition from the time of the early white settlers through to the present day  
b) dendrochronology or the study of tree growth rings  
c) charcoal / pollen deposits  
d) a pragmatic approach that uses existing knowledge to identify likely management strategies

Each of these fields is examined separately below.

**Changes in Vegetation**

The earliest form of scientific evidence to be presented regarding pre-European fire regimes came in the form of a series of observations and assumptions regarding changes in vegetation structure following European settlement. There is a perception in some areas gained from comments made by explorers that the Australian bush was at first encounter entirely composed of open woodland with no large patches of forest.
“Australian bushes are (so far as I am acquainted with them) all nearly destitute of shade, the trees of which they are universally composed (I mean the Eucalyptus), growing in the first place only solitary, never in combined tufts”.

Lhotsky, 1834 from Ryan, Ryan & Starr (?)

Speaking some decades after the period to which he refers, A.W. Howitt states:

“The valley of the Snowy River, when the early settlers came down from Maneroo to occupy it...was very open and free from forests...

Howitt, 1890, from Ryan, Ryan & Starr (?)

It was put forward at this time by Howitt and others, and is still a strong school of thought today that the phenomenon of widespread forest (as opposed to open woodland) is a direct result of reduced fire frequency following European settlement. The question relevant to this report is whether the forests present throughout the Australian Alps are evidence that fire frequency was different prior to European settlement.

At a later point in Lhotsky’s journey to the Australian Alps, he comments on the Monaro plains near Michelago and the view from that point into the Tinderry Mountains and the Clear Range in Namadgi National Park.

“It is besides, a most remarkable but not very easily explicable fact, that although they (the Monaro Plains) are altogether destitute of trees of any kind, and only on the secondary hills or banks, which divide their plications, are some gum trees thinly scattered, whereas large timber covers the main ranges”.

Lhotsky, 1834, from Ryan, Ryan & Starr (?)

Lhotsky’s account here describes 3 categories of land cover – the open grasslands which are still present today, the scattered eucalypts which grow on the low ridges of the Monaro, and the “large timber” of the Clear Range. Although the description is not here explicit, it is clear that Lhotsky sees the ‘large timber’ to be in stark contrast to the scattered trees of the grassland ridgelines. Contrasting the two as is the point of his comment, ‘large timber’ was not only large in size of trees, but ‘large’ in its spread – it was not scattered woodland but a vast expanse of tall forest as it is today.

This being the case, it cannot be stated that tall dense forest was not widespread through the Alps before white settlement, although the following quotes demonstrate that some changes have occurred.

In Howitt’s account of the lower Victorian Alps, he describes the changes in the Snowy River corridor.

“After some years of occupation, whole tracks [sic] of country became covered with forests of young saplings...and at present time 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.
It is most likely that Howitt was referring to the Cypress and White Box forests that stretch from the Byadbo or Biddi area of Kosciuszko National Park most of the way southward through the Alpine National Park to the more fertile floodplains of the river. The change of the vegetation in this country is well documented – Robinson describes this area in 1844:

*Callitris* [sic] from four to five feet in circumference grew amid shrubs of every variety of tint. The country is well grassed and abounds with cattle, the soil varies from a rich black mould to a chocolate.”

Robinson, 1844, from Pulsford (1991)

Another comment, made to the Soil Conservation Service Officer Alec Costin in 1948 stated:

*The old stockmen told me that the Willis (where the river crosses the Victorian border) was ‘good’ until the young pine came like wheat in 1878, before that there were only large trees...”*

Harnett, 1948, from Pulsford (1991)

Whilst these statements confirm that the cover of thick forest has occurred since European settlement, the question to be addressed is whether this colonisation has occurred as a result of changing fire regime, and if so, what indications are there as to what the pre-European fire regime was.

There is ample archaeological evidence to indicate that the Snowy River corridor was a main thoroughfare and home for many of the Ngarigo people (Pulsford 1991, Flood 1980, Hancock 1972). However, as for the rest of the Alps, there are no direct observational records indicating that Aboriginal burning took place in the Snowy River corridor or how often the burning was conducted (Pulsford 1991, Flood 1980, Hancock 1972).

Along with the changes to vegetation, significant changes to the soils have occurred. The quote from Robinson describes the country in 1844 as having soil that

“…varies from a rich black mould to a chocolate”.

In contrast, Costin (1954) described the soils 110 years later as follows:

“…almost without exception they have now been stripped to the subsoil or bedrock”.

The loss of the dark humus and chocolate soils prior to 1954 are consistent with conditions of disturbance, usually promoting the growth of primary and secondary colonising species rather than climax community species.

Costin (1954) explained the changes as follows:
"These changes are attributed not to recent climatic variations as popularly supposed, but to severe overgrazing by rabbits leading to destruction of the herbaceous stratum, followed by bushfires and floods or heavy rains."

Three factors are mentioned here, the primary one being overgrazing by rabbits, which acts to remove the herbaceous stratum and expose the soil to erosive elements. By itself, this would give no indication that fire regimes have changed since European settlement and suggests that the second of the 2 possibilities is more likely, that factors other than fire have been influential in causing the increase in tree density. However, rabbits were not reported for the area in newspapers until 1900, with the first plague listed as 1914 (Pulsford, Banks & Hodges 1993), 36 years after the Callitris trees are remembered as coming up “like wheat”. Clearly, some other factor introduced before the rabbits was the main factor in stripping the herbaceous stratum and accelerating the loss of topsoil.

Costin (1954) lists bushfires and flooding rains as other factors involved in the process of soil loss. As it was the herbaceous layer (presumably assisted by the layer of surface leaf litter) that was holding the topsoil in place, a low intensity fire would effectively expose the soil and make it vulnerable to erosion. The only known factor to have changed since European occupation was the introduction of hard-hoofed grazing animals, and the influence of large numbers of such may have been sufficient to destabilise the topsoil so that large quantities would be lost in rainfall events. Any increase in even low intensity fires would therefore be magnified in its effect on the landscape.

The science of dendrochronology or dating (of fire scars in this case) from tree rings adds additional information to the Snowy River corridor issue (dendrochronology will be studied in greater depth in the following section). Extensive analysis in the Willis area by Pulsford (1991) examined trees dating back many years prior to the arrival of Europeans to the site. This study demonstrates a dramatic change in fire regime at this point. For the 55-year period 1790 to 1845/46, there is no evidence of any fire in the Willis area. Following this first recorded fire in 1845/46, there is a fire recorded on average every 6 years.

This change in the fire regime does not fit well with the perception of the graziers that

“the blackfellow was constantly setting fire to the grass and trees, both accidentally and systematically for hunting purposes”

(Curr, cited in Ryan, Ryan & Starr (?))

As the dense regrowth was predominant at Willis where it appears that there was a massive increase in fire frequency, the suggestion that decreasing fire frequency caused the regrowth is unlikely to be the case. Further to this, the consistent change in vegetation across the Snowy River corridor may be sufficient evidence to say that European influence was similar for all of this community. In short, that fire frequency in the Snowy River corridor was significantly less prior to European settlement, and that the increase in fire frequency coupled with increased grazing pressures changed the forest from a climax community to a community of post-disturbance coloniser species.
Following the same argument as for the Snowy River corridor, Howitt (cited in Ryan, Ryan & Starr ?) argues that European settlers reduced fire frequency across much of the Victorian mountain areas including “the Tambo valley from Ensay up to Tongio”, the Omeo district, “the mountains, from Mount Wellington to Castle Hill, in which the sources of the Avon River take their rise”, “the upper valley of the Moroka River”, and the Caledonia, Wellington and Macalister Rivers. It is not certain how this knowledge of aboriginal burning was attained as Howitt did not profess to have ever observed it, but as it is given in the same context as the Snowy River corridor statements and using the same evidence of increased forest cover, it is likely that the beliefs regarding burning practices were also assumptions based upon the beliefs of the time. Furthermore, as the author was not present to observe aboriginal burning practices, he was also not present to observe the forests in their original state and his statements as to regeneration should be used carefully until they are further verified.

Wakefield (1970) also argued this point in response to Howitt, as recorded by Banks (1989):

“…settlers caused the return of the trees and scrub not by stopping the fires but by starting them. As an experienced biologist, he interpreted observations made on the Rogers’ property on the Wulgulmerang plateau, where from 1900 to 1960 the open forest had become filled with scrub in spite of burning every three to four years in an attempt to keep it open for grazing.”

Changes to the forest structure are discussed in more detail in the next chapter.

Dendrochronology

The science of dendrochronology involves examining tree rings to identify events in the history of the tree that can then be given a specific date. Fire events have been regularly recorded by several researchers using fire scars and the growth flushes that commonly follow fires. Such records across the KNP / Brindabella / Namadgi areas tell a consistent story – prior to European settlement and burning practices, trees dating back to 1730 display fire-free intervals as high as 91 years in the upper Tooma river catchment to 121 years in parts of the Brindabella mountains (Banks 1989). A theory has been proposed that this is because only higher intensity fires will actually scar a tree, and that these fires have increased in number as the frequency of burning has decreased. It is true that only higher intensity fires will scar many trees such as *E. dalrympleana* (Mountain Gum) and *E. viminalis* (Manna Gum), however thin barked trees such as *E. pauciflora* (Snowgum) and at times *E. delegatensis* (Alpine Ash) will scar very easily (Banks 1989). Recent work carried out in the northern Brindabella mountains (Richards, Carey & Bradstock 2001) for instance found that even in areas burnt on an ‘as often as possible” basis, Snowgum trees were scarred by 8 out of every 10 fire events regardless of fire intensity. The majority of these fires could be expected to have been low intensity due to the frequency of the burning.

Considering the sensitivity of Snowgums to fire then, such intervals as those cited above almost certainly represent nearly all fire events. Based upon this evidence and
without exception, all fire regimes increase dramatically in frequency following European occupation (figure 3). On average over all sites cited by Banks (1989), each point was burnt once every 25 years before 1830. From 1830 and 1959, the frequency increased to an average of 1 fire every 3.5 years, or 7 times more often than previously. Considering such a short between-fire interval, it is highly improbable that these were all scars from natural high-intensity bushfires resulting from fuel build-up due to a reduction in fire frequency.

In another study, Costin (1954) cited earlier dendrochronological work, stating that there were

“...higher fire-scar frequencies in Monaro forests near the periphery of tree stumps than towards the centre”.

Whilst this does not list years that trees were burnt, it does state that there were more fires scarring the trees in recent times than there were in pre-European times.

This evidence strongly refutes the claims that burning frequency has decreased from Aboriginal times. Evidence in fact points to a seven-fold increase in fire frequency across much of the Alps following European occupation. This increase may have come directly from intentional fire, however McArthur (1962) when speaking of the fires lit by graziers in the high mountains said:

“The lack of adequate control lines meant that no area restriction was placed on the burn and large scale fires resulted when weather conditions deteriorated.”

This idea is borne out by the fact that the largest recorded fire in the Alps (1939) was known to have started from the fires of graziers and other settlers in the mountains. It is therefore reasonable to suggest that the seven-fold increase in fire frequency was a result of both planned low intensity fire and the resulting unplanned, often high intensity fires that occasionally escaped.

Charcoal & Pollen Deposits

Charcoal studies provide an insight into changing fire regimes over a span of many centuries. By counting the grains of charcoal present in lake sediments, it is possible to find 'how much fire' there was in the catchment of the lake. The results are general, because they do not indicate whether large amounts of charcoal have come from frequent fires, or from a high intensity event that burnt more vegetation thereby producing more charcoal. The studies are useful however in giving an unbiased index of the importance of fire in the general area of the lake, and as the strata can be Carbon Dated, the core sample is read like a time-line.

Alpine Zone

Studies of charcoal in the sediments of Club Lake (Sharp 1992) give a picture of the fire environment from approximately the year 1400 to the present. Pre-European fire during this period was not constant, experiencing two main phases – the 17th and 18th
centuries saw charcoal concentrations at roughly 1/8 of the concentrations produced during the 19th and early 20th centuries. Prior to this, the 15th and 16th centuries experienced a time of more frequent and/or higher intensity fires with deposits approximately half of the values input in the 19th and early 20th centuries (figure 4).

Dodson et al (1994) found in his studies of Club Lake charcoal deposits evidence for 9 fires within the local area having occurred in the 800 years preceding the historic period that began with the grazing era; this suggests a fire frequency of slightly more than 1 fire per century in the Club Lake catchment.

Club Lake gives an indication of the fire environment within the Kosciuszko Alpine area. It should however be noted that this information is specific to the Club Lake area, and the ratio of fire before the European era to during that era will not be the same for other alpine areas. The Bogong High plains for instance experienced a different pattern of burning by graziers due to the dominance of cattle and their different feeding patterns relative to the sheep of Kosciuszko.

Montane / Subalpine zone

Charcoal studies (Mooney et al 1997) in the montane / subalpine zone at Brook’s Ridge (elevation 1450m) found that there was evidence for very little fire within the local area prior to European settlement, with the exception of a charcoal peak at approximately the 5th century AD. Large fire events appeared to have been extremely rare. A sharp change occurred with the movement of Europeans into the area, when the concentration of charcoal in the sediments increased by an order of magnitude, indicating a massive increase in the frequency and/or intensity of fires. Mooney (2004) stated that this study revealed evidence of only 1 true local fire (presumably within the catchment of the site) in the 1400 years covered prior to European land use.

A study of sediments at Mt Buffalo (Binder & Kershaw 1978) which only considered visible bands of charcoal most likely to have been caused by locally high intensity fire events found evidence for a frequency of such events approximating 2 fires per millennium.

General

Kershaw et al (2002) examined 58 charcoal studies carried out through south Eastern NSW, with the main study areas being Barrington Tops (5 studies), Blue Mountains (7), East Gippsland (6), Central Highlands of Victoria (8), and Discovery Bay through to the Otway Ranges (13). The other sites were scattered across Tasmania and the Bass Straight Islands, Kangaroo Island, the Mallee and Wimmera country of Victoria, and the NSW South Coast and South East Highlands. Only 1 of these sites (Club Lake) was located within the Australian Alps.

Figure 5 shows the relative change in charcoal abundance for Wet Sclerophyll forest, Dry Sclerophyll Forest, Heathland and Woodland for the period 5000BC to the present, based on the figures reported in the study. During this period, the evidence suggests that:
• Wet Sclerophyll forests have shown very little change in fire frequency/intensity, with a maximum during the early European period and a minimum during the late European period (post 1940).

• Dry Sclerophyll forests and heaths had the most frequent/intense fires in the early European period, with a lesser peak during the period 2000BC to 0AD. The least fire influence was found post 1940, before 3000BC and in the period 0AD to 1850AD.

• The influence of fire in woodlands was found to have steadily increased, reaching a maximum during the early European period then falling to 5000BC levels again in the late European period.

The general trend for all of these vegetation types across South Eastern Australia is that fire frequency/intensity prior to European influence was significantly less than it was during the early European period, but slightly greater than it is currently.

This trend correlates well with the evidence already presented for the Alps, with one main difference. All studies indicate that fire frequency/intensity in the Alps under Aboriginal management was far lower than for the rest of south-eastern Australia.

A Pragmatic Management Approach

Fire ecology, where it is well understood, provides considerable evidence of pre-European fire history in certain forest communities. If a 100-year-old plant can be easily killed by fire, it can safely be said that it has not been burnt in the last 100 years. If a forest is full of these plants, it is safe to say that the forest has not had a fire in that period. This is a crossover point with dendrochronology – forests of fire sensitive species tend to be single-age groupings, the age of which indicates the last fire.

As established earlier, Aboriginal burning was a planned, systematic lore that was applied to achieve definite goals. If fire was introduced to some areas to encourage the growth or proliferation of food species, it was logically excluded from those areas where the food species were found to be fire sensitive.

Areas supporting important food plants such as Murnong (Yam Daisy) that responded favourably to fire and met other requirements for frequent visits (such as reliable water supply) were probably burnt in such a way as to encourage these plants. In the same way, it is believed that grassy woodland supporting grazing species such as Kangaroos and Wombats was burnt so that the sweeter regrowth would attract game.

By contrast, many game species decline in number through regular burning due to the destruction of nests, habitat or food sources. Costin (1954) listed several such species as having declined, in his opinion as a result of increased fire frequency:

“…many species are verging on extinction (eg) Dromarius novae hollandiae (Emu), Phascolarctos cinereus (Koala); whilst others have now disappeared from the Monaro fauna (eg) Eupodotis australis (Bustard), Perameles nasuta (Bandicoot).”
The reduction or loss of these species in itself is not sufficient evidence to prove an increase in fire frequency or intensity since Aboriginal times, but coupled with other evidence such as direct observation, tradition or dendrochronology; the case becomes very convincing.

As mentioned earlier, fire ecology can be applied more conclusively in another sense. Where there is a high presence of plants that are easily killed by fire, it can be stated definitely that there has been no fire in the lifetimes of these plants. Such evidence was offered to Judge Stretton in the Royal Commission into the 1939 fires of Victoria by Patton (Stretton 1939), the Senior lecturer in botany and agricultural botany at the University of Melbourne.

“In connection with the condition of our forests before the arrival of white men, I have given attention to that factor over a considerable period. Very large trees existed in our forests, reaching a maximum in the case of King Edward VII which is on the track from Marysville to Cumberland. I have tried to arrive at the age of those huge trees, and find it very difficult.

On the other side of the world, tree age can be calculated very readily by rings of growth, but that is impossible in our case. The rate of growth was very low in the old age, and I would not be surprised, or rather. I estimate the age of King Edward VII to be in the neighbourhood of 3,000 years. Possibly it is the world’s oldest tree.

There are a large number of these old large trees, which indicates that the forests were not burnt. Hill tree ferns which accompany the mountain ash I would regard as being in the neighbourhood of 500 years old. The size of the old musk trees, blanket woods and beeches suggests that they have been immune from fire in the past.”

Patton’s observations were directed at the fire sensitive Eucalyptus regnans forests of the lower mountains in Victoria, but the same logic applies across much of the wet mountain forests in the Alps. Roger Good (Pers. Comm. 2003) of the NPWS for instance has observed stands of E. delegatensis at World’s End in the Kosciuszko National Park that are estimated to be 400 years old. Ted Taylor (Pers. Comm. 2004) also recalls his work for the Snowy Mountains Authority in the 1950’s involving the removal of large areas of Ash killed in 1939 in the Tooma and Geehi areas. Whilst he did not date the trees, his impression was that they were far larger than most of the trees present in Kosciuszko today.

In deducing a possible Aboriginal fire regime, it is obviously necessary to determine whether there was a need for regular burning. Much thought in this area follows a circular-reasoning pattern – ‘We know that Aborigines burned the area because the Australian bush thrives on fire. We know that it thrives on fire because the Aborigines burned the area.’ Obviously, concrete facts need to be entered into the argument somewhere for it to have any meaning. If society at the time relied upon fire sensitive plants and yet burnt the plants, society would cease to exist in that area. If society relied on access to the subalpine and alpine Bogong moth grounds as their summer feasting areas (Flood 1980), it is likely that they used fire to clear travel routes
through forest as in other parts of the country (Pers. Comm. Kamminga 2004). It is however unlikely that they burnt these travel routes through subalpine and alpine areas as they were naturally dominated by herbfields at the time and burning only served to encourage shrub dominance over time (Williams 1990, & earlier discussion), reducing access. Whilst Murnong is present in the subalpine and alpine areas, burning to expose yams and promote a flush of growth as in lower areas would have been counter-productive in the uplands. This again is due to the tendency of shrubs to colonise long-term burnt areas over time at the expense of herbs including the Murnong.

In the light of these forms of evidence, Aboriginal fire regimes in the Australian Alps could be summarised as below.

a) Low altitude grasslands and grassy woodlands were probably burnt to attract game and encourage beneficial species, but there is no indication as to what frequency a particular patch would have received fire.

b) Lower dry montane forests were probably burnt where the climax vegetation was shrubby, but fires were of lower intensity (‘cool burns’) and less frequent than European fires. Generally, montane forests were not burnt, thereby keeping them open for travel, hunting and other purposes

c) Wet mountain forests were not burnt except where ancestral pathways were to be kept open and fire was the chosen and most effective method

d) Sub alpine, alpine and high frost hollows were not burnt

LARGE BUSHFIRE EVENTS IN THIS PERIOD

It is often stated that regular, low intensity burns conducted by Aboriginal communities served to prevent the occurrence of large, high intensity bushfires. McArthur (1962) for instance stated that in dry forests, “forest ground fuel rarely exceeded 2 or 3 tones per acre” (5-7 t/Ha), and Cheney (1993) went even further to state “fire intensities were relatively mild even on extreme days because the fuels were light.” The context of what has just been discussed throws doubt over this for the Alps region, as the only available evidence gives no reason to believe that, aside from colonisation by shrubs in eroded areas, fuels were any different from the current day. The possible implication that Aboriginal communities may have managed fire with the intention of preventing large fires demonstrates a lack of understanding of the spiritual view of fire, in the words of Mason (2003)

“…fires started by lightning are the deliberate action of the fire spirit, or spirits, and are therefore not to be interfered with. These fires have been given to the land.”
If, as the evidence suggests, the frequency of human induced fire has actually increased through the Alps since European occupation, bushfire frequency will probably have been affected, but not in the way often expected. Both the dendrochronology and charcoal studies suggest that the fire regime in the mountains since the early European period provides a closer comparison to pre-European burning. Whilst there is similarity in fire frequency, the landscape is much altered due to the proliferation of flammable scrub and tree regrowth following the grazing/burning era, some of which has been discussed already. The increase in post-fire colonisers consequently creates an increased fire risk and encourages the spread of existing fires, so a truly pre-European fire regime will not be attained until the soils are restored and the climax community returns.

Comparing the post 1986 approach in Kosciuszko National Park to the broad-acre burning approach of the preceding 2 decades, Zylstra (2002) found that large fires (greater than 10,000Ha in area) occurred in KNP 1.6 times more often when the area was broad-acre burnt than when it was burnt using smaller areas and less often. This difference was even more pronounced in drier periods, with large fires occurring 1.8 times more often in the broad-acre burning period than in the recent period with a more pre-European burning pattern. As the current environment has a large quantity of shrub and tree regrowth encouraging the spread of fire, it is possible that the pre-European period saw even less regular large-scale fires than the current period.

Speculation as to the size of pre-European bushfires is possible (with great caution) given the evidence already presented; comparison of fire scars may give some indication of fire sizes before mapping records were kept. Whilst the study areas are widely spaced, large fires are more likely to scar more than one study area in a given fire season. Concurrent fire scars are not of themselves proof of a large fire as multiple fires may also have occurred, but the lack of multiple scar sites does suggest that no fires in that year covered enough area to scar more than one site at a time. In the 5 sites with fire scar records going back to 1820, concurrent scars do not occur at all for the first 21 years until 1841. From this period, coinciding with the general time at which European burning practices were first introduced across the mountains, the next multiple scar year was 21 years later in 1862. After this year, scars common to 2 or more sites are found on average every 7 years. The fires of 1898, 1924 and 1939 left 4 sites scarred for the year (Figure 6). This information should be used carefully as the estimate of which year a site burnt is at times approximate.

The factors causing very large fires are also a matter of interest here. The 2 largest fires recorded (1939 and 2003) are similar in most ways except their modes of ignition. Both fires burnt vast areas, and both achieved such a scale only because multiple, broadly distributed ignitions occurred coinciding with severe drought conditions and extreme fire weather. Such drought and weather conditions do occur with regularity in the mountains, but without an ignition they come and go with no resulting fire. When there is an ignition (such as the Ravine fire in 1964/65), tens of thousands of hectares can be burnt with extreme intensity. The phenomenon of millions of hectares burning in one event only occurs when multiple ignitions ignite an effective line of fire across the classic west to east direction of fire travel, and on the upwind side of the fuels. There is only one record of such a natural event in the Alps for the period that such records have been kept, and this is the fire of 2003.
The fire of 1939 was only made possible because of the number of fires lit by people.

The implications of this are that fires of the scale of 2003 were probably quite rare prior to the early European period. The limiting factor for such events is the occurrence and pattern of ignition, and although lightning ignitions do naturally occur more often on the western side of Kosciuszko National Park for instance (figure 7), it is probably quite unusual to have such a quantity and spread of them as occurred on January 8, 2003. Considering the evidence that Aboriginal burning was very limited in extent and frequency through most of the mountains, it appears that such fires would only have been probable through natural events. The increase in the widespread presence of untended fire through the mountains in the early European period consequently created multiple opportunities for large conflagrations that would not have been possible earlier.

A statistical estimate of fire frequency and the frequency of very large (>= 100,000 Ha) bushfires is possible based upon current trends and fire scar information as described in Appendixes I – III. In the centuries preceding European occupation, the weight of evidence suggests that Kosciuszko National Park probably received fire both naturally and via human introduction at a rate of about 10 fires per annum. Given the frequency of fires and the average age of the fuels, fires of 100,000 Ha and greater probably occurred on average every 49 years. Such fires would have at times attained extreme intensity, made all the more intense due to the sheer size of the old-growth forests they were burning. These figures should be treated with care, keeping in mind that they are only a best estimate.

**SUMMARY OF PRE-EUROPEAN FIRE IN THE AUSTRALIAN ALPS**

Considering the evidence that is available to date, the Australian Alps prior to European settlement were subject to fire, both of natural and human origins to very varying extents.

A study of Aboriginal fire practice in the area reveals that burning is a precise activity that specifically targets small patches or narrow corridors. Fires are planned meticulously, and often use specific weather prescriptions and ignition patterns. Fire frequency is determined by seasonal and vegetative indicators, and fire regimes are specific to vegetation types.

In all, studies of 12 dendrochronological study sites were examined within the Australian Alps area. Of these, 11 indicated or were consistent with the finding that fire frequency during Aboriginal management was on average 1/5th to 1/7th as frequent as it became during the early European period (prior to 1840/1850). The 12th study suggested that fire frequency pre-contact was less than that post contact, but not statistically significant as that particular study site appeared to have burnt or been burnt on a 10-year cycle under Aboriginal management. This 10-year fire-free interval represents the evidence for the most frequent fire regime discovered anywhere in the Alps under Aboriginal management. It is likely that about half of the fires were caused by human activity, as the frequency of lightning fires for that area appears to be about
1 fire every 20 years (figure 7). Considering all 12 sites, the frequency of all natural, planned and accidental fires under Aboriginal management in KNP equates to about 10 fires in the park per annum (Appendix I).

Charcoal studies give a longer-term perspective. In a general sense across southeastern Australia, dry forest, heath and woodland experienced less fire under Aboriginal management than during the early European phase, and probably more fire than during the current phase. Dry forest and heathlands had a possible period of fire frequency/intensity during the period 2000 BC to 0 AD that was greater than the 1800 years pre-contact but still less than the early European phase.

Charcoal studies within the Alps varied from this pattern in that the modern European phase still suggested more frequent/intense fire than the period under Aboriginal management. All 4 studies showed that fire frequency/intensity under Aboriginal management was less than the early-European fire management, although these results were not statistically significant in 1 study.

The incidence of human ignitions under Aboriginal management overall appears to have been significantly less than that commonly assumed. Some areas such as the lower Snowy River corridor, the wet mountain forests, the frost plains and the subalpine/alpine areas probably received no introduced fire except where ancestral pathways needed to be cleared or other site-specific objectives met. At one such site, a 10-yearly burning cycle was observed. The exception may have been the low altitude grasslands and woodlands, which possibly received more regular burns although this is purely theory based upon other parts of south-eastern Australia and is not supported by evidence specific to the Alps.

Large and high intensity bushfires almost certainly occurred, but pre-European fire-scar records suggest that these appear to have been infrequent. The reasons for this relate to 2 main factors,

1) the necessary ignition pattern and extent of ignitions for such large fires as 1939 and 2003 appears to be a very rare natural event (figure 8), and

2) under Aboriginal management, the west – east spread of fires would have been hampered by the climax grass/herb dominated alpine and subalpine areas (figure 9). This is currently not the case as these areas are to a greater extent dominated by more flammable shrub and heath communities resulting from early European fire disturbance.
Figure 2. High intensity fire stopping at the ridgeline. This particular run (western fall of the Main Range, 17 January 2003) spotted 15 to 20 kilometres ahead to ignite the Perisher and Ramshead Ranges. Photo Ian Dicker
**FIRE FREQUENCY SINCE 1730**

**Figure 3.** Changing fire regimes based upon dendrochronological evidence compiled by Banks (1989)

**Frequency / Intensity of Fire in the Alpine Region**

**Figure 4.** Fire frequency / intensity in the vicinity of the Alpine area of Kosciuszko National Park as indicated by charcoal deposits in Club Lake. Data taken from Sharp 1992.
Figure 5. Fire frequency / intensity averaged across South Eastern Australia for broad vegetation types. Data taken from Kershaw et al 2002.

Figure 6. Number of fire scar sites burnt in each fire season. Years where more sites were burnt in the one season indicate more widespread fire, either from a single event or individual fires. Data taken from Pulsford (1991)
Figure 7. Occurrence of lightning ignitions in Kosciuszko National Park based upon ignition records since approximately 1960 (NPWS 2003). The largest area of most frequent ignition is at the western edge of the Park in the Youngal/Geehi/Scammel’s Ridge area.
Figure 8. Distribution of lightning strikes on January 8 2003 (Cheney 2003). It is the coincidence of such a broad distribution of ignition points with conditions producing dry surface and live fuels as well as extreme temporal fire weather that allows for the largest natural fire events.
Figure 9. Distribution of alpine and subalpine communities in Kosciuszko National Park. Prior to modification under early European management, areas marked in brown were dominated by grass and herbfields which slowed or blocked the west–east spread of most fires.