FIRE IN KOSCIUSKO NATIONAL PARK

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During 1975, some Plant Industry ecologists were involved in discussions with officials of several New South Wales Departments concerning the role of fire in the management of Kosciusko National Park (KNP). More specifically, discussions centred on the disadvantages of extending control-burning operations into areas of subalpine woodlands dominated by *Eucalyptus pauciflora* (snow gum) at altitudes between 1370 m and 1675 m, for the reduction of fire 'hazard' in the region. This essay summarises some of the information and opinions discussed on the subject and concludes with some recommendations concerning overall management of this large national park in relation to fire.

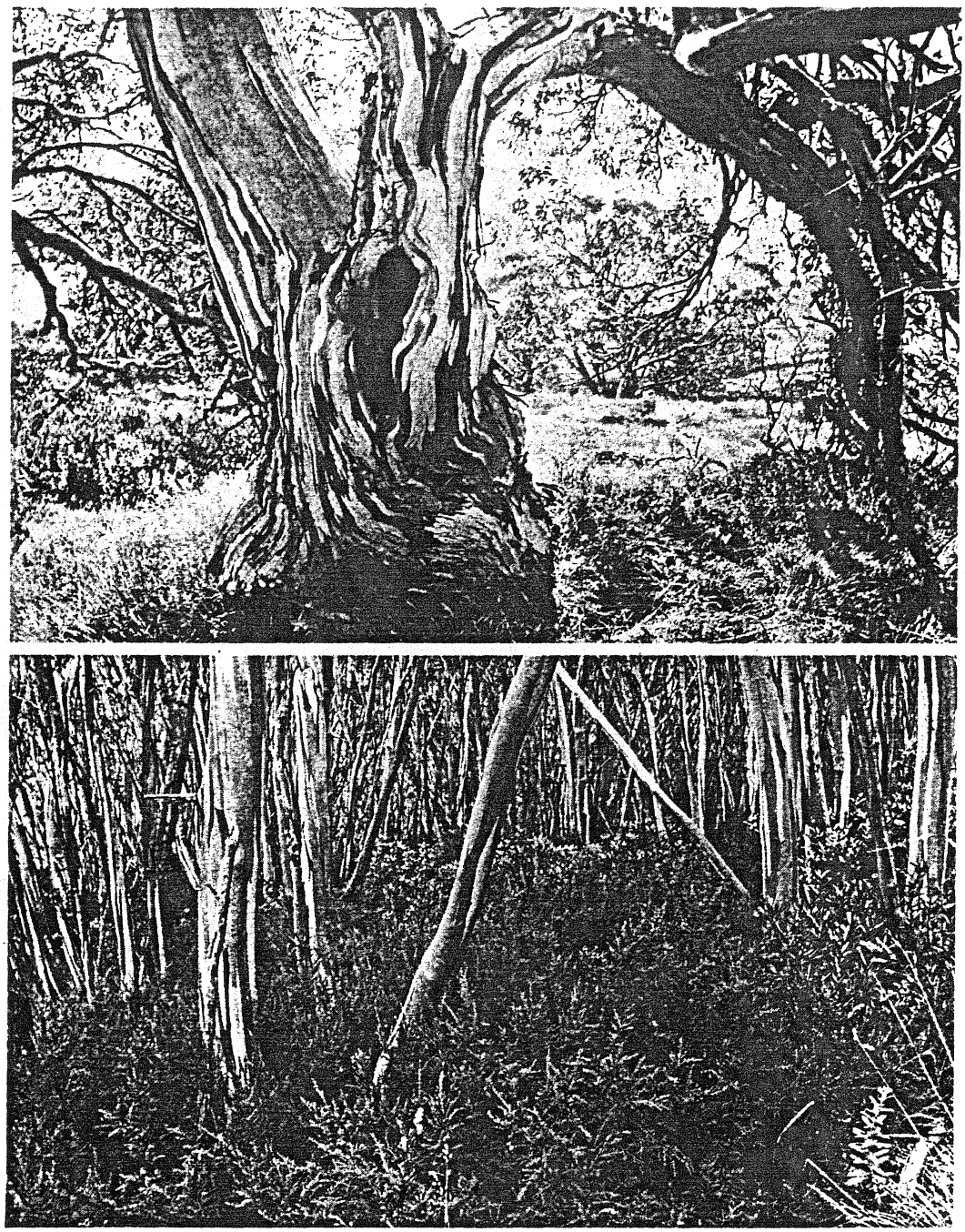
Fire history

Information about the use of fire by the Aborigines in the highlands of south-eastern Australia is very sparse. The most recent evidence suggests that the Aborigines were regular visitors to the mountains and tablelands for only the past 8000 years or so, and that their presence was seasonal and tied to the presence on the higher peaks of aestivating moths, which they used as food.

There is no such lack of information, however, about burning by European settlers. Many published accounts exist of 'burning off' for protection of property boundaries at lower elevations, for clearing of stock routes, and for 'sweetening' the native pastures for stock. The main targets for the latter were the alpine and subalpine snowgrasses that were relatively unpalatable to stock. The accumulation of dead grass material was removed by fires of low intensity lit in autumn, and this had the effect of opening the snowgrass sward and allowing the more palatable forbs, both native and exotic, to increase in cover.

Repeated low-intensity fires in autumn also had a dramatic effect on the composition of the subalpine woodlands dominated by *E. pauciflora*. Young, fire-sensitive trees were top-killed by fire and regrowth from seedlings and from lignotubers, when grazed constantly by stock, was eventually killed. Thus the older trees, widely spaced and heavily butt-scarred, were all that remained. Leguminous shrubs have increased in overgrazed areas, and further regular burning was used to try to keep them in check. When the occasional wildfire of higher intensity occurred, it often killed the remaining trees and some areas became treeless.

A few unburnt stands of snow gum remain, though they are rare in KNP. These are often open and park-like in appearance, with few shrubs. Park (1975) has concluded from a study of a large number of sites at the interface between *E. delegatensis* (alpine ash) and *E. pauciflora* that there is a natural succession in the understorey of subalpine woodlands after fire. Following a fire, there is a period of rapid growth and litter production during which increasing amounts of nutrients and energy are stored in the layers above the soil. This storage rises to a maximum about 55 years after a fire in snow gum communities, after which changes in the structure of the woodland result in declining litter production accompanied by increasing rates of litter decomposition. In the communities studied there was also a concomitant succession from shrub to grass-herb understorey as the initial phase of nutrient and energy storage reached its maximum.



Two *Eucalyptus pauciflora* woodlands in Kosciusko National Park – mature (100+ years) with a predominantly herbaceous understorey (top), and young (30–40 years from fire) trees with mallee habit and a dense shrubby understorey (bottom).

remedy this deficiency and thus increase the accuracy of such predictions. Based on the assumption that repeat burns are prescribed in order to keep the flammable fuel below about 15 t/ha, there has been no effect of the 1972 fire in reducing the 'hazard' in this subalpine vegetation.

Table 1

Dry weights of litter (tonnes/ha) from two ages and two aspects of an *Eucalyptus pauciflora* woodland at Grey Mare, Kosciusko National Park (1620 m above sea level)

Values are averages from six 1 m² quadrats sampled in April 1975

Aspect	Time from last fire (years)	Eucalypt and shrub litter < 6 mm	Total dead	Total living and dead
South	3	7.2	15.4	18.2
South	36	12.5	16.0	35.9
West	3	6.0	9.7	14.5
West	36	11.8	14.9	35.0

Fire resistance of trees

Fire resistance of tree stems is largely a function of bark thickness, a variable characteristic dependent upon species, stem radius, growth rate, height above ground and site history. Ideally then, any comparison between species should take all these variables into account. This is usually impossible in practice. Some idea of species differences may, however, be obtained by taking trees of similar girth and measuring bark thickness at the same height on the stem. We have observed that subalpine and frost-hollow eucalypts have particularly thin bark compared with other eucalypt species elsewhere. Preliminary results of our survey presented in Table 2 suggest that stems of subalpine eucalypts because of their thinner bark are more sensitive to fire than most other species.

Table 2

Average bark thickness of some *Eucalyptus* spp. growing in the Australian Capital Territory and the Monaro Region of New South Wales

Average bark thicknesses were recorded at 1.5 m height for stems of 50 cm girth

Environment	Average bark thickness (mm)	Range (mm)
Subalpine/frost-hollow	6.4	3 – 9
Montane forest	13.6	10 – 21
Tableland woodland	14.8	11 – 23

Although the stems of a tree may be fire-sensitive, the plant may survive fire because quiescent buds, at or below ground level, may be stimulated to grow by death of the stem. This is the case with *E. pauciflora*. Thus, as Costin (1954) has observed, the species '. . . is so fire-sensitive that in most areas recurrent fires have destoryed the original single-boled dominants, causing their replacement by smaller trees of mallee-like habit due to recoppicing from the old root stock'. Over much of the subalpine country in KNP, coppiced stands of *E. pauciflora* are dominant. Bark thicknesses of stem clumps originating after the extensive bushfires of 1939 were commonly less than 4 mm at 1.5 m height, and less than about 6 mm at 20 cm above ground level.

Thus, it is likely that any fire in these areas will top-kill the eucalypts since they are so thin-barked, and this contention is supported by observations made on the effects of recent fires in the subalpine region. Where the fires had died down and been extinguished naturally all stems were killed, although the fire intensity must have been very low. This evidence suggests, therefore, that *any* fire, whether prescribed or unplanned, will top-kill the 1939 regeneration of *E. pauciflora*. Experimentation would reveal the levels of tolerance but, as yet, such experiments have still to be initiated.

Interaction between fire and grazing

The practice of summer grazing, chiefly by cattle, of the snowgrass (*Poa* spp.) grasslands of the alpine areas and the cold air drainage valleys of the Snowy Mountains over the period 1830 to 1958 led to progressive decreases in vegetative cover and species composition, and increased soil erosion associated with fire and grazing. Costin (1954, 1958) and Costin *et al.* (1959, 1960) have described the potential disadvantages of grazing, and Carr and Turner (1959) demonstrated for similar grasslands in Victoria that the exclusion of cattle-grazing led to increases in vegetative cover (especially of the forb Celmisia), soil organic matter and soil water content, and a significant decrease in bulk density.

Whilst the end result of man's interference was plain to see in 1958, even today it is not known how much of the deleterious effects were due to grazing *per se* or to the frequent fires of low intensity that graziers deliberately lit as they left the grazing leases at the end of each season. Such fires removed moribund grasses and promoted a fresh earlier pick of herbage the following spring. It is quite possible that it was the combined effects of fire, trampling and defoliation that caused so much damage.

The results of experiments commenced since the general cessation of grazing by domestic stock give some insights into the problems involved. On grasslands that had been control-burnt prior to grazing, Bryant (1973) showed that sheep-grazing caused continued loss of cover on all except the densest grasslands studied. Regeneration to pre-fire conditions occurred within five seasons of control-burning in the absence of sheep-grazing, but cover was not fully restored after six years when grazed by sheep. Control-burning reduced to ground level young trees of *E. pauciflora* previously beyond the reach of sheep, and subsequent grazing caused mortalities (Bryant 1971). The effects of wild fire were similar to, but more severe than, control-burning, with many trees being killed outright.

A large-scale trial has commenced on the Kiandra Plains in KNP, aimed at documenting the effects of rabbit, kangaroo and wombat grazing on burnt and unburnt areas.

Fire in wilderness areas

Considerable portions of subalpine woodlands occur in two of the four areas designated wilderness in KNP, namely The Pilot and Jagungal. It has been proposed that at least some of these woodlands be control-burnt and so, in this section, we wish to look at the role of such practices in wilderness areas.

In true wilderness we believe there to be no place for man-centred management practices such as control-burning. Some of the subalpine woodlands in KNP, with their primitive natural character still obvious, are ideal for preservation as wilderness because they cover extensive areas and constitute only a low fire hazard in most years, and because they are at present remote from areas requiring fire protection, such as private land and State forests.

Probably the most pressing aspect of wilderness management is the planning of reaction to an unplanned fire. If conditions over most of KNP were similar to those present before the coming of man, there would be no need for any management, but we must acknowledge that the continuity of the natural landscape has been drastically altered, and that there are many more potential sources of ignition nowadays. If left alone, wilderness areas would be subject to a fire regime very different from the 'natural' one. What attitude should be adopted in this situation? In formulating our set of recommendations on the role of fire in KNP we shall try to take these aspects into account.

Recommendations for fire planning in KNP

Some of our recommendations seem to be agreed on generally by all parties interested in KNP and its conservation. These are:

- there should be no control-burning of alpine vegetation types, because these ecosystems are only slowly recovering from the firing-grazing interaction referred to earlier;
- every effort should be made to continue to protect from fire the few remaining stands of mature *E. pauciflora*; and
- some control-burning in KNP may be necessary to protect installations or areas used for intensive recreation from wildfires of high intensity, or to promote the flowering of certain colourful species adjoining visitor centres.

Other recommendations we would make are more controversial. Where possible we have tried to base them on an understanding, albeit limited, of the plant ecology of the communities concerned. These are:

- until we have more adequate knowledge of bark thickness of *E. pauciflora*, litter sampling and vegetation dynamics, and the role of non-domestic grazing animals, the subalpine woodlands should preferably *not* be control-burnt. We believe that the cumulative effects of frequent control-burns may be damaging to the conservation of a diverse range of subalpine ecosystems;
- the present practice of control-burning the montane forests of KNP should be re-examined. In particular, there may be a need to increase the level of monitoring of litter amounts, floristic composition and vegetation structure, especially under pre-burn conditions;
- the time base for many ecological studies in KNP is the time since the last wildfire. This baseline is being eliminated in most areas of montane forest in KNP by the present and

proposed control-burning programmes. We suggest that significant loss of scientific value accrues from such a policy; and

– in wilderness areas, three aspects should be included in planning: (a) public access may need to be restricted during periods of high fire danger; (b) the provision of buffer zones with low fuel accumulations around the wilderness area might be considered, even though this may interfere with the movement of naturally-occurring fire into the wilderness; and (c) fires originating because of man's activities may need to be extinguished, whereas those known to be caused by lightning or other natural phenomena should, ideally, be allowed to run their course until well outside the wilderness area.

In advancing these recommendations, we hope they will stimulate further research on the ecological relationships of the plant communities of Kosciusko National Park, especially the subalpine woodlands.

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