Lessons on fire

Henrik Wahren

From the ashes of the worst blaze to hit the Australian Alps since 1939, scientists have seized a rare opportunity to study the nature of fire in the high country. Their work is revealing new understanding about management interventions needed to ensure the continued survival and functioning of these rare and specialised alpine communities.

SOME 1.73 MILLION hectares of sub-alpine and alpine landscapes, across Victoria, New South Wales and the Australian Capital Territory, were severely burnt in January 2003 after hot, windy weather, prolonged drought and a string of lightening strikes combined to set the Alps ablaze.

Immediately after the fires, and now, as the winter snow melts, Dr Dick Williams of CSIRO Sustainable Ecosystems, Dr Henrik Wahren of the Research Centre for Applied Alpine Ecology at La Trobe University, and colleagues from Parks Victoria and the Department of Sustainability and Environment, are documenting burning patterns and intensities, and plant responses in the Victorian Alpine National Park. Similar studies are underway across the Alps, including Kosciuszko National Park (NSW) and Namadgi National Park (ACT).

'We're trying to piece together the patterns of burning, the severity of burning and the patterns of regeneration in the main treeless plant communities – the grasslands, herbfields, heathlands and bogs,' Williams says.

To document burning patterns, the group is overlaying high-resolution aerial photographs of the burnt areas with topographic and vegetation maps. Fire severity in different areas of heathland is being determined by various means, including measuring the minimum twig diameter of burnt shrubs. The smaller the minimum diameter of the burnt end of the twigs, the less severe the fire.

Patterns of regeneration are monitored by documenting how various species re-establish post-fire (whether vegetatively, or by seed, or a combination of both), and by measuring the cover and height of key species. These measurements commenced immediately post-fire, at permanently marked reference areas, and will continue for many years.

By documenting these observations, scientists will have a valuable reference tool for the future management of alpine communities, which are under pressure from a range of man-made threats including skiing, bushwalking, grazing by cattle, deer and horses, and climate change.

Last summer's alpine blaze, the biggest fire event in six decades, races up the Bogong High Plains of Victoria's Alps.

High-country history

The work follows a long history of research in the Alps, looking at the effects of grazing by sheep and cattle, and prescribed burning (to provide green feed for livestock and reduce fuel loads). Some 50 years of study by scientists such as Dr Alec Costin and Mr Dane Wimbush, formerly of CSIRO Plant Industry, and the late Mrs Maisie Carr and Professor John Turner of The University of Melbourne, showed that the combination of grazing and burning in alpine regions caused changes to the composition of plant communities, land degradation, and a subsequent reduction in nature conservation values, water production and water quality.

In the few years following 1958, the combined interests of the Snowy Mountains Hydroelectric Scheme and nature conservation saw a gradual end to grazing in Kosciuszko National Park. But grazing continues in other parts of the Alps, including parts of the Bogong High Plains in Victoria, where Williams and his colleagues are working.

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There is continued pressure in some quarters, however, to reintroduce grazing in Kosciuszko, based on the belief that 'alpine grazing reduces blazing'. In other words, grazing reduces fuels more or less evenly across the whole of the landscape, such that in the event of fire, fire intensity is reduced. However, there is a growing body of evidence to the contrary.

Grazing and fire

Studies of other alpine fires, and fire behaviour in general, have shown that the most flammable part of the alpine landscape is the dense, closed heath communities that are dominated by unpalatable shrubs such as *Prostanthera, Phebalium* and *Orites*. These communities are usually avoided by cattle, which prefer open grassy communities where there is abundant, palatable fodder that is significantly less flammable than the shrubs.

Across the Bogong High Plains, the Victorian researchers now have the perfect natural experiment through which they can compare burning patterns and fire intensity in grazed and ungrazed areas. Preliminary data collected immediately after the 2003 fires indicate no real grazing effect.

'Our observations and measurements in February and March show burning patterns that appear to be just as common in burnt ungrazed country as in burnt grazed country,' Williams says.

'The first is the pattern of burnt heath abutting unburnt grassland or herbfield, and second, there are examples where fires have jumped, sometimes 100 metres or more, between patches of closed heathland, over grassland. We could also find no difference in fire severity between grazed and ungrazed areas of heathland. More research is needed, but these preliminary observations are consistent with what we understand about fire and cattle behaviour.'

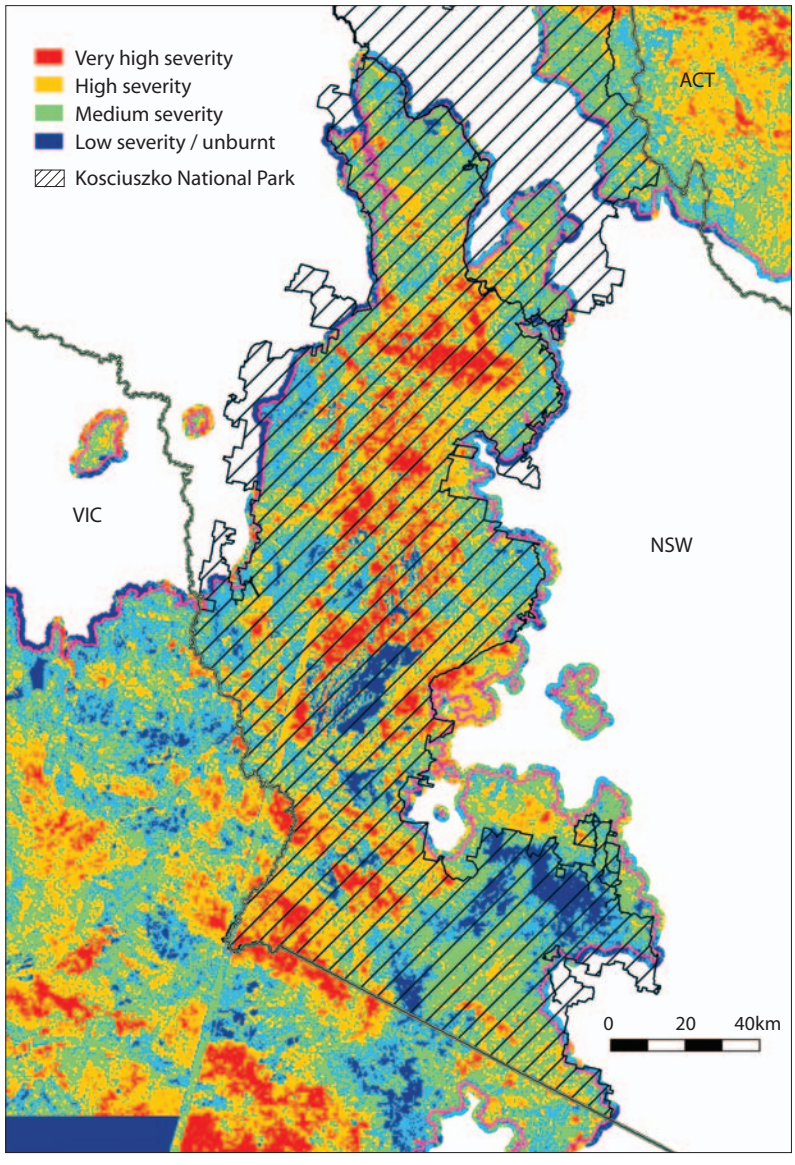
While the idea that grazing reduces blazing is intuitively attractive, Wahren says it is an over-simplification, even a 'furphy'. However, the constant trampling and nibbling of regrowth by livestock after fire has a very real impact on the recovery of alpine shrubs, herbs and bogs, and the exposure of bare ground to erosive processes. Bushwalking, skiing and other human activities may also contribute to the problem.

'Anything that disturbs the soil and slows the regeneration of vegetation cover is a major issue for soil, water and nature conservation,' Wahren says.

'We've now got a massively changed environment where the protective blanket of vegetation over delicate alpine soil has been removed. The flora has the capacity to deal with this through resprouting and reseeding, but it takes time.'

Alpine regeneration

So how long will regeneration take, and what sort of changes to the vegetation cover can we expect? Will shrubs encroach on grasslands? Will the bogs, which are so important to regulating water production and quality, return to their former condition?



NSW Department of Environment and Conservation

Fire severity in the Kosciuszko National Park with classes derived from satellite (LANDSAT) imagery taken before and after the summer 2003 fires. High severities are generally associated with the forest vegetation types; low severities predominate in the alpine and sub-alpine vegetation.

By studying the regeneration rate of grasslands, heathlands and bogs, Williams and his colleagues hope to find answers to these questions and to identify management interventions that will make a difference.

'Management sometimes means leaving things alone,' Williams says.

'Knowing which parts of the landscape can look after themselves, post-fire, will be an important contribution to management. We don't want to be throwing resources at the wrong places.'

Climate change effects

Williams and Wahren hope the study will also shed some light on the way fire and climate change interact. As fire leaves bare ground in its wake, regeneration opportunities for sub-alpine shrubs and trees increase up-slope. A combination of rising temperatures and continued disturbance in alpine regions could see sub-alpine species, such as snow gums, migrating upwards and leaving the specialised alpine communities with nowhere to go. Grazing and other human activities that increase bare ground may encourage such migration.

Further, if summer rainfall increases with climate change, then vegetation cover and the unique alpine bogs will assume an even greater role in regulating both the quality and rate of catchment discharge.

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Distinct localised burning occurred in taller, more flammable vegetation (these were Alpine *Orites,* Family *Proteacae*) compared to the surrounding plains grasses, which remained untouched.

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The sensitive sphagnum bogs of the high plains (foreground) may be irrevocably damaged by the blaze and continuing cattle trampling.

'We don't understand the rates and threat of potential changes that changing temperatures, snow and rainfall regimes might have on the alpine communities, and how that might interact with fire frequency,' Wahren says.

'By observing what happens in response to this particular fire, across the landscape, we can get a better handle on how climate change may affect the alpine environment.'

Balancing competing priorities

So how do we balance the demands of grazing, recreation and tourism, and the threats these pose in combination with climate change and fire, with the need to protect our sensitive, unique and rare alpine communities? According to Dr Ross Bradstock of the NSW Department of Environment and Conservation (DEC), these questions will preoccupy park managers for years to come. However, Williams' and others' work will provide some answers.

'By making detailed maps and observations now, people will be able to look back on this data in the future and use it to improve the sustainability of alpine communities through better management,' Bradstock says.

The need for this sort of work is acute, as comprehensive maps and measurements from the 1939 and later fires are not available for many parts of the Alps. This has stymied the ability of managers to look at the long-term consequences of fire in alpine regions.

'Understanding what the effects of this fire are likely to be requires that we put it into a context of what's happened in the past. This is because the response of organisms to fire is a function of the period of time since the last fire, and the fires before that,' Bradstock says.

'So in the future, if we have a broadscale view of where the 2003 fires went, and their burning intensities at different places, we'll have a much more substantial platform from which to predict the effects of future fire.'

One useful resource now at hand is a map prepared by Tom Barrett of the NSW DEC, which documents the range of fire intensities experienced during the 2003 fires in NSW. The map is based on pre- and post-fire imagery provided by the LANDSAT satellite and illustrates that the fire burned with widely varying intensities, reflecting the influence of weather during the course of the event, and the complex, rugged nature of the high country.

'Maps such as this provide a template for the design of monitoring programs which can track the course of post-fire recovery, and may be useful in targeting areas for control of feral animals which interfere with the recovery of native species,' Bradstock says.

For now, however, the work will enable National Parks managers to understand the consequences of immediate management decisions relating to grazing and recreation/tourism development.

'We are constantly monitoring and surveying the flora and fauna in our National Parks, and a lot of work is focused on the interactions between biodiversity and high profile recreation activities such as skiing,' Bradstock says.

'Balancing the alpine ecosystem recovery will be an additional challenge, but one that can be undertaken with some confidence, given past and current research in these ecosystems, and the effort devoted to documenting the extent of this natural event.'

● **Wendy Pyper**

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