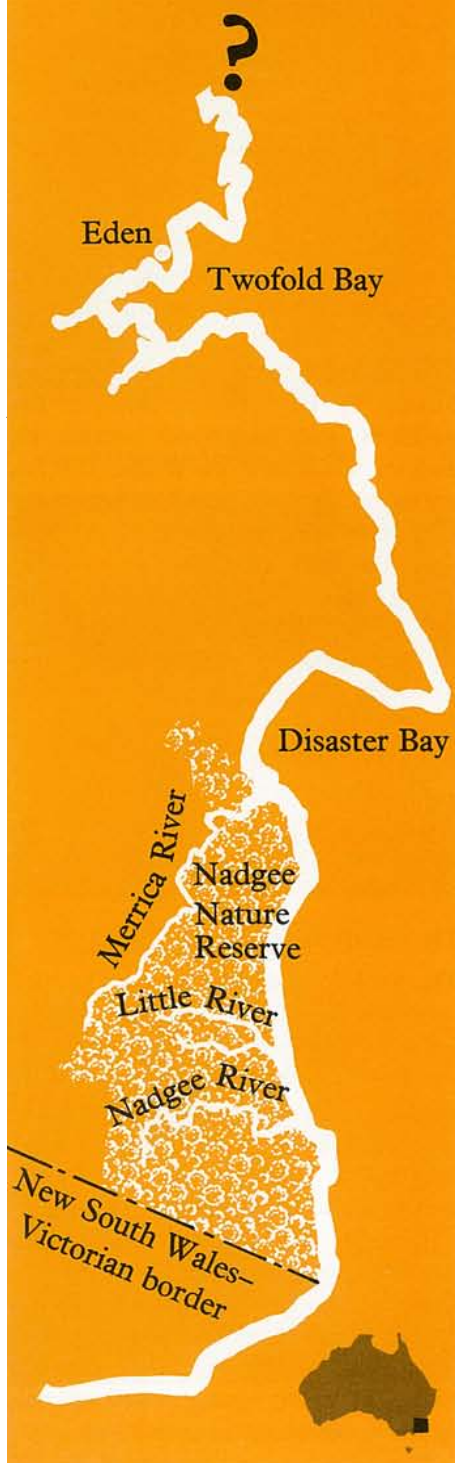


What happens to animals in a bushfire



Scientists have made very few studies of the effects of summer bushfires on Australia's forest animals—mainly because it is extremely difficult to set up experiments.

Nobody can predict when a bushfire will occur in any area, but species have to be identified, counted, and examined immediately before the fire as well as after. The problem is to be in the right place at the right time.

Luck stepped in on science's side, although not on the side of large numbers of animals and birds, when a fierce bushfire swept through 60 000 ha in the south-eastern corner of New South Wales in December 1972.

Part of the area burnt out was the 15 000-ha Nadgee Nature Reserve, which stretches about 22 km up the coast from the Victorian border. Two research teams were studying the Reserve's animals when the fire struck, and both have seized the opportunity to follow its effects.

One team—Dr Alan Newsome, Dr John McIlroy, and Mr Peter Catling, from the CSIRO Division of Wildlife Research—was studying the ecology of dingoes and their prey. The research began about a year before the fire, and included population counts of 20 animal species.

The other team comprises Dr Harry Recher, Mr Daniel Lunney, and Mr Haymo Posamentier, from the Department of Environmental Studies at The Australian Museum, Sydney. Their research, a detailed study of the ecology of four small native mammals, began nearly 4 years before the fire. A major aim is to gather information needed for recommendations on reserve management.

The fire

Lightning started the Nadgee fire, which came at the end of two unusually dry years. Observers describe wallabies jumping off cliffs into the sea to escape the flames, and flying birds suffocating in smoke and falling to the ground.

The Reserve's extensive heaths were reduced to ashes. In the eucalypt forest, which covers most of the Reserve, ground and understorey vegetation suffered the same fate in all but a few moist areas, and an estimated 60% of the tree canopy was burnt or scorched.

People inspecting the damage shortly after the fire saw the charred remains of animals of all sizes, from marsupial mice to kangaroos. Twenty-four wallabies and kangaroos were found washed up out of the sea. Hundreds of dead birds littered the beaches.

Observers describe wallabies jumping off cliffs to escape the flames.

But many animals and birds survived, including representatives of all species in the Reserve before the fire. Burrowing animals like wombats escaped underground. Others found refuge in areas that remained unburnt. Some may have outrun the fire. Groups of surviving kangaroos and wallabies had sore feet; they probably ducked back around the fire to already-burnt areas.

Green shoots began to appear on defoliated trees almost immediately after the fire. With the first rain, which came within weeks of the blaze, ground vegetation sprouted throughout the Reserve from roots and seed stored in the soil. By the middle of 1973 the heaths and forest floor were green, and by the end of the following year the undergrowth in the forest was thick enough to make walking difficult.

As young eucalypts, wattles, and banksias grow, they will increasingly shade the forest floor. Smaller plants will die and the forest will become less dense, as it was before the fire. Growth of new shrub vegetation is slower in the less-fertile coastal heath areas.

Seeing what passes

The CSIRO team used footprint counts to assess changes in populations of the larger animals. They prepared areas of loose soil along dirt roads, tracks, and beaches that animals use as thoroughfares. These soil plots, each a metre wide, were smoothed one day and examined the next for three consecutive days in each measuring period. The scientists worked out the number of crossings made by animals of each species.

Wombat crossings increased markedly after the fire, probably because the animals were attracted to roadside grass, which recovered particularly rapidly. The wombats would have escaped the flames in their burrows.

Bandicoot tracks fell initially, but were back above their original numbers a year after the fire. The scientists suggest that



Nadgee just after the fire. The bare earth in the foreground was, and is again, heathland.



Part of Nadgee's eucalypt forest after the blaze. The ground is covered with ash.

This possum didn't escape.



Vegetation begins to return.

The fate of this rain gauge gives an idea of the heat of the fire.



the decline was probably due to destruction of nests built among dense ground vegetation and logs as well as to deaths in the fire. The ground vegetation was again dense enough for bandicoots within a year.

Possum numbers also appear to have declined and then rapidly returned to pre-fire levels. Ringtailed possums live in grassy nests in the canopy of dense melaleuca scrub, and nearly all this scrub was burnt out in the Reserve. Brush-tailed possums live in hollow trees. After the fire, possums of both species were found mainly in wet areas where the tree canopy had not been destroyed.

Most of the rabbits in the Nadgee Reserve live along the beach dunes and sea cliffs. These areas were badly burnt, but the rabbits were probably safe in their burrows. The scientists recorded rabbit tracks almost twice as frequently a year after the fire as before it; they suggest that the lush new vegetation led to increased populations.

Tracks of kangaroos and wallabies were down by nearly half 12 months after, although good-sized populations remained. One reason for the decline appears to have been increased predation by dingoes. Studies by Dr Newsome indicate that wallabies and kangaroos became the dingoes' main food source after the fire; previously they had been a minor source. Kangaroo and wallaby numbers have since increased again.

Fox and cat numbers fell. The scientists suggest that the reason might be a big decline in populations of the small mammals that they depend on for food. Mammals such as native rats and marsupial mice formed a major part of the diet of dingoes before the fire. Probably it was their decline that led the dingoes to turn to kangaroos and wallabies for most of their food.

The small ones

The fire had an initially devastating effect on the Reserve's small mammals—Stuart's marsupial mouse, Swainson's marsupial mouse, the swamp rat, and the bush rat. The bulk of the research effort is going into seeing how these animals respond as conditions in the Reserve change in the years following the fire.

These are interesting animals, particularly the marsupial mice. Stuart's forages at night for insects, in trees and shrubs as well as on the ground. Swainson's, which often lives in the same areas of bush, gathers its insects by day as well and only on the ground.

The most curious aspect of the life



Part of the Nadgee forest a few weeks after the fire ...

... and nearly a year after.



Coastal heath before the fire ...



... shortly after it ...



... and 9 months after.

Survival of each of the small mammal species depended on some areas remaining unburnt.

cycles of both species is the sudden death of the males within about 2 weeks of mating. Also the mating season lasts only a week or two. The females usually die soon after they have reared their young to independence—a 90-day operation.

At Nadgee, Swainson's marsupial mouse normally mates in late June, most males are dead by mid-July, and the females give birth to up to eight young in early August. Stuart's goes through the same processes about a month later.

The rat species have a much greater potential for rapid population growth, being able to reproduce from spring right through to autumn. Dr Recher and his colleagues have records of both species giving birth in spring and then the females in these litters producing their own young during the following summer. The mothers have to look after their young for only 25–30 days after birth.

The swamp rat forages by day for grass, herbs, mushrooms, seeds, and insects. It depends on ground vegetation for cover as well as food. The bush rat forages only at night, and insects make up a much larger part of its diet.

The Australian Museum team is monitoring populations of the small mammals in 4 ha of eucalypt forest beside the Nadgee River. This area was burnt out.

Since the fire, the scientists have also been measuring population changes in nearby unburnt areas that provided refuge for the animals. They catch the rats and mice in traps, give them individual markings, and let them go. Populations in coastal heath country are also sampled regularly.

Dr Newsome and his CSIRO colleagues use similar trapping techniques to follow populations of the small mammals in two areas of eucalypt forest, each of about 3 ha. They also trap regularly in several smaller areas chosen as representative of different habitats—swamp, grass-covered sand dune, coastal and upland heath, and forest.

Survivors

Immediately after the fire, the scientists found considerable numbers of survivors of all species in burnt forest areas and



Swamp rat.

Bush rat.



Swainson's marsupial mouse

Stuart's marsupial mouse.



some on the blackened heaths. But numbers declined rapidly, and soon no small mammals were being caught on the heaths and only greatly reduced numbers in the forests.

The species that suffered the most devastating early decline were Swainson's marsupial mouse and the swamp rat. Within months of the fire, they had disappeared completely from the forest study areas, although some still occupied unburnt areas nearby. Both species are more dependent than the other small mammals on ground cover, and would have been very easy targets for predators when this cover disappeared. Small populations of Stuart's marsupial mouse and the bush rat continued to live in burnt forest areas.

None of the species managed to reproduce in burnt-out areas the first year after the fire, but all bred successfully where the burn was patchy. In the second year, the marsupial mice again bred only in patches that escaped the fire and their numbers remained very low. Numbers

were still low after the third post-fire breeding season.

Both rat species, on the other hand, had very successful breeding seasons in the reviving forest in the second year. Their numbers increased dramatically.

The bush rat began reproducing earlier than normal, and by the end of the season had completely recolonized the forest. The swamp rat was rare in the forest before the fire, but now became common. However, both rats were still unable to breed in the heath areas.

The problems the fire presented to the small mammals were compounded by the weather. The two years before the fire and the year after it were very dry. Swainson's marsupial mouse, which forages only on the ground and depends on logs and dense ground cover for protection, was particularly affected by the dry conditions. Dr Recher's group had recorded a decline in its numbers from 1971 up to the fire, and both teams found a big reduction in the average weight of

this mammal after the fire, presumably because of a shortage of food.

Flood follows fire

Then in November 1973 and the winters of 1974 and 1975, heavy rain caused rivers and creeks to flood. Many of the patches that escaped the fire and acted as refuges for the mammals were inundated. Again Swainson's marsupial mouse was the species most severely affected.

The last survivors in the areas the Museum team was monitoring died in the floods of winter 1974. But the species survives in other unburnt patches of the Nadgee Reserve.

The common house mouse has found conditions since the fire very much to its liking. It was first sighted early in 1973, although the Reserve probably housed small numbers before the fire. A year later it had colonized most of the Reserve, and its population was growing rapidly.

The house mouse came to Australia with the white man. It breeds profusely

Animals using the track leave their footprints on areas like this prepared by the scientists.



Both teams expect that populations of the four small mammals will eventually return to pre-fire levels.

Tracks, in the sand at Nadgee—of a grey kangaroo, a bandicoot, and a dingo—depicted by wildlife artist Frank Knight.



Ringtailed possum



and throughout the year, disperses rapidly, and thrives on a wide range of foods. However, the scientists expect its numbers to decline drastically as populations of the native species recover and the weedy post-fire vegetation declines. The main cause is expected to be competition from the native rats for food, but predation will also play a part. Cats and foxes are among the animals that eat house mice, and even the little marsupial mice have been known to kill and eat them.

Both teams expect that populations of the four small mammals will eventually return to pre-fire levels. The rats have recovered quickly, but marsupial mice are still very few and far between.

The scientists can't estimate how long recovery will take. Very little is known about the rates of dispersal that marsupial mouse populations can achieve. Also, how soon these animals will again be able to breed successfully in burnt-out areas remains to be seen. Both teams intend to watch progress for a few more years.

It is clear that survival of each of the small mammal species depended on some areas remaining unburnt. All live only about a year, so they must reproduce each year if populations are to survive. None managed to breed in burnt-out areas the year after the fire.

The timing of the fire also was important. It came in December, after the marsupial mice had bred and their young had become independent. If an equally devastating fire occurred a month or two earlier in any year, it would have an even more drastic impact on these animals.

For the rats, December was not such a good month. Normally few, if any, young are independent in December. However, the rat populations have shown a very healthy capacity for recovery.

More about the topic

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