

Black cockatoos and fallen trees

'I have seen, more than once, small trees lying prostrate, occasioned by the powerful bills of the large black cockatoo, who, on observing on the trunk, externally, indications of a larva being within, have diligently laboured to extract it; and should the object of their search be situated (as often occurs) far in, before they reach it, the trunk is so much cut through that the slightest puff of wind lays it prostrate.'

This testimony to the strength of the bills of some of our cockatoos dates from 1834. Since that first record of cockatoo activity around Yass in New South Wales was published, many more substantiations of the cockatoos' destructive habits have been made. An ornithologist in 1928 reported cockatoos severing an 18-cm-diameter branch of a eucalypt in the Bogong High Plains of Victoria, while another in 1949 quoted an observation of the birds cutting off a 45-cm-diameter limb — albeit riddled with borers — at Seville in South Australia.

The list could go on, but before we create an impression of these remarkable birds as full-time timber-fellers, it should be quickly said that, in the general scheme of things, the damage they do is slight. On the contrary, for decades timber-cutters have felt kindly at the sight of cockatoo flocks flying unerringly

between the trees or upon hearing their unmistakable prolonged harsh call.

They regarded the cockatoos' food-foraging activities as a good thing, believing that the birds were preventing severe outbreaks of wood-boring insects. Even the loss of trees could be seen as beneficial. It was the weakest trees that usually became borer-infested, so if they did succumb to cockatoo bills, this performed a desirable thinning of the stand and promoted better form and growth in the remaining undamaged trees — a good example of Nature in balance.

Heavy damage

In the light of this satisfying scenario, a recent study of cockatoo-inflicted tree damage is instructive in showing how the picture quickly distorts when Man changes the ecological balance and establishes a monoculture.

The study was carried out around Coffs Harbour, N.S.W., by Mr Ray McInnes and Dr Phil Carne, of the CSIRO Division of Entomology, with the help of amateur ornithologist Mr John Courtney of Glen Innes. It showed that plantations of flooded gum (*Eucalyptus grandis*) in the region could lose up to 40% of trees through cockatoo attack.

Since the trees are deliberately spaced for



After the bird has flown. A 'chopping board', which the cockatoo cut out and sat upon to further its grub-hunting.



The yellow-tailed black cockatoo, depicted here by W. T. Cooper. Behind is the white-tailed black cockatoo, a close relative.

optimum growth, the destruction of trees represents a loss of productivity, not just a thinning operation. The damage cannot be repaired during the planned life of the plantation.

How was the ecological balance tipped, allowing cockatoos to go on the rampage? And what counterbalancing forces can be exerted? The present study, funded partly by APM Forests Pty Ltd, aimed at finding this out.

Where it happened

The plantations involved cover some 4500 ha in the Bellinger and Kalang River valleys. Most of the trees have been planted on creek flats and on the lower slopes of hilly country that was cleared for dairying more than 70 years ago.

When eucalypt plantations began to be established in the area 15 or so years ago, the more fertile river flats had only recently been surrendered from dairying, and still carried lush *paspalum* and *Kikuyu* pastures. The less fertile slopes had been allowed to revert to bushland for varying lengths of time.

The better stands of such second-growth forest remain, to be harvested later. The poorer ones stand no longer — the area is now what the locals call 'swept-off country'. It has been bulldozed, contour-ploughed, and, like the creek flats, planted out with nursery-grown seedlings.

... and how and why?

The steeper ranges above the old dairying areas carry native forest, much of it designated as State Forests. This bushland contains many ancient trees that provide the

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feathered subjects of this story, the cockatoos, with grand nesting sites.

A fact not appreciated at the time the plantations were established is that *E. grandis* is the preferred food of a borer (*Xyleutes boisduvali*) that forms a gallery in the middle of the tree-trunk. The borer larva is, in turn, the preferred food of the yellow-tailed black cockatoo (*Calyptorhynchus funereus*), native to the area and much of south-eastern Australia besides. The stage is set for a strong ecological drama.

The two protagonists set the plot in motion: the borer shows efficiency in establishing itself in plantations of flooded gum, and the cockatoo displays thoroughness in locating the borer larvae and extracting them from the centre of the tree.

The study team searched through many plantations of flooded gum — some recently planted, some 15 years old — and found most of them significantly infested by the borer. In contrast, when they surveyed native forests — traversing many kilometres of roads and fire tracks — they found the borer in only a small percentage of flooded gums.

The team suggests that the explanation lies in plantation conditions, or management, that somehow weaken the trees and make

them susceptible to borer attack. Evidence for this supposition came to hand when the team found that infestation was much more prevalent in the weaker plantation specimens. These were trees whose early growth and vigour had been checked in some way.

Loss of vigour was most frequently due to competition with *paspalum* and *Kikuyu* during the first year. These grasses, a remnant of the old dairying days, competed with the seedlings for light, and later also with the saplings for moisture and nutrients.

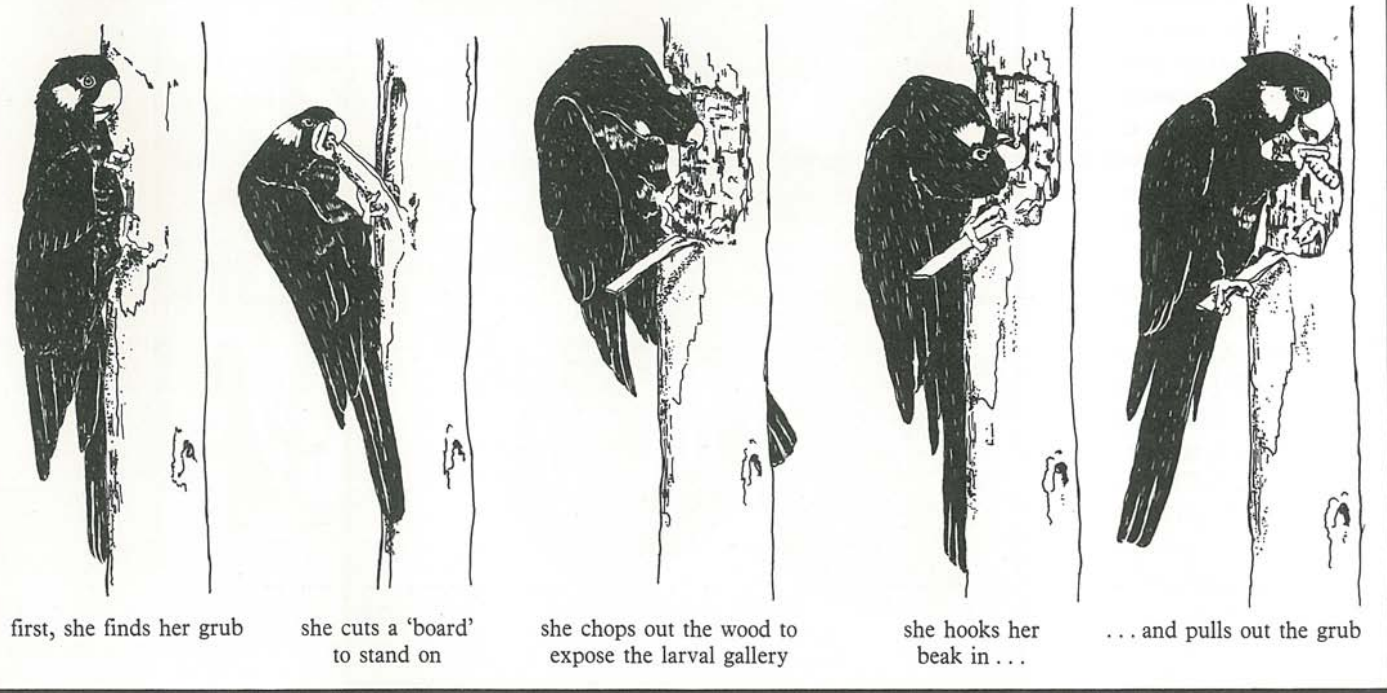
Other restraints on growth could be attributed to physiological stress from drought, frost, defoliation by Christmas beetles, and planting of twin seedlings. All increased the likelihood of borer infestation. Healthy, vigorous trees are in some manner able to resist the visitations of borer larvae.

The borer's development

The borers — actually cossids, or 'goat moths' — start life in a mass of eggs laid by a female moth on an upper branch of a tree. The moth is large — her wingspan can reach 230 mm, and her abdomen up to 70 mm in length — and she can lay many thousands of eggs. Myriads of larvae hatch from the egg mass and suspend themselves from the branch on silken threads, giving the appearance of a fine curtain. The thread subsequently breaks near the egg mass and the larva drifts through the air, suspended by the thread, eventually landing on the trunk of a flooded gum.

The larva bores into this and eats and grows until it is ready to pupate in a gallery it makes for itself in the centre of the trunk. For

How the cockatoo prepares for a meal of goat-moth larva



some unexplained reason, less than 1% of the many thousands of galleries the team located were more than 2 metres above the ground. The average height was half a metre.

Signs of the larva's presence are a pronounced swelling of the tree in the region of the gallery and two holes in the trunk: one 3–4 cm in diameter is cut as an exit hole for the adult moth; a smaller hole about 1 cm across serves as a garbage chute. The larva can grow up to 18 cm long; no wonder cockatoos will work so diligently to extract it.

The larvae are the birds' preferred food, although they also eat seeds. Some other wood-boring larvae are also searched out; however, these lie close to the tree's surface and so the damage incurred in extracting them is considerably less.

The cockatoos will fly at least 12 km to forage in the flooded gum plantations. They swoop and glide between the trees until the first candidate tree is found. A bird alights on the smooth white trunk of the flooded gum, hanging on with its claws and tail. It then begins a systematic search of the tree for the tell-tale swelling and associated holes.

What happens when it finds a larva? That's a difficult question to answer because the birds are very shy. As an entomologist in 1927 wrote: 'I have never been able to find a person who has seen the black cockatoo engaged in this work'. So it was not surprising that the present team found that prolonged observation at close range was rarely possible.

They therefore obtained a permit to capture this protected bird and, after much difficulty, caught a mature female. They housed her in a special aviary built on Mr Courtney's property, and took lengths of grub-infested trunk to her. Then observation began.

How it's done

The bird's pattern of behaviour in extracting a grub is nearly identical in each case observed, right down to the smallest details.

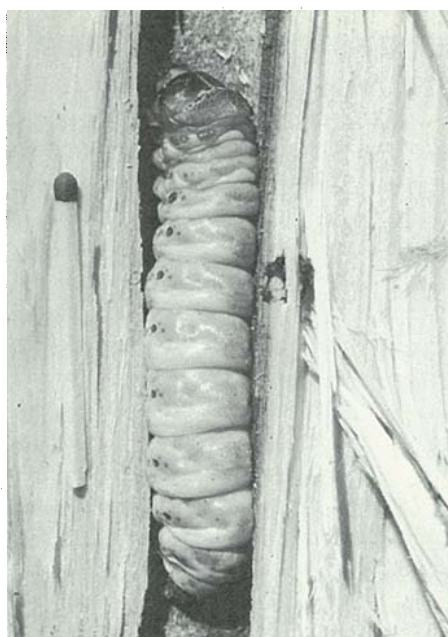
The most ingenious step is the stripping of a board from the tree to use as a working platform for further 'wood-chopping'. With both claws on the board, the bird uses its extremely powerful bill to bite off more strips to gain access to the grub at the centre of the trunk. When the inner gallery is exposed, the bird hooks the protruding tip of its bill — specially adapted for timber digging — into the gallery and extracts the larva.

The whole process may take 15–30 minutes in a young tree 10 cm in diameter. The diagrams show the successive stages in this work.

The most amazing aspect of this performance is that it is a learnt behaviour pattern,



These 10-year-old flooded gums in a plantation near Coffs Harbour have survived borer- and cockatoo-attack in their infancy.



What the cockatoos are after. The cossid moth larva lives in a gallery in the centre of a young gum tree.

not instinctive. When 'tame' yellow-tailed black cockatoos, reared in an aviary since they were nestlings, were placed in the observational aviary and exposed to infested trunks, they didn't know what to do! Only if the grub gallery was very near ground level would they even attempt to get at the grub.

The young cockatoos learn the trick from their parents. But how did the first Coffs Harbour cockatoo learn its wood-chopping tricks? A good, but unanswered, question.

Notwithstanding this problem, the Coffs Harbour cockatoos have learnt their lessons well and are particularly thorough in searching for their delicacy. The investigators

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found that the birds excavated, on average, more than half the galleries present in a plantation. This under-represents the number of galleries the birds discovered, since they can distinguish galleries containing mature larvae from those containing small ones. The team found that cockatoos had 'investigated' the latter, leaving as evidence claw scratches and sometimes exploratory 'test bites'. It seems that they keep the plantations under close surveillance and excavate the grubs as these become available.

Two remedies

The big question of course is how to reduce damage caused by the cockatoos' excavations. The study team suggest two ways in which this may be done.

The first is to reduce the physiological stress on the plantation trees in their early growth, since this predisposes them to infestation. The most significant stress, competition from pasture grasses, can be minimized by use of selective herbicides or additional fertilizer.

The second makes use of the observation that the cockatoos avoid entering stands where dense undergrowth makes it difficult for them to get at the lower tree trunk — where the grubs usually are. The reason is that the birds are unable to fly from a tree without temporarily losing altitude: they push themselves off the trunk and drop for a distance before gaining sufficient air speed to allow them to climb.

The solution is therefore to encourage the development of a vigorous understorey of woody perennials in the plantations. An area in one plantation in which the lower tree trunks were surrounded by tall dense undergrowth was cleared, as a test. Within 8 months, 45 of 47 newly exposed galleries had been ransacked. By contrast, all 78 galleries in nearby control trees in an uncleared area remained intact.

More about the topic

Predation of cossid moth larvae by yellow-tailed black cockatoos causing losses in plantations of *Eucalyptus grandis* in north coastal New South Wales. R. S. McInnes and P. B. Carne. *Australian Wildlife Research*, 1978, 5, 101–21