REVEGETATION

DECLINE IN A REMNANT OF SALMON GUM AND YORK GUM WOODLAND, 1978 TO 1997

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As a result of changes to native vegetation cover since its settlement by Europeans over 200 years ago, Australia now poses an interesting conundrum in relation to the supply of hollows in trees for nest sites for birds and other fauna. Eighteen percent of Australian land birds nest in hollows in trees and 11% are obligate hollow nesters. All depend on a continuing supply of what, in many areas, is a rich and diverse array of hollows in a wide range of tree species. However, what of the future?

Figure 1: Tree T027 in July 1981 and the same tree in August 1997. Although there has been little apparent change over 16 years in the condition of the tree there is marked thinning of the shrub and tree layers, increase in paddock weeds and lack of regeneration of the woodland species.

In May 1978, as part of a study by CSIRO on the ecology of two species of black cockatoo, a 15 ha remnant of salmon gum and York gum woodland on a farming property at Nereeno Hill in the northern wheatbelt of Western Australia was examined. Before clearing for agriculture, the vegetation consisted of salmon gum-York gum woodland on the red loam soils, with tamma thicket on the stony and lateritic ground. The vegetation of the patch was dominated by salmon gum with smaller numbers of York gum and morrel interspersed. The understorey was dominated by jam and there was an area of mallee at the southern end of the patch. The density of the dominant vegetation was typical of mature salmon gum-York gum woodland of the area.

The property containing the study patch was selected for farming in the mid-1920s and wheat was the first agricultural product after the native vegetation was cleared for its establishment. Sheep were introduced to the area in 1929 and were allowed to graze on most of the uncleared vegetation on the property. The rabbit invaded the area and was common throughout most of this period. The last clearing of native vegetation on the property, carried out in the early 1970s, isolated the patch of woodland under study. No attempt was made to keep sheep out of the woodland, which provided shade and shelter, particularly after shearing.

The patch under study was an important nesting area for cockatoos in the district. These included (in decreasing numerical order): the galah, the red-tailed black cockatoo, the long-billed corella, the little corella, Carnaby's cockatoo and the Major Mitchell cockatoo. In the northern wheatbelt, all of these are obligate tree hollow nesters. In May 1978 the woodland was searched for trees possessing hollows of at least 90 mm diameter and at least 90 mm deep. This was the minimum-sized hollow thought to be used as nest sites by the galah, the smallest of the cockatoos breeding in the area. The sizes of the trees were not measured, however the condition of each of these trees was noted. Condition was rated according to the following categories: good – tree apparently healthy; staghorn – dying back from

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the top and showing a "staghorn effect"; broken top – broken off along the trunk, but not showing any staghorn effects; and dead. In addition, the dimensions of each of the hollows large enough for one of the species of cockatoo to nest in were recorded.

In July 1981 the location, condition and circumference (cms) at breast height of every eucalypt tree (including the hollow trees examined in 1978) in the woodland patch were recorded. A photograph was taken of each tree. On this occasion, a condition category of "fallen" was added. Each tree was marked with an aluminium disc onto which an individual number had been stamped. The data from 1978 and 1981 were analysed and formed the basis of a paper (ref 1) on the availability of tree hollows for cockatoos and the twenty-eight parrot and on the condition of trees in the woodland patch.

In August 1997, the area was visited again and the condition and circumference of every tree that could be identified were again recorded. A photograph was taken of each tree. Analyses of the changes showed that there had been a decline in the number of trees in the good category over time, see Table 1, and the decline occurred in all size classes. The drop in the number of healthy trees was particularly marked.

The decline in condition was far greater in the period 1978 to 1981 than from then until 1997. The trees declined at an average rate of 27% per year in the early period and 1% per year for the latter period. Damaged trees also declined proportionately more in the early period than the latter. Obviously environmental conditions in the period 1978 to 1981 were very much more unfavourable for the trees than the period 1981 to 1997.

What of the survival of trees with large hollows? Using probabilities of survival over time based on the rate of decline for the period 1978 to 1997, predictions indicate that by 2016 there would be no salmon gums with large hollows in the good category. By 2016 there would be only 44 (23%) of the salmon gums with large hollows alive and only 4 (2%) by 2092. By then, predictions are that only 12 (6%) trees with large hollows would be standing, over two thirds of them dead.

There is no doubt that the salmon gums and York gums in this patch were deteriorating rapidly and the growth rates of those trees indicating signs of stress were about half those of healthy trees. The earlier period between 1978 and 1981 was the second half of a prolonged period of drought. These years of low rainfall placed extreme pressure on agricultural production in the district and also had a major impact on the social fabric. They also had a major detrimental effect on the woodland patch under study. An increase in average annual rainfall for the period 1982 to 1997 explains the lower rate in decline of the condition of the trees in the latter period.

Predictions of future condition of trees in the patch based on results of the dry period 1978 to 1981 illustrate the danger of using relatively short-term data sets. Predictions based on the 19-year data set, incorporating a range of environmental conditions, are more reliable, but nevertheless they are of great concern for the future of the woodland patch. However, the effects of low rainfall on tree condition are dramatic, as witnessed by the decline in salmon gums with large hollows between 1978 and 1981, and an equivalent period of drought could shorten these long-term predictions.

The smallest of the trees in the patch probably predated 1929, when sheep were first introduced to the area. There is no indication of any regeneration of eucalypts in the patch in the period between 1981 and 1997 (Fig. 1). It is obvious that under the present management regime, with only 13% of all of the salmon gums in the patch predicted to be alive by the 2092, the future for this woodland patch is bleak, as it is for any species dependent on the trees in the patch for food, shelter or nest sites.

Clearing of native vegetation and its replacement with cereal crops and pastures and the provision of water throughout the wheatbelt have created the equivalent of riverine plain. This clearing pattern has left many trees scattered across the agricultural landscape in patches, like the one at Nereeno Hill, and as individual paddock trees. So there are still many trees with nest hollows to provide nest sites. However, species dependent on trees for nest sites are going to be threatened by the loss of woodland, as without

Table 1.

	1981		1997	
	good %	dead or fallen %	good %	dead or fallen %
salmon gum	24.0	23.8	16.2	34.5
York gum	46.7	7.1	39.8	17.6

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nest sites they, and other species dependent on tree hollows, have no future in the area. The fact that dead trees remain standing for many years means that for species that will nest in hollows in dead trees (and not all obligate hollow nesters will do so), this resource will be available for some time after the trees have died. However there will be very few trees surviving the minimum 130 years required for a eucalypt to grow to a size sufficient to support a hollow for the smallest of the cockatoos to nest in, or for the longer time frames required for bigger hollows.

The results of this study are for one 15-ha patch of woodland on private property in the northern wheatbelt of WA. How much credence should the results of this study be accorded when extrapolated over much larger areas? As European development of the wheatbelt proceeded, woodlands were regarded as indicators of better quality agricultural soils. Accordingly, they were preferentially selected for farmland and cleared. For example, in south-western Australia, 94% of marri-wandoo woodlands, 72% of mallet-powderbark wandoo woodlands, 97 % of York gum-salmon gum-wandoo woodlands, and 78% of salmon gum-gimlet woodlands have been cleared for farmland. The remainder is distributed mainly on private land and is being degraded by a variety of threatening processes. It is clear that the decline and lack of regeneration of this patch at Neereno Hill is typical of woodland patches throughout the wheatbelt.

The first rule of management of woodlands in the wheatbelt should be to protect all remaining vegetation. In the first instance this should be fencing remnant patches to exclude grazing. However, active management beyond fencing to reduce grazing pressure will be required. Management regimes that foster regeneration need to be developed as do incentives to encourage land holders to engage in active management, instead of the benign neglect that characterises much of the management of rural woodlands.

Without a major change in attitudes towards rural woodlands, their future and that of their dependent fauna is exceedingly bleak.

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REFERENCES

(1) Saunders, D. A., Smith, G. T. and Rowley, I. (1982). The availability and dimensions of tree hollows that provide nest sites for cockatoos (Psittaciformes) in Western Australia. *Aust. Wildl. Res.* **9**: 541-56.

(2) For the full story, read: Saunders, D.A., Smith, G.T., Ingram, J. A. and Forrester, R. I. (2003). Changes in a remnant of salmon gum *Eucalyptus salmonophloia* and York gum *E. loxophleba* woodland, 1978 to 1997. Implications for woodland conservation in the wheat-sheep regions of Australia. *Biological Conservation* **110**: 245-256.

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