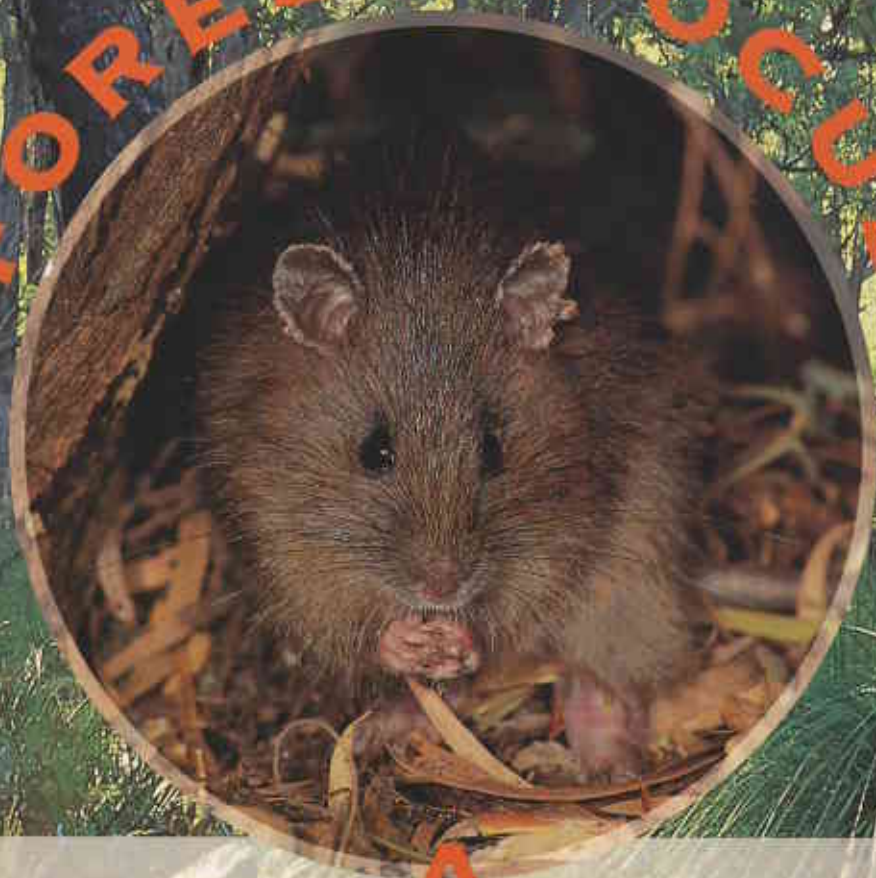




FOREST FOCUS



A five-year scientific study in the jarrah forest should greatly increase our knowledge of how wildlife populations behave before and after logging.

BY
CAROLYN THOMSON, BRENT JOHNSON AND MIKE CRAIG

Animals such as the chuditch, woylie and numbat, which were once found across much of the Australian continent, can now only be found in numbers in the forests and woodlands of the South West. They lived in the forest during more than a century of timber cutting, but their numbers declined sharply following the arrival of the European fox during the early 1930s, when they became confined to very small localised populations in the South West. Special intervention by scientists through recovery programs, and widespread fox-baiting programs by the Department of Conservation and Land Management (CALM), has resulted in greater numbers and new populations.

Because the South West forests are such an important habitat for these animals, they must be managed carefully to ensure the animals' continued survival. Over the past few decades, studies have been made of the mammal, frog, reptile, bird, invertebrate and plant communities of the South West jarrah forests. But much more needs to be known about their interactions, their habitat use and their response to human disturbance.

People continue to demand beautiful jarrah timber to build houses and furniture, and for a myriad of other purposes. Marri, growing in association with jarrah, is also used to make paper and is growing in popularity for furniture. Thousands of people rely on the Western Australian timber industry for their



livelihood. Although there has been no evidence that timber harvesting has caused the extinction of any animal species, harvesting undoubtedly has an impact on local populations of some animal and plant species, possibly causing temporary decreases or even increases in numbers of some species. Managers need more information on how to manage these effects, so that the forest environment is as little disturbed as possible.

The effect of timber cutting on animals such as chuditch, phascogales and forest birds will be put under scientific scrutiny in a major, five-year study in the jarrah forest. The study will be carried out by a large team of scientists, working with local CALM district staff and volunteers. Animal, plant and fire ecologists and silviculturists from CALM will participate. The bird and invertebrate research will be carried out by PhD students from The University of Western Australia and Murdoch University. Detailed studies by PhD student Susan Rhind on the brush-tailed phascogale (see 'Fascinating Phascogales',

LANDSCOPE, Summer 1993-94) will also be taken into account.

The study follows research done in the past on habitat requirements for animals such as the woylie, numbat, tamar wallaby, and brushtail and ringtail possums, and the effects of timber harvesting on forest birds and insect communities. However, this will be the first long-term study of its kind to be done in our forests by a large team of scientists from across different disciplines.

ROUND THE TRAPS

CALM scientists Gordon Friend and Keith Morris recently began an intensive five-year trapping program at Kingston, Winnejup and Warrup State forests, 25 kilometres north-east of Manjimup, parts of which will be logged 12 months after the start of the study. The study area is in mature jarrah forest which was cut over in the 1940s and 1970s. The forest is inhabited by endangered mammal species such as numbats, southern brown bandicoots, chuditch, western ringtail possums and woylies. Brush-tailed phascogales, southern bush rats, brushtail possums and little long-tailed dunnarts are also common. Ongoing, intensive baiting for foxes is carried out throughout the area.

The study is the latest, and the biggest to be done in WA, to aim at finding out how timber cutting affects wildlife populations. For instance, after an area is logged, do all animals leave the area? What happens to them if they stay? If mammals leave, where do they go? How do they use the trees left for them as habitat? When do they start to use the



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Main: Kingston Forest is the site of a major study on the effects of logging.
Photo - Dennis Sarson/Lochman Transparencies
Inset: Bush rats are active foragers and will eat virtually anything.

Photo - Jiri Lochman

Left: Radio-tracking of the western yellow robin will reveal where this bird forages, nests and roosts.

Photo - Kim Howe

regenerating forest for food? Are any species badly affected and, if so, how could logging be carried out to minimise this effect? How long does it take for an area and its animal populations to recover?

Timber harvesting in the jarrah forest is carried out in several ways, depending on its existing condition. In some parts of the forest (in patches varying from 0.25 to 10 hectares) most of the trees are removed to allow small trees space to develop. In other patches about half the trees are removed to provide the conditions for regeneration, creating what is known as shelterwood forest. In other patches thinning may be done to allow selected trees to grow faster. The silvicultural treatment of the forest depends on past logging history and is aimed at achieving the best regeneration results.

In all of these areas at least three habitat trees are left on each hectare. The study will monitor the effectiveness of retained habitat trees for tree-dwelling animals, and determine the density and distribution of trees required to sustain fauna populations. It is extremely important to leave enough habitat trees standing in the harvested areas—it may take jarrah and marri trees more than 100 years before they form hollows suitable for tree-dwelling mammals and birds. For this reason, stream zones, travel routes and other areas are left uncut throughout the forest.

Researchers will trap medium-sized and small mammals in both logged and unlogged areas. Mammals such as chuditch, possums, woylies and phascogales will also be radio-tracked to determine how they use the area before, during and after tree-felling. Ringtail possums, for instance, are uncommon, occurring in isolated populations in certain areas such as peppermint forest around Busselton, the Perup area and along rivers in the karri forest. Around Perup, near where the study will take place, they have been observed to favour jarrah that was logged 20–30 years previously. Further investigation is needed on their use of habitat within the jarrah forest. The immediate impact of timber harvesting on these animals may depend on the scale of logging in relation to the size of their home ranges. Particular attention will be given to their use of hollows instead of the nests (known as dreys) they commonly use nearer the coast.



Top: In the jarrah forest, the rare ringtail possum inhabits hollows instead of the nests, or dreys, used in coastal areas

Photo – Babs & Bert Wells/CALM

Above: Invertebrates, such as this native bee, play an important role in the forest ecosystem.

Photo – Ann Storrie

Right: Black cockatoos (*Calyptorhynchus* spp.) nest in tree hollows so may be affected by logging.

Photo – Ann Storrie



FROGS AND REPTILES

Frogs and reptiles will also be put under the microscope. Skinks found at Kingston include Rosenberg's monitor (*Varanus rosenbergi*), Napoleon's skink (*Egernia napoleonis*), King's skink (*Egernia kingii*), shrubland skink (*Morethia obscura*), common dwarf skink (*Menetia greyii*), elegant slider (*Lerista elegans*) and yellow-bellied skink (*Hemiergis peronii*). So far at least seven species of frog have been caught at Kingston. They include the moaners (*Heleioporus eyrei*, *H. inornatus*, *H. psammophilus*), Guenther's toadlet (*Pseudophryne guentheri*), Nicholl's toadlet (*Metacrinia nichollsi*), quacking frog (*Crinia georgiana*) and banjo frog (*Lymnodynastes dorsalis*). These species burrow into sandy areas of the forest floor in the drier months and emerge at the first autumn rain.

Data collected during the five years of the study will help build up a fascinating picture of the abundance of these species before and after timber is taken. Cutting is unlikely to have much effect on King's skinks, which occur mainly near rock outcrops in the forest, where they shelter in rock crevices, but it is unclear what effects harvesting will have on lizards that need elevated sites for basking and foraging. Recaptures of individual animals will reveal details about the life histories of some relatively long-lived species of frog, such as the moaners, and the larger skinks. For instance, it will be interesting to see whether any individuals are captured in the same area both before and after logging.



Researchers will also examine cyclic patterns. The response of many species to seasonal changes may be more marked than their response to logging or fire. Scientists expect to see some changes, as each species reacts differently to disturbance. After logging, the forest floor could see many changes. Increased solar radiation is likely to alter moisture content and temperature, which could temporarily create an environment favouring certain species of plants and animals over others. Opening up the canopy after logging may encourage lizards. In the short term, the taking of timber will introduce more debris to the forest floor, which may also favour some species. In the medium term, there will be a denser understorey, which could

disadvantage some of the smaller skinks but favour some species of bird. And in the long term, the large trees will return and the cycle will begin again.

FOR THE BIRDS

Kingston Forest has a fairly diverse bird fauna typical of most jarrah forest, with more than 60 species so far recorded. The silvereye, inland thornbill, grey fantail and white-naped honeyeater are among the most common. Endangered or specially protected species, such as the peregrine falcon and crested shrike-tit, and uncommon species, such as the square-tailed kite, also occur in small numbers.

Jarrah forest birds have many different lifestyles. While emus and painted button-quail peck for seed and vegetable matter on the forest floor, rufous treecreepers search for ants on tree trunks and fallen logs. Western yellow robins perch low down on trunks and branches and drop onto insects in the leaf litter, grey fantails sally for insects from an exposed perch and striated pardalotes glean sap-sucking insects from leaves high in the canopy.



Above: Moaning frogs are particularly active after the first rains. These burrowing frogs spend most of their life underground.

Photo - Babs & Bert Wells/CALM

Left: The yellow-bellied skink lives among the litter on the forest floor.

Photo - Jiri Lochman



Timber cutting in the jarrah forest is likely to have most impact on two particular groups of birds. The first group includes birds that nest in tree hollows, such as the black cockatoos, parrots, owls and the rufous treecreeper; cutting will result in a reduced number of suitable tree hollows which may affect numbers of these species. The second group contains species such as the black-faced cuckoo-shrike, varied sittella and rufous treecreeper, which need dead wood for foraging or nesting; if there are fewer old trees with dead wood in logged forests, there could be a shortage of foraging and nesting sites for these species. The impact of these changes will depend on many factors, including the home range of each species and the abundance of hollows of different sizes in unlogged and adjacent sites. Birds such as white-breasted robins and red-winged fairy-wrens, which inhabit the dense vegetation of gullies and creeks, are unlikely to be affected by logging. This is because these areas are left unlogged to maintain aquatic ecosystems and prevent sedimentation of streams. Stream zones are also left uncut, leaving dead wood and hollows for nesting species.

PhD student Mike Craig will count birds at regular intervals on about 100 one-hectare plots scattered throughout the forest. Counts taken before and after logging, and in unlogged control areas, should show what effects there are on each species. The ecology of four species will also be studied in detail: the western

yellow robin, golden whistler, rufous treecreeper and white-naped honeyeater. These species will be colour-banded and radio-tracked—the first time in WA that forest birds have been radio-tracked. Radio-tracking should reveal which sites they use for foraging, nesting and roosting. Nesting biology, dispersal of young, movement of adult birds through harvested and unharvested areas and use of retained habitat trees will also be studied. By examining these species in detail, scientists hope to be able to draw inferences about the impacts of timber cutting on other species of jarrah forest birds.

SPINELESS WONDERS

'Spineless Wonders', in *LANDSCOPE*, Autumn 1991, describes the complex and important roles of invertebrates in the forest ecosystem and the staggering amount of life that can exist in a very small area within a forest: '130 000 invertebrates can live in the top 10 centimetres of a square metre of soil and up to 3 000 invertebrates can live in the leaf litter over a square metre of soil.'

Invertebrates are an important source of food for other animals. Many frogs, reptiles and mammals feed on insects living in leaf litter. Numbats, for example, subsist almost solely on termites, eating some 15 000 to 20 000 each day. Insects living in foliage are a major food source for many birds, and it is also believed that bark-dwelling insects are an important component of the brush-tailed phascogale's diet. Some insects fall prey



Above: Timber awaits collection at a log landing in Kingston forest.
Photo – Brent Johnson

Above left: The hollow-nesting rufous treecreeper forages on tree trunks, limbs, fallen timber and the ground.
Photo – Babs & Bert Wells/CALM

to other invertebrates, such as spiders and centipedes. Invertebrates also play a profound role in inhibiting or promoting the growth of various plant species. Consider the importance of insects like bees and wasps that act as pollinators for plants. Others have a less obvious but nonetheless crucial role: recycling nutrients by breaking down plant or animal matter, or converting nitrogen to a form that can be readily used by plants.

Karin Strehlow, a PhD student at Murdoch University, will be studying the impact of timber-cutting on invertebrates at Kingston. Intensive sampling of invertebrates is being undertaken. Karin will be analysing broad patterns of abundance within invertebrate families both before and after logging, and pinpointing any changes that may occur. Because of the incredible diversity of invertebrate species—there are an estimated 18 000 in the South West forests, and only 10 per cent of these have been scientifically described—a few key groups, will be selected for detailed analysis as trends become apparent.



Left: Trailing ants are common and aggressive in the jarrah forest. The effects of logging on such a dominant invertebrate are unknown.
Photo – Jiri Lochman



Some invertebrates are keystone species. Trailing ants (*Iridomyrmex* sp.), for instance, play a pivotal role in the jarrah forest ecosystem. These are the small brown ants that overwhelm their prey in large numbers, once a food source is located by a random forager. Ants eat about 90 per cent of the seed produced by jarrah and thereby affect the distribution of trees in the forest. They also consume large quantities of bull banksia seeds. They affect the growth of plants by consuming other insects such as aphids and scales. Ants are an important part of the food chain, forming about 10 per cent of the diet of lizards, which are in turn eaten by small marsupials, such as dunnarts and mardos. Because they are so common and aggressive, ants put pressure on many other invertebrate species by competing with them for food. Termites are perhaps equally important in the forest ecosystem and are another valuable food source for lizards. Past studies have shown that spiders may also be affected by disturbance and this group will be given close attention.

OTHER RESEARCH

An important part of the study is related to the medium and long-term effects of logging. Because five years is not long in terms of forest regeneration, scientists plan to carry out studies in similar jarrah forest areas with a range of management histories. Research will be carried out in areas with similar landforms to Kingston, but in forest of different ages following logging and

burning. These studies will provide data on how animals respond to timber cutting and other management operations in the jarrah forest over a longer period of time.

The Kingston study will include additional detailed research on important elements such as regeneration, changes in the composition of plant species, and structure of the forest. Scientists will also investigate the number of hollows found in the different tree species. Characteristics of hollow-bearing trees such as age, size and form will also be recorded. This information will be related to the information being collected on use of hollows by various animals.

Prescribed burning is an integral part of the regeneration process, so the effects of this burning will be closely monitored. Control sites that will stay both unburnt and unlogged will provide baseline information that can be compared with the pre- and post-impact data. Further comparison can be made with current studies on the effects of fire on animals and plants, as well as earlier studies carried out in the 1970s.

The introduced predators, foxes and cats, are now recognised as major contributors to the decline of native Australian animals. Logging reduces cover in the short-term and may displace animals from their preferred refuges, so it could put some native animals at greater risk. While standard 1080 baiting will continue throughout the study area, methods of monitoring fox and cat numbers will be developed to see if increased predation is a significant factor.

CONCLUSION

Modern forest management practices are designed to ensure ecological sustainability of forests. These practices can be modified as knowledge is gained and technology improved. This major study at Kingston is designed to supply further information to help forest managers make decisions and formulate harvesting plans that minimise disturbance to wildlife populations. Only in this objective manner can we gain an understanding of the complex processes within the forest ecosystem, and adapt management systems to preserve them.

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Brent Johnson, a technical officer at CALM's Wildlife Research Centre (09 405 5100); and Mike Craig, a PhD student at The University of Western Australia (09 380 1495), are working on the study at Kingston.

This article could not have been written without the valued assistance of Gordon Friend, Per Christensen, Keith Morris, Paul van Heurck and Neil Burrows.

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The golden whistler is a common forest bird. 'Forest Focus' (on page 10) discusses a five-year study into the effects of timber harvesting on forest birds, insects and mammals.



The 10th Light Horse Memorial Trail is one of two walktrails in Neerabup National Park. The story on page 22 takes you inside this little-known park in Perth's northern suburbs.



In the closing days of 1991, heavy downpours of rain flooded Rowles Lagoon in WA's Goldfields; and so began an unusual year of floods, frogs, flowers and fires (see page 42).



Aboriginal people of the northern deserts call the black-headed python 'warrurungkalpa', which roughly translates as 'grinder or crusher of rock wallabies'. See the story on page 17.



Radio collars are fitted to feral cats to help scientists track their movements. 'Hunting the Hunter', on page 36, focuses on research into the habits of these supreme desert hunters.

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The majestic and graceful whale shark visits the north-west of Western Australia each year and is fast becoming a major tourist attraction. What does the future hold for the world's largest fish? See page 28.



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