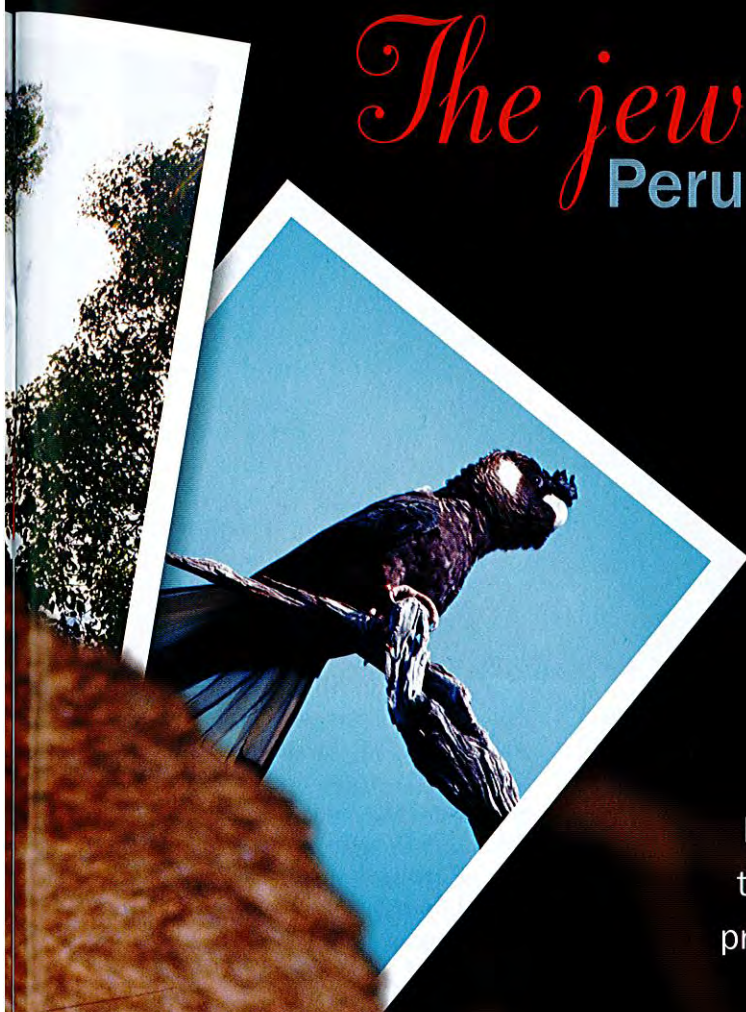





The jewel in the crown: Perup and the Upper Warren



It is more than four decades since foresters and locals began to recognise the forests around Perup and the Upper Warren for a diversity of wildlife that had become extinct elsewhere. These discoveries led to some important research projects, as well as education, interpretation and ecotourism activities. Today the area is still one of the best places on mainland Australia to find many threatened vertebrate species in abundance—a priceless biodiversity and conservation treasure.

by Adrian Wayne and Joanna Moore



Some 300 kilometres south of Perth and lying between Bridgetown, Manjimup, Boyup Brook and Lake Muir, the catchment area of the upper reaches of the Warren River remains one of Australia's best-kept secrets for forest biodiversity, especially threatened marsupials.

Threatened species that have disappeared elsewhere or are now rare across Australia are still found in the area, including one of the two remaining indigenous populations of the numbat (*Myrmecobius fasciatus*), two of the four remaining indigenous populations of the woylie (*Bettongia penicillata ogilbyi*), the largest inland population of western ringtail possum, or ngwayir (*Pseudocheirus occidentalis*), the largest known population of the south-west species of brush-tailed phascogale, or wambenger (*Phascogale* sp.), and large and important populations of the tammar wallaby (*Macropus eugenii*), chuditch (*Dasyurus geoffroyi*), quenda or southern brown bandicoot (*Isodon obesulus fusciventor*) and western brush wallaby (*M. irma*). The region is also home to threatened birds such as Muir's corella (*Cacatua pastinator pastinator*) and Baudin's (*Calyptrorhynchus baudinii*) and Carnaby's (*C. latirostris*) black cockatoos, as well as threatened and endemic flora.



The Upper Warren region refers to around 285,000 hectares of publicly managed forest within the river catchments of the Wilgarup, Yerraminup, Perup and Tone rivers, all tributaries to the Warren River. The area includes State forest, the 56,000-hectare Tone-Perup Nature Reserve, the 21,000-hectare provisionally named 'Greater Kingston' National Park and several other smaller nature reserves. Across a rainfall gradient ranging (roughly west to east) from 1,000 millimetres to less than 700 millimetres per year, the area supports a diversity of forest and woodland types including those dominated by jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*), wandoo (*E. wandoo*) and flooded gum (*E. rudis*).

The Upper Warren and adjacent Lake Muir area is a biodiversity hot spot. It is home to 925 vascular plants

(of which 10 are rare or endangered), 497 non-vascular plants, hundreds of fungi species, around 1,000 terrestrial invertebrate species, 216 aquatic invertebrate species, six fish species—all of which are locally endemic—13 species of frog, 26 reptiles, 130 birds and 30 mammals.

There is also profound cultural significance in the area. In the north, the Perup and the Upper Warren were once home to the Kaneang Aboriginal people, in the south the Minang people and, in the west, the Pibbelmen. As a site of early European settlement, the region also has non-Aboriginal cultural significance, with pioneering forestry and farming activities occurring in the area.

Research in the Upper Warren region, especially around Perup, into the conservation of threatened mammals has played a major role in providing new knowledge and understanding of wildlife in Western Australia. It is the site of numerous research programs carried out by the Department of Environment and Conservation (DEC) and some of its predecessor departments, the Department of Conservation and Land Management (CALM) and the Forests Department, since the early 1970s. Today, Perup and the surrounding Upper Warren stand to be one of the most important areas in nature conservation in south-west WA, a 'jewel in the crown' of the state's biodiversity.

Early days of conservation

But how did it all start? Perup and the surrounding forests were gazetted State forest and harvested for timber, particularly in the 1940s and again

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Main The population of woylies in the Perup and Upper Warren region is highly significant.

Photo - Jiri Lochman

Insets Numbat (*Photo - Jiri Lochman*); tammar wallaby (*Photo - Sallyanne Cousins*); jarrah (*Photo - Marie Lochman*); Baudin's black cockatoo (*Photo - Jiri Lochman*).

Left Brush-tailed phascogale and young. *Photo - Jiri Lochman*





Above Southern brown bandicoot or quenda.

from the 1960s to the early 1970s. In the 1960s, scientists from the then Forests Department were alerted to the presence of tamar wallabies and woylies in the Perup area by a forester based at the Tone River settlement, Harry Winfield (see 'Possum magic', *LANDSCOPE*, Spring 2004). In 1971, researcher Per Christensen with Graeme Liddelow, Dave Fauville, Tom Leftwitch, Chris Vellios and the late Peter Skinner verified these reports by trapping and spotlighting: they found that tamar wallabies, woylies, numbats, chuditch, quenda and koomal, or brushtail possums (*Trichosurus vulpecula hypoleucus*), were present in the forest. In recognition of its importance to conservation, the Forests Department zoned the Perup area a management priority area for fauna, flora and landscape values in 1971. The Perup has been effectively managed as a nature reserve since.

Parts of the area had also been cleared for farmland and leased for stock. Keen for the opportunity to do more research into fauna in the area, the department acquired 'Perup' farm in 1972 as part of an amicable land swap. The old farmhouse was useful as a base for research staff and, with some improvements and additions, became a research station known as the Perup Field Ecology Centre. As much of the research on threatened species was carried out at night, having an overnight base was particularly useful.

Right The Indigenous name for the western ringtail possum is ngwayir.
Photos - Jiri Lochman

A number of important research projects began at Perup in the 1970s, including work on woylies and tamar wallabies and the impact of fire on habitat. Through his work during the mid and late 1970s, Per and his team discovered that both species were well adapted to the environments in which they lived and had a marked degree of 'fire dependence'. This was related to the fact that the food and plant species on which they depended for shelter and protection from predators were themselves reliant on fire to stimulate regeneration and growth.

Per's team discovered that both species had remarkably high survival rates during experimental burns, with woylies showing what is described as 'high home-range fidelity'—that is they retreated to unburnt patches or jumped back through the flames onto burnt ground to stay within their territory. Woylies were found to be particularly reliant on the abundance of post-fire 'fruiting' of hypogean fungi (native underground truffles), which is their staple diet—another important discovery made by Per at the time. Perhaps most importantly, it was while



studying woylies and tammars that Per discovered that the fox (*Vulpes vulpes*) was a deadly predator. He demonstrated that the fox was a serious threat to native mammals of the south-west and initiated the first fox baiting program to protect native wildlife in WA.



Left Carnaby's black cockatoos.
Photo – Jiri Lochman

Below left The Perup Field Ecology Centre is used by many researchers including students.
Photo – Sabrina Trocini

2000 when numbers were so abundant it became increasingly difficult to catch other species due to the saturation of traps by woylies. The recovery of the woylie in Perup and surrounding forests played a crucial part in it becoming the first Australian vertebrate species to be downgraded from an endangered conservation status in 1996 (see 'It's back... the woylie', *LANDSCOPE*, Autumn 1996).

The long-term monitoring continues with the involvement of Bush Rangers WA—an extracurricular high school program run by DEC as part of Cadets WA, focusing on biodiversity conservation and land management. Bush Ranger cadets visit Perup as one of their reward experiences, where they help with work such as monitoring the effect of fox baiting on native animal populations. Through this they learn how to bait and clear fauna traps, monitor and record information, carry out night fauna counts, use GPS units, handle native animals safely and effectively and analyse results. These young volunteers are 'skilled up' to be the conservation workforce of the future.

Significant studies

In 1981, Neil established a project in Perup that aimed to test the long-term effects of different fire regimes and seasonality on understorey vascular flora species in the jarrah forest. This involved burning plots of forest in short, normal and long rotations as well as leaving some areas unburnt. Many strategically timed experimental burns later, significant findings about fire regimes have been published in a number of papers, informing other researchers and land managers.

Immediately to the west of Perup, the Kingston Study began in 1994 to investigate the responses of biodiversity

Thirty-five years of knowledge

The 1970s also saw the beginning of long-term monitoring at Perup. With detailed studies starting in 1974 and continuing ever since, Perup is the site of one of the longest fauna monitoring studies in Australia. Building on the early work started by Per and his colleagues and followed on by then Forests Department researcher Neil Burrows and others, regular monitoring by live cage-trapping has provided important data on the abundance and population changes of marsupials such as the woylie, chuditch, quenda and koomal in relation to increasing fox control over time and ongoing fire management including prescribed burns.

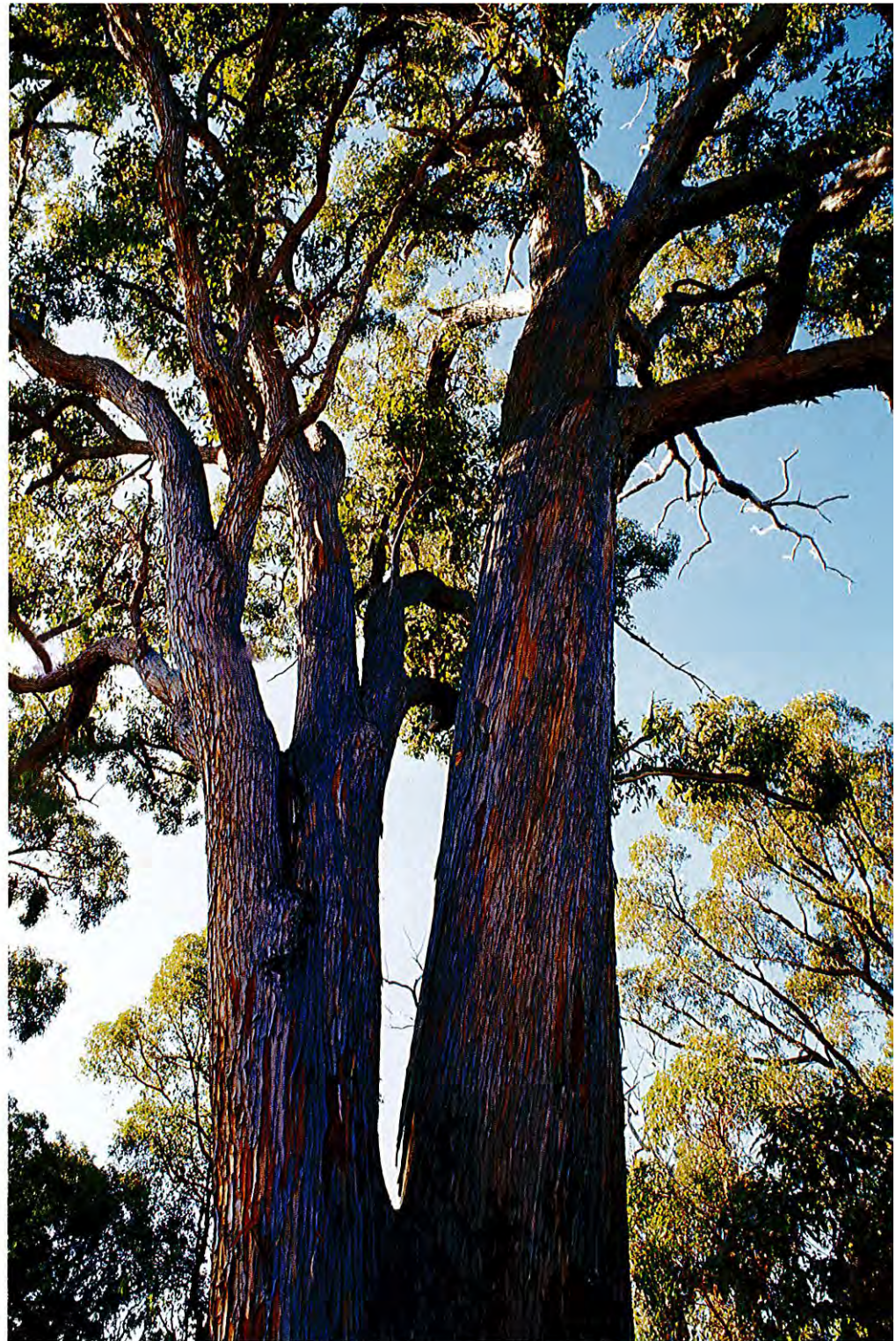
In 1976, the first formal fauna reintroduction program in WA was successfully conducted by Per and Tom Leftwich with the establishment of a new population of woylies in the northern part of Perup, using animals from southern Perup. The success of the translocation was largely attributed to the commencement of fox control at the reintroduction site, using baits containing the 1080 toxin. Fox baiting has continued ever since, culminating in 1997 when it was integrated into the broader-scale *Western Shield* program. Woylie numbers have grown steadily since the 1970s, with marked increases corresponding with improvements to the fox baiting regime, peaking around



to timber harvesting in the jarrah forest and help improve ecologically sustainable forest management practices. Gazetted as State forest at the time, this area was chosen because of its abundance and diversity of wildlife, particularly threatened mammals. This comprehensive scientific study involved a large team of CALM (now DEC) scientists, local district staff, university students and volunteers, investigating plant diversity, abundance and structure, soils and the distribution and abundance of tree hollows, as well as frogs and reptiles, invertebrates, birds and mammals. Findings from the study have significantly shaped the management of south-west jarrah forests including increased protection of habitat trees and other important habitat such as balga (*Xanthorrhoea priessii*), the development of fauna habitat zones and the increased control of introduced predators.

In 2001, a long-term ecological monitoring program called FORESTCHECK began in the area and has subsequently been expanded more broadly across the forest. A complement to the Kingston Study, FORESTCHECK monitors changes and trends in key elements of forest biodiversity associated with forest management activities (particularly timber harvesting and fire) across forest landscapes throughout the south-west. Nearly 3,000 species, many not yet scientifically named, have been sampled in this study so far, only 0.6 per cent of which are mammals. Like the Kingston Study, FORESTCHECK continues to improve understanding of the biodiversity and ecology of the jarrah forest with the aim of ensuring positive conservation outcomes based on solid science.

Earlier findings from the Kingston Study showed that the ngwayir and, to some extent, the koomal were sensitive to timber harvesting and predation. This led to a broader study in the Upper Warren between 2001 and 2005 which focused on aspects of the possums' ecology and biology with the aim of managing and conserving these species and their habitat more effectively.



Above A majestic jarrah tree.
Photo – Marie Lochman

Ongoing successful projects in Perup and the Upper Warren are built on the shoulders of these early projects. The area deserves ongoing recognition as an important and unique place: important because it supports several threatened species that have undergone massive range contractions across Australia, and unique because it has a mammal suite almost completely intact (except the bilby and boodie—although moves are afoot to once again see these species at home in the Upper Warren). Other than Dryandra Woodland and offshore islands, there

is no other area in WA like it in terms of supporting so many threatened marsupial species.

Ecotourism, education and experiences

From early beginnings and a constantly evolving range of activities, ecotourism in the Upper Warren is bigger than ever. Since the mid-1970s, alongside projects on forest ecology and management, training for Forests Department staff began at Perup.

Volunteers, students and paying guests also joined researchers to camp at Perup and be involved with wildlife research. These were soon extended to include courses for school teachers and participants of The University of Western Australia's extension program 'LANDSCOPE Expeditions' (see 'A wild weekend', *LANDSCOPE*, Summer 1990–91).

The 1980s saw the expansion of facilities at Perup, with temporary 'donga' accommodation brought in to accommodate course participants and researchers. The late 1990s saw a major upgrade of facilities, and dongas were replaced with eco-sensitive

buildings including several cottages, a lodge, bunkhouse, classroom and laboratory and a caretaker's house to accommodate small to large groups, ranging from couples to school and corporate groups. Using renewable solar and wind-generated power and rainwater, guests can stay and have a genuine wilderness experience within the heart of one of the country's key locations for fauna conservation and research. The public can also visit and stay in 'Perup – Nature's Guesthouse' to learn about nature conservation and forest management. Special night spotlighting wildlife walks are run out of the guesthouse.

Today, Perup is also the site of numerous university student projects and a range of education and training activities. It is also the destination of national and international science groups and school excursions. Volunteers, students, local interest groups and local landholders have been a substantial and important part of all of the major research in the area and continue to play a key role in the ongoing conservation and management of the region.

Worrying about woylies

In recent years, a major project to identify the causes of decline in woylie populations has been under way at Perup (see 'Down but not out: solving the mystery of the woylie population crash', *LANDSCOPE*, Winter 2008). Following the success of recovery programs for the woylie during the late 20th century, woylie numbers started to plummet. Numbers across the country have dropped around 80 per cent since 2001 and at some sites numbers were recorded as dropping up to 97 per cent. As a result, the woylie has been relisted on state and federal threatened species lists and is now listed as critically endangered on the International Union for the Conservation of Nature 'Red List'.

The Woylie Conservation Research Project was set up to identify the causes of this baffling decline, focusing on the Upper Warren region. The project joined the forces of DEC, Murdoch University, the Australian Wildlife Conservancy (AWC), Perth Zoo and South Australian Department of Environment and Heritage. While predation, especially by feral cats, is involved, and disease is a suspected potential factor, this major collaborative research program has so far been unable to definitively prove the causes of the woylie decline. And it's getting critical: in 1999, there were about 240,000 woylies in the Upper Warren region—perhaps more than two-thirds



Left DEC Senior Technical Officer Chris Vellios with a woylie to be released into the Perup Sanctuary.

Photo – Emma O'Leary/DEC



Above Woylie.
Photo – Sallyanne Cousans

of the estimated animals in the wild—and there are now estimated to be just 10,000. Given the rapid species collapse, and the risk of extinction of the woylie, it was decided that emergency conservation action was needed.

Perup Sanctuary

An exciting new phase in the Upper Warren's history has now begun. Adjoining 'Perup – Nature's Guesthouse', a 420-hectare predator-free enclosure has been constructed to support about 400 wild woylies. The Perup Sanctuary is based on the proven success and importance of the

Karakamia Wildlife Sanctuary, managed by AWC, in supporting a healthy woylie population free from predators. It will be monitored and managed as insurance from local extinction for the indigenous woylie populations of Kingston and Perup. The sanctuary will also enable scientists to conduct research on the impact of predators and disease in the conservation and recovery of the woylie. The same project will also see another complementary captive insurance population established at Perth Zoo that will try to capture the genetic diversity of the entire species. Woylie releases into the two insurance colonies began in late 2010.

Below Perup entry sign.
Photo – Cliff Winfield

Below left Jarrah forest at dawn.
Photo – Jiri Lochman



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For more information about staying at 'Perup – Nature's Guesthouse' contact DEC's Donnelly District Office on (08) 9776 1207.

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