W.A.'s Rainforests

by Norm McKenzie, Kevin Kenneally and Cliff Winfield

Rainforest. The term conjures up images of lush, steaming jungles, festooned with lianas and snakes, full of undiscovered Amazonian tribes. To see an Australian rainforest you would have to go to the coast of Queensland, right? Wrong!

On W.A.'s Kimberley coast tiny pockets of rainforest have survived for thousands of years, completely cut off from similar ecosystems by the arid savannah that surrounds them.

Although well known to Aborigines for thousands of years, these remnants were only recognised by scientists just 22 years ago. They are scattered in a strip along the coast between Broome and Wyndham, sometimes occurring up to 100 km inland. They vary in size from a few tree canopies to 100 ha. The first broadscale ecological study of W.A.'s rainforest was undertaken in June 1987, following a grant from the Federal Government's national rainforest conservation program.

The first step was to co-ordinate plans with the Conservation Commission of the Northern Territory, as well as consulting with Aboriginal communities at Derby and Kalumburu. They nominated a liaison person from each community to help our investigations. How many rainforest patches occur in the Kimberley? Where and how big is each one? This information was essential before the ecological survey could begin, but how could we get it? To take colour aerial photos of the entire area would be too expensive.

R. Drummond

Rainbow Pitta

Satellite Sensing

After consultation with the Department of Land Administration's Remote Sensing Application centre and the CSIRO, it was decided that the only feasible approach to identify rainforests accurately and economically within the 90 000 square kilometre study area was to use LANDSAT satellite information.

Using LANDSAT Multispectral Scanner (MSS) it was possible to provide a broad classification, but due to the limited spectral range of its sensors, accurate discrimination between mangroves dense woodlands and rainforest was not possible.

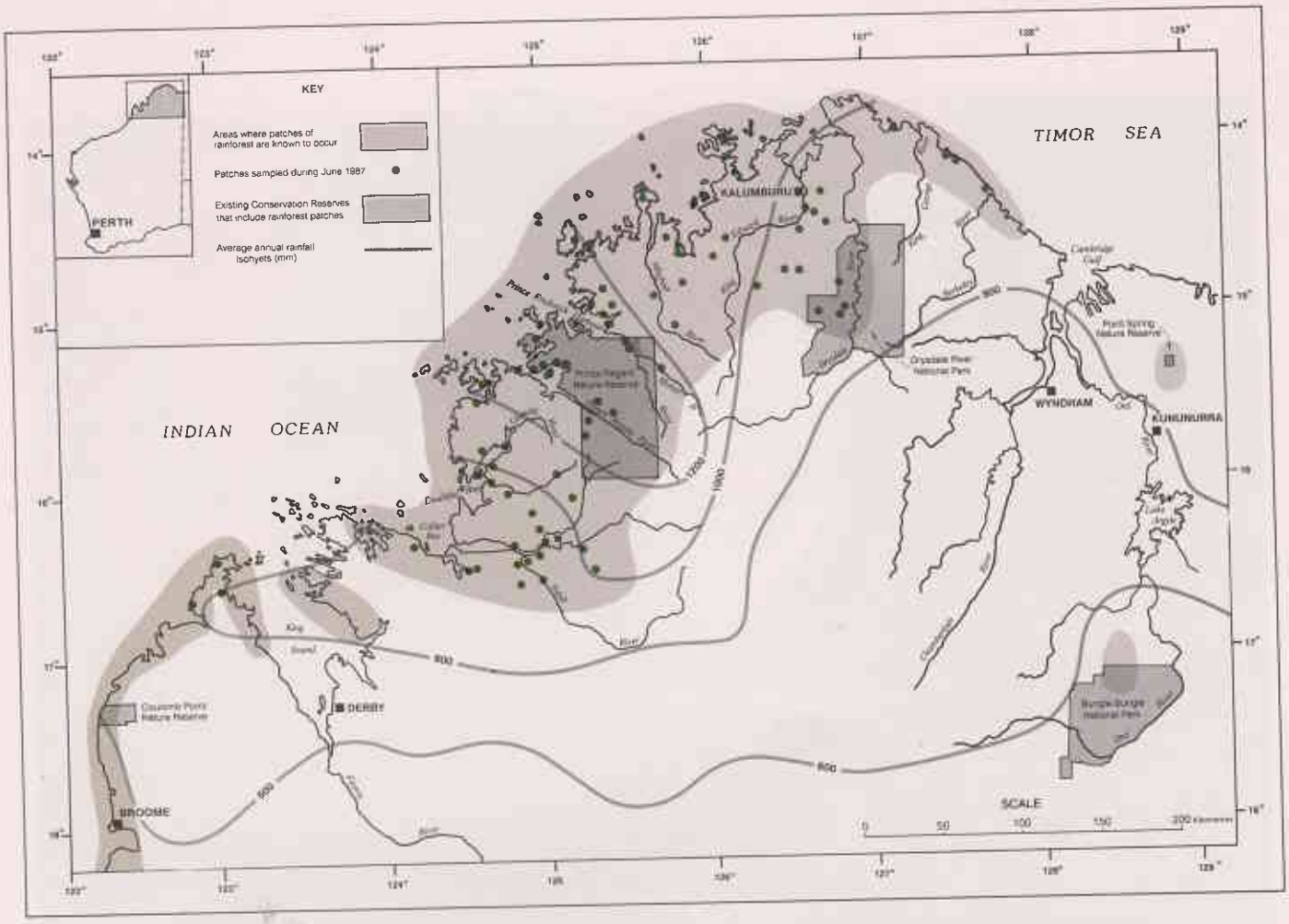
It was decided to evaluate the recently acquired LANDSAT Thematic Mapper (TM) imagery which provides significantly improved spectral and spatial resolutions.

Statistical analysis of the LANDSAT TM data revealed that mangroves and rainforest could be successfully differentiated using the infra-red sensor to detect differences in soil moisture. The computer-generated image from the LANDSAT TM satellite, using false colours, clearly discriminates between rainforest (dark red) and mangroves (black).

LANDSAT TM satellite imagery can home in and accurately detect stands of rainforest greater than 30 m square: about the size of a suburban house block. Using maps drawn from satellite images the location, and the approximate size and shape of each Kimberley rainforest was determined. From the 400-500 small pockets of rainforests recognised via satellite, the project team selected representative areas for more intensive ground 'truthing'.

Moist conditions in some rainforest patches favours the growth of ferns. In this example, *Cyclosorus interruptus* dominates the ground, the coarse climbing snake fern *(Stenochlaena palustris)* and the delicate climbing maidenhair *(Lygodium microphyllum)* scramble up the tree trunks. (Right)

Norm McKenzie



Prior to ground operations, low-level observation from a light aircraft confirmed that areas showing lush growth in the satellite images were in fact rainforest patches.

The flight team also received a pleasant surprise: during the flights from Derby to Kalumburu and beyond they saw several patches much larger than expected, some nearly 100 ha.

Courtesy Remote Sensing Application Centre

Field Operations

The next step was a complex field operation: in June 1987, a helicopter landed a team of five specialist scientists within walking distance of the first of the 83 chosen patches. Sampling was arduous; most patches are on steep slopes below sheer escarpments; to reach many of the rainforests the survey team had to walk half a kilometre or more over rugged and precipitous sandstone country because the helicopter was unable to land any nearer. The budget allowed for 21 days flying. After allowing an average of three hours per day for flying between patches, the time left to actually sample each patch ranged from 50 minutes to 2 hours and 10 minutes, depending on size.

The average day involved 10 hours away from base camp, followed by two hours of specimen preparation in the evening.

1819 Allan Cunningham collected first rainforest species along the Kimberley coast, but he did not describe the vegetation well enough for his readers to realise he had collected from rainforest.

1880 Julius Brockman gave first published account of Kimberley rainforest from the Dampierland Peninsula north of Broome.

1923 C.A. Gardner noted 'the total absence of rainforest in the Kimberley.'

1954 CSIRO land systems survey failed to identify rainforest in the Kimberley.

1965 First recognition of rainforest appeared in the Bureau of Mineral Resources notes to the Montague Sound geological sheet by A.D. Allen.

1975 Alex George and Kevin Kenneally of the W.A. Herbarium reported rainforest in the biological survey report of the Prince Regent River Reserve.

1976 John Beard investigated, and published a preliminary description of rainforest (monsoon forest) patches on the edge of the Mitchell Plateau, the largest estimated at 22 ha. At the same time biological surveys by the Department of Fisheries and Wildlife of the Drysdale National Park, the off-shore islands and Dampier Peninsula confirmed the existence of rainforest pockets over much of the Kimberley. Since then, the W.A. Museum has studied the mammal fauna of patches on the Mitchell Plateau and the W.A. Herbarium has collected rainforest specimens and studied rainforest patches while working on the flora of the Kimberley.

1987 the first broad-scale ecological study of the Kimberley rainforests was launched. Coordinated by the Department of Conservation and Land Management, funded federally by the three-year National Rainforests Conservation Program, the study team has so far mapped the extent of W.A.'s rainforests and recorded the species of plants, birds and land snails present in a representative selection of patches.

N. McKenzie

Substantial changes since 1979: the vegetation under the trees has been trampled by cattle, and the rainforest birds and land snails have been replaced by species from the adjacent woodlands.

N. McKenzie

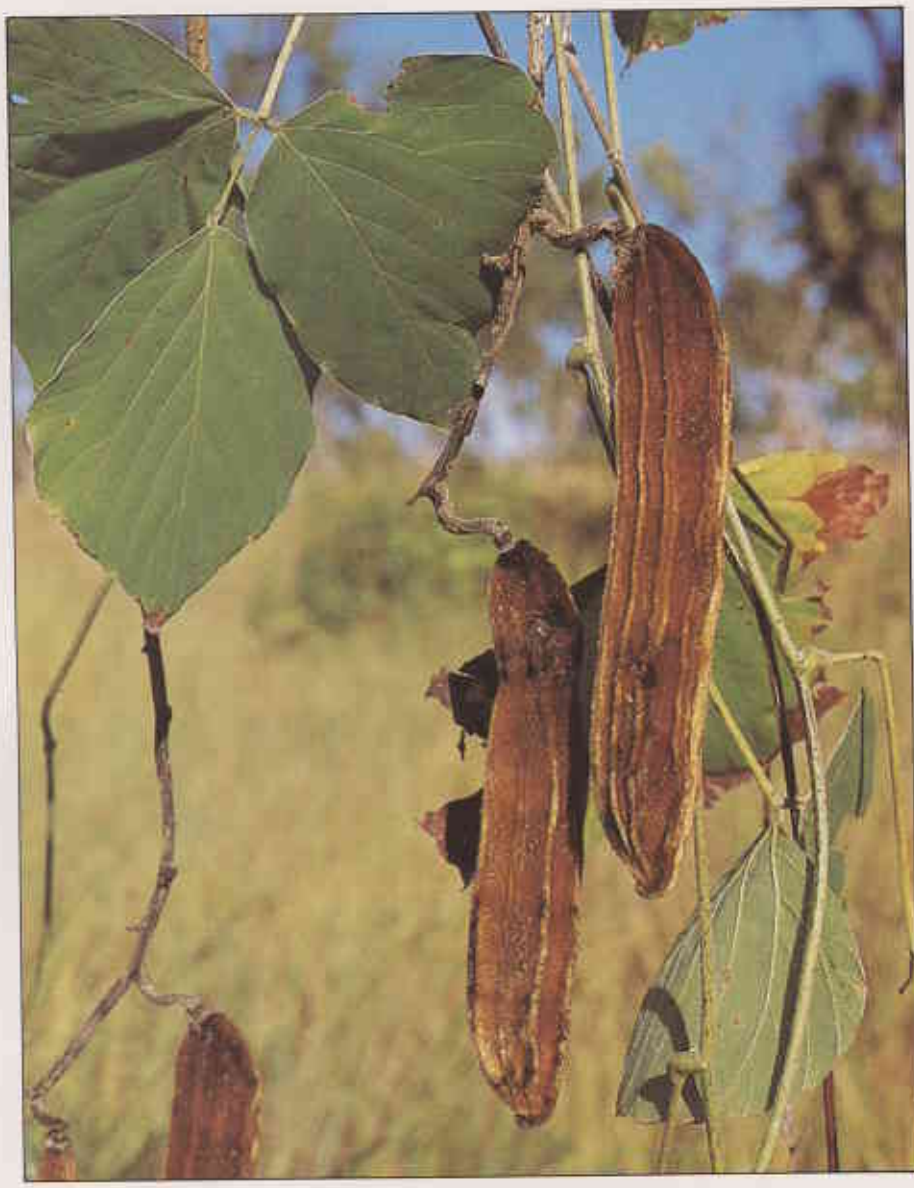
Lunchtime at Carson Escarpment. (The red numbers indicate the date and time the sites were visited)

The location, size, shape, and geomorphology of each patch was recorded; and a list was made of the plant, bird and landsnail species present. Where necessary, voucher and museum specimens were collected. The five biologists also recorded visible evidence of disturbances caused by cyclones, fire, flood and cattle (for more information about this see *Landscope*, Vol 3, No 1, p. 46).

The expedition operated from two base camps: on the King Edward River near Mitchell Plateau, from 4th to 17th June, then at Mt Hart station from 18th to 30th June. Three people, stationed at base camps, transferred the biological data from sheets to computer and provided other support.

A second team of four biologists carried out more detailed ecological surveys at five of the 83 patches. Their two-to-three day sessions of sampling provided a comparison that could be used to cross check-results from the rapid inventory team. It also allowed collection of some reptile and mammal information.

K. Kenneally



K. Kenneally

Mimusops elengi fruits - traditional food for the local Aborigines. (above left).

A liane, *Mucuna diabolica*, so-called because its pods are covered with dense, velvety hairs which highly irritate the skin (above).

Despite their relatively small size, our results show that the rainforests of the Kimberley are much richer in plant species than previously thought and contribute substantially to the richness of W.A.'s flora. At least 300 species of plants have been collected from the Kimberley rainforests; 80 per cent are restricted to that environment. New generic records for W.A. include the trees *Ailanthus* (Simarubaceae), *Eugenia* (Myrtaceae) and *Dimorphocalyx* (Euphorbiaceae). New records for W.A. include species of *Croton, Alstonia, Buchanania* and *Canthium*. Some of these trees are up to 30 m high, others are lianas, e.g. *Pisonia aculeata, Mucuna diabolica* subspecies *kenneallyi*. Many of the climbing plants in the thickets are armed with sharp thorns or their pods are covered with fine hairs that cause skin irritation. This makes it very difficult to penetrate the rainforest; secateurs or a brush hook are needed to cut paths through the often tangled *Capparis, Paramignya, Flagellaria* and *Smilax australis*.

Rainforests in coastal areas of the Kimberley were the richest for plant species, more than 65 were recorded at patches overlooking the mouth of the Sale River, on the Marigui Promontory, on the Mitchell Plateau and on Southwest Osborne Island. The botanists recorded an average of 45 species per patch. Further inland, the rainforests were both smaller and poorer in species.

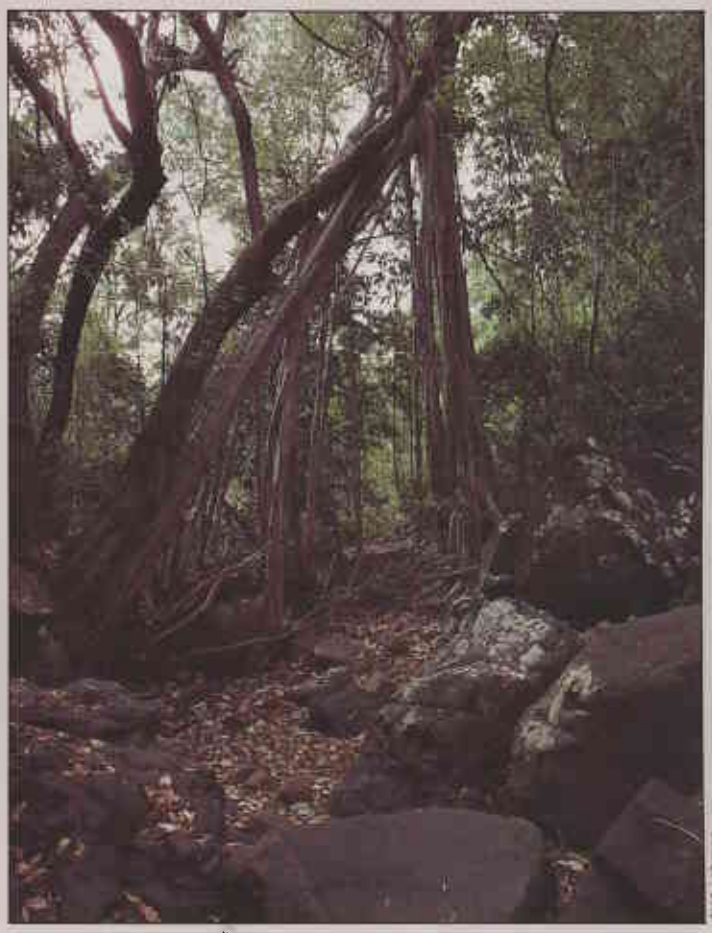
K. Kenneally

Caesalpinia major - aboriginal children use the seeds for marbles, and bower birds use the seeds to decorate their bowers.

Rainforests: Why the fuss?

The species of plants found in rainforests are truly primitive: the flowering plant kingdom's living equivalent of dinosaurs. Some of the earth's rainforests have existed continuously for more than 100 million years. They include the most complex and species-rich terrestrial ecosystems that have ever existed on this planet. Such lushness can usually only be sustained by high rainfall and tropical climate.

Fossil evidence suggests that much of what is now the Australian continent was, in an era of high rainfall 10-60 million years ago, covered in verdant rainforest. The very species that give the Australian flora its distinctive character (such as the banksia family) evolved from rainforest ancestors, as aridity reduced the extent of rainforest habitat. Rainforests in north-east Queensland probably evolved from isolated pockets which survived the last ice age, some 12 000 years ago. They contain elements of plant life that date back 120 million years.



Rainforest, Mitchell Plateau – Kimberley

Broadly speaking, rainforests have what is known as a 'closed canopy'. This means that the taller trees are dense at the top and they interlace and allow very little light to penetrate to the ground. Consequently, a moist micro-climate is formed in the understorey. This protection enables a myriad of lifeforms to survive in otherwise harsh conditions.

In the Kimberley, closed canopy communities are rare, and the rainforest pockets occur in a variety of forms. These vary from forests, with dense canopies comprised of a diversity of trees up to 30 m tall, to thickets of small (6-9 m) trees. The tree canopies are festooned with woody vines and lianas. Epiphytic orchids occur, but are not common. The patches are usually surrounded by savannah woodland dominated by *Eucalyptus* and *Acacia*.

The patches of rainforest across northern Australia form important biological corridors into which animals can move, feed and shelter. They are also important for those Torresian species which migrate into and out of Australia from New Guinea and S.E. Asia. Because of their high number of edible fruits, they also have strong, traditional importance to the Australian aboriginal people.

For many species the rainforest habitat is essential; they cannot live outside it. Since European settlement approximately 75 per cent of Australia's rainforest has been destroyed, principally for conversion to farmlands.

At this stage, W.A.'s remnant rainforests are still largely intact, although threatened in some places by fire or feral animals.

This survey is seen as the first positive step to ensure adequate rainforest conservation in the Kimberley region of W.A.

N. McKenzie

A Bower bird's bower - used by the male to attract the female. It is often decorated with sea-shells, land snail shells and other colourful objects.

Jiri Lochman

Jiri Lochman

A selection of 'camaenid' land snails that are restricted to rainforest patches of the N.W. Kimberley. Each is localised to a very small area, for example, the two pictured on the right (*Carinotrachia carsoniana* Solem 1985) are known only from the vicinity of Putairta Hill, near the Carson River crossing.

N. McKenzie

The strangler fig or banyon *(Ficus virens)* often uses another of the rainforest trees for support.

Many of the rainforest trees produce fruit that are eaten by birds, providing a rapid dispersal mechanism for the seed. Of the 87 bird species recorded in rainforests during the survey, 20 depend on this environment for the persistence of their Kimberley populations. Birds that are primarily rainforest dwellers in the Kimberley include the spectacular Torres Strait Pigeon, the colourful Red-crowned Fruit Pigeon and Rainbow Pitta, the Yellow-footed Scrub-fowl, Rufous Owl, Green-winged Pigeon, Yellow Oriole, Figbird, Varied Triller, Little Shrike-thrush, Great Bower Bird and Green-backed Flyeater. A number of these were considered rare in W.A.; we now know that they are better classified as 'of restricted habitat'. Up to 30 species were recorded in the richest patches - usually those of the near-coastal areas in the north-west Kimberley between Walcott Inlet and Cape Bougainville. We were also lucky enough to record, for only the second time ever, *Melotis caronata*, the rarest of Australia's pythons.

About 70 species of land snails were collected; about 80 per cent of these are rainforest specialists. The richest patches had up to ten species, the poorest about three. At one riverine patch none could be found at all. Within the genus *Amplirhagada*, which is endemic to the Kimberley and has 28 described species, the survey yielded several species never collected alive before, and a few new to science.

From this base information long term plans for the study of W.A.'s rainforests will be formulated, and management plans for their preservation devised. In addition, results from the survey may provide insight into the origin and history of these rainforests.

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Cover Photo

We've heard of wolves baying at the moon, but frogs? Obviously, this amphibian is not above displaying a little lunacy. Nor is the photographer, Jiri Lochman, who must have been moonstruck to get this superb shot.

EDITORIAL

Every year at this time the subject of bush fires becomes a preoccupation with land managers. Steps must be taken to ready fire-fighters and their equipment; hazards must be identified and minimised; education programs for neighbours and visitors must be renewed. Fires are inevitable. The combination of hot, dry weather, inflammable fuels in the bush and ignition from lightning or careless people will see to it that almost every day over the next few months Conservation and Land Management Staff or Bush Fire Brigades will be fighting a bush fire somewhere in the State. Because of modern technology and efficient fire control practices, land managers these days can very largely determine the fire regime which is to be applied in a given area. For example, in most of the land CALM is responsible for, the policy is to try to keep fire out, pending a better understanding of ecological requirements. In a small proportion of the CALM estate (notably parts of the south-west forests), regular, controlled burning is done. The aim of this operation is to minimise the risk of serious wildfires in places where values are highest. The most important value to be considered in the South-West is human life.

In this edition of *Landscope* readers are urged to recognise their individual responsibilities. Most importantly, these are to make their own houses safe from bush fires and to learn how to look after themselves and their families if a fire occurs.

This dual approach by land managers and householders will help combat the worst consequences of one of nature's most dangerous and predictably-occurring events: the Australian summer bushfire.

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