Tropical Topics

An interpretive newsletter for the tourism industry

Termites

No. 64 December 2000

Notes from the Editor

Welcome to this, the first 'orange' issue of *Tropical Topics* dedicated to the dry tropics, Australia's tropical savannas. Earlier in the year, when regular readers were questioned in a survey about their interest in a new type of *Tropical Topics,* dealing with this area, 62 percent replied that they would definitely be able to use such information, while 36 percent said that they were interested. Funding has now been obtained from the Cooperative Research Centre for the Sustainable Development of Tropical Savannas for the production of two 'orange' issues in the course of this financial year. This is the first.

While a majority of the readers who responded to the survey indicated an interest in a Dry Tropics issue, there will be some for whom it holds no interest. I would appreciate if those people could contact me. I am happy to continue sending green (Wet Tropics) and blue (Great Barrier Reef) issues to them as before, but would prefer not to waste newsletters which are not wanted.

This first issue deals with termites. Possibly the most prominent feature of the landscape, their mounds and their stories hold much of interest. I hope you enjoy this issue.

I would like to thank Peter Jacklyn, Tropical Savannas CRC, for his valuable help with this issue.

The good guys

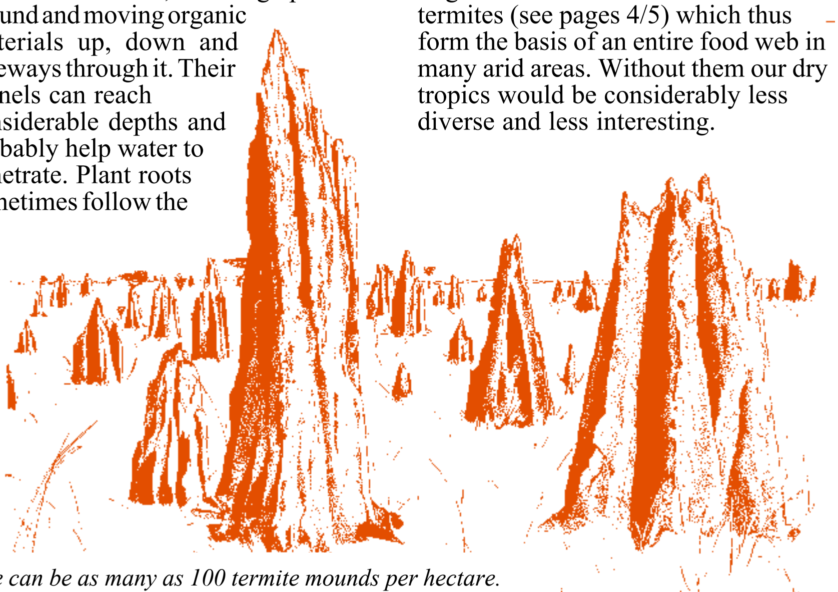
Termites are not well loved. They cause a great deal of damage to wooden structures but the blame for this lies with just a few species. In fact, termites are a very important part of the ecosystem, particularly in the dry tropics.

Termites are excellent recyclers. Very few animals are able to break down cellulose and lignin, the main components of wood. Termites, however, specialise on feeding on dead plant material which leads eventually to the nutrients trapped in it being released back into the environment for reuse by growing plants. In wet areas, and during wet seasons, this job is also done by fungi, earthworms, micro-bacteria, beetle larvae and other animals. However, when the climate is dry, termites are the main decomposers, hard at work throughout the year.

It has been suggested that the topsoil in northern Australia is largely the result of several thousand years of termite activity. Constantly tunnelling through the earth, these busy insects condition the soil rather as earthworms do in moister areas, breaking up hard ground and moving organic materials up, down and sideways through it. Their tunnels can reach considerable depths and probably help water to penetrate. Plant roots sometimes follow the old tunnels through hard ground.

At the end of its life, a termite nest, whether underground or a mound above the surface, begins to disintegrate. This releases nutrients, in the form of faecal material and other debris, into the soil. Mounds in high densities can contain up to 60 tonnes of soil materials per hectare. Since these tend to be most common in places where soils are least fertile, their demise can make a considerable contribution to the local environment.

It has been said that a collection of termite mounds in the landscape is the equivalent of a herd of cattle. Like cattle, they are herbivores, converting the nutrients from grass and wood into protein — themselves. Indeed, each large termite mound probably contains the same amount of 'flesh' as a cow. A large number of other animals eat termites (see pages 4/5) which thus form the basis of an entire food web in many arid areas. Without them our dry tropics would be considerably less diverse and less interesting.



There can be as many as 100 termite mounds per hectare.

Tropical Savannas CRC
Cooperative Research Centre for the Sustainable Development of Tropical Savannas
Queensland Government
Environmental Protection Agency
Queensland Parks and Wildlife Service

The colonial life

On a suitably humid night, often at the beginning of the wet season, winged termites spill out of the colonies in which they were raised. These winged termites are special. They are colony founders.

Alate

Unlike their pale, blind brothers and sisters, winged termites are fully-developed adults, dark in colour with well-developed compound eyes. Also, in contrast to the workers which raised them and the soldiers which guarded them, they are sexual beings and their job is to reproduce. Although they have two pairs of wings, they are weak fliers, and don't move far from their home nest. Their first flight is usually their last and soon after landing they lose their wings, by breaking them off at a line of weakness at the base. However, they have other thrills in mind. Elevating their abdomens, females produce a sex-attracting hormone — and the males come flocking.

King

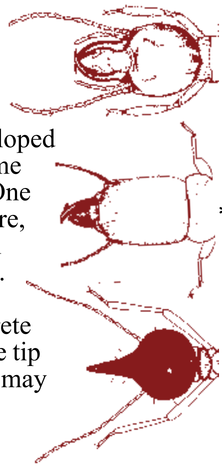
As soon as they have paired up, each couple chooses a site suitable for a new colony and dig themselves a chamber. Sealed safely inside, the honeymooners mate repeatedly and within a few days the female, now a queen, begins her lifetime job of producing eggs. She and her mate, the king, tend these first few eggs and the young which hatch from them, but their devotion to childcaring duties is a passing phase. The young they produce are an investment in their future. When they are old enough they will devote their lives to feeding, defending and caring for their parents and subsequent generations, leaving the king and queen free to pursue a long career of full-time mating and egg production. Laying up to 3,000 eggs a day from her greatly enlarged abdomen, the queen is thought to live for many years and even decades (see *How old?*, p7.) eventually building colonies which, in some cases, are inhabited by a million or more of their children.

Queen

The majority of termites which hatch from the eggs are workers while a small number (about 1-15 percent) are soldiers. Both these types of termites are sterile. It is only after the colony has been established for several years that sexually active, winged 'alates' — potential kings and queens — are produced and released to start new colonies. It is uncertain how the type of termite to emerge from an egg is determined but it seems that pheromones released by existing termites play a part. Pheromones are chemical substances which are used to communicate messages around the colony as members exchange saliva and food. If the number of soldiers in the colony drops, the level of pheromones they produce also drops and more soldiers are then created. However, if there are too many of one type of termite some are destroyed by the workers.

Worker

Workers engage in a number of chores; constructing and repairing the family home, caring for eggs and younger siblings, collecting food and feeding their parents and other colony members. Nestmates, of some species, need only twitch the antenna of a worker to be treated to the contents of its stomach. Workers are soft and vulnerable and generally hide from the light. To protect themselves, some species build special mud tubes through which to travel beyond the nest, out of sight of predators and hidden from dangerous sunlight. Other species emerge at night but some, which are pigmented to protect them from UV rays, risk foraging during the day.



Soldiers

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Soldiers defend the colony, taking up duties wherever the nest has been attacked or is being repaired and when the winged alates are emerging from breaches. Many have strong, well-developed jaws used to bite intruders although some employ a curious snapping technique. One side of the jaw is released, under pressure, rather as we snap our fingers, to give an intruder an unexpected sideways whack. If the soldier misses, however, it may be the one to go flying! Other soldiers secrete chemicals in droplets or threads from the tip of their pointed heads. These chemicals may be toxic or repellent or may physically entangle attacking predators. Yet other species use strong, enlarged heads, to barricade tunnels against intruders. Soldiers may also warn of an intrusion by beating their heads against a tunnel wall. The specialised mouthparts of soldiers mean that most cannot eat and must rely on the workers to feed them.

While the colonies of some species are the progeny of just one queen, in other species additional termites with reproductive capacities are produced as 'stand-bys'. These termites never leave the nest. They may be produced when reproduction rates of primary queens and kings begin to fail, so they can supplement production. This is particularly common in the nests of the more primitive species, which have smaller-bellied queens, and can result in massive colonies. The female substitutes are less productive than the primary queens, so more are needed — over 100 were found in one mound. These reproductive termites are usually darker than workers and soldiers and may have wing buds and compound eyes.

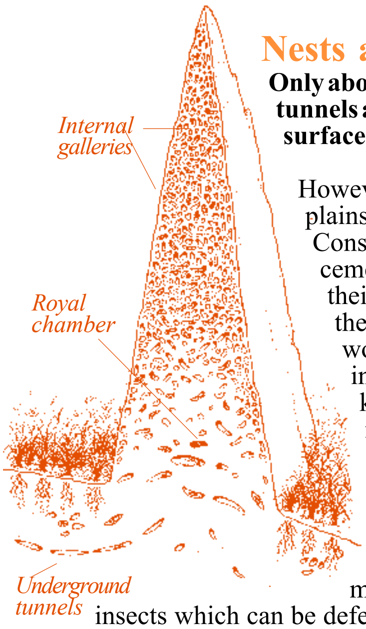
Not ants

Although termites are often referred to as 'white ants' and their social system is very similar to colonial ants, wasps and bees, they are not closely related. In fact, like their nearest relatives, cockroaches, they are more primitive in origin and are thought to have been the first insects to adopt a social lifestyle. One basic difference is that bees, wasps and ants hatch from eggs as larvae and later go through an abrupt metamorphosis (just as caterpillars turn into butterflies) to achieve their full adult form, with tough dark skin and compound eyes, in just one step. Termites, like cockroaches, grasshoppers and bugs metamorphose gradually. With each moult the young becomes progressively more adult in form. Nonetheless, workers and soldiers never get past the 'juvenile' stage — the termite colony depends, in fact, on child labour. As undeveloped adults they are small with pale skin and weak eyes, characteristics which dictate a lifestyle confined to moist, closeted surroundings and a reliance on chemical rather than visual cues. Only the reproductive caste are complete adults.

Termites also differ by having kings in their colonies. Ant, bee and wasp queens mate only once, storing sperm for the rest of their reproductive lives. Termites are also quite different from ants, bees and wasps in appearance. They are less armoured and have no waist.

Ant

Nests and mounds

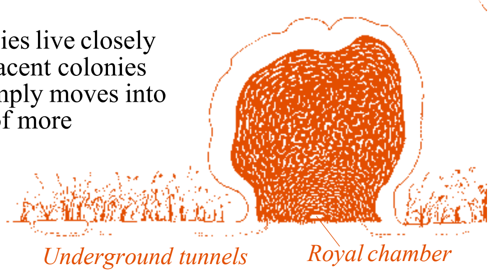


Only about one-fifth of Australian termite species build mounds. The others live in tunnels and chambers within their food source — generally in wood or below the soil surface. Some don't even build recognisable nests.

However, it is the mounds, poking up from the savanna land plains like headstones in a cemetery, which fascinate us. Constructed by thousands of individual, blind insects busily cementing grains of soil together with saliva and excreta, their colour varies according to the type of soil from which they are built. These mounds are an organisational wonder. The equivalent of the bigger cathedral mounds, in human terms, would be a skyscraper nearly two kilometres high and covering eight city blocks, built by a million blind-folded people.

Mounds provide the inhabitants with a retreat where temperature and humidity can be regulated; thin-skinned termites need high humidity, which is generally kept above 90 percent in the nursery chamber. The mound is also a fortified home for these soft-bodied insects which can be defended against ants and other predators. In addition, it is used as a storehouse for food.
Building techniques and architectural plans differ according to species and local conditions (see page 4). Usually they contain intricate systems of galleries, along which the termites move, and a royal chamber and nursery at the centre of the mound.

Some termite colonies of different species live closely together. This may be the result of adjacent colonies merging but sometimes one species simply moves into the nest of another, taking advantage of more sophisticated building techniques and better defences. This can lead to some confusion in identification.



Not mounds

Some termites build intricate systems of tunnels, created from glued soil particles, over trunks and branches, leading to the woody food sources. Eventually these may completely encase a tree trunk with soil, so it appears to be wearing a brown or orange sock. Undercover, the termites are free to move.

How old?

How old is a termite mound? This is a hard question to answer without lengthy records but the history of one cathedral mound provides interesting clues. When the Overland Telegraph line was being constructed, the top of this 3-metre high mound was removed in 1872 because it interfered with the wires. At that stage it must have been already several decades old and, fifty years later, in 1935 it was still thriving. This colony may therefore have reached an age of almost 100 years, before it fell into disuse, sometime before the next inspection in the 1950s. Extraordinarily, colonies belonging to this type of termite — the spinifex termite, (*Nasutitermes triodiae*) — are believed to be derived from just one irreplaceable queen, the mound lasting just as long as she does. In the short-lived world of insects this is a remarkable record.

Researchers studying golden-shouldered parrots reckon that that conical mounds used by the birds must be 30 years old or more before they are suitable for nest sites. They calculated a growth rate of between one and two centimetres a year for these mounds, some even decreasing in size.

Food preferences

Like cockroaches, termites feed on vegetable matter. They are among the few insects able to digest cellulose and lignin in wood. In most cases micro-organisms (bacteria and protozoa) in their guts do the work, producing enzymes or otherwise converting this tough material into a useable form. The fact that some of these micro-organisms are also found in the guts of some cockroach species, points to a common ancestor. Indeed, termites and cockroaches are the only wood-eating insects which depend on symbiotic micro-organisms in their guts. Some of these bacteria enable termites to absorb nitrogen from the atmosphere, an unusual attribute for an insect.

Cellulose provides carbohydrates. Protein may be obtained from fungal sources and also from the bodies of protozoa which die in their guts. Termites also eat the cast-off skins of growing nymphs and members of the colony which die, thus efficiently recycling nutrients. They are also not averse to eating each other when protein is scarce.

Termites cause confusion

Constantly moving grains of soil around, bringing them up from metres below the ground and plastering them into their mounds, termites have caused confusion for archaeologists who generally work on the principal that the deeper an artefact, the older it is. However, as soil particles are moved up around them, these artefacts can sink faster than they would in termite-free areas.

Some dating techniques depend on how long the sand grains tested have been buried away from light. However, if termites are constantly bringing these grains to the surface and 'resetting' their clocks, it is easy for them to give a false date.

Aboriginal medicinal uses

Pieces of termite mounds have been used traditionally as cures for diarrhoea and other stomach upsets. Possibly this acts in the same way as kaolin, the clay used in western medicine, by forming a protective lining in the stomach and absorbing toxins. Antibiotic qualities in the termite saliva may also be useful. In addition, termite clay may be a good source of iron which is sometimes present in quite high proportions, and is possibly a reason for the traditional popularity of termite clay with pregnant women.

Although the termites themselves are edible, and are eaten in Africa, this is not well-recorded in Australia. Possibly the Australian forms are smaller and less tasty than the African ones.

Material from the centre of tree-piping termite mounds is burnt as a mosquito repellent and is buried along with fish, kangaroo or other food in underground ovens to flavour the meat.

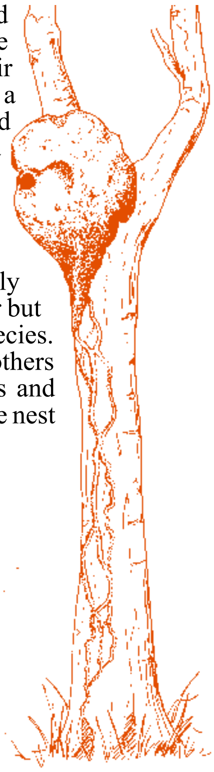
Citadels and invaders

Magnetic mounds

These wedge-shaped mounds are all aligned in a north-south direction. This appears to be a response to particular environmental constraints. The termites which build them feed on grass roots and other plant debris found in plains which are seasonally flooded. They are therefore unable to retreat from the extremes of the summer heat into underground chambers as many other termites do, but are forced to remain above the water, in the mound. However, in winter, opposite problems occur as cool air is trapped in these low-lying depressions — temperatures as low as 4deg. have been recorded. The mound therefore functions as a clever temperature regulator. The eastern side is warmed by the morning sun, and the western side by the evening sun, but in the middle of the day only the thin upper edge of the mound is exposed. At this time air temperature alone allows the mound temperature to remain stable. Experimental rotations of mounds, putting them in an east-west position, has caused an overall increase in internal temperature of 6deg.

Wind and shade also affect the mound temperature but because of the wedge-shape the termites are able to adapt to different conditions by building mounds with different orientations. By orientating the mound slightly more to the north-west the termites can increase the amount of heat received on the eastern side, to compensate for the cooling effects of wind and shade.

Magnetic mounds are built by a number of termite species. One, *Amitermes meridionalis*, is found south of Darwin and across the western part of the Top End. Another, *A. laurensis* which is named after the Queensland town of Laura, is found in Cape York Peninsula and eastern Arnhem Land. South of Laura, mounds of this species are more rounded in shape, rather then 'magnetic'. This is thought to be a response to drier conditions, where the seasonal flooding which dictates the 'magnetic' shape is not a factor.



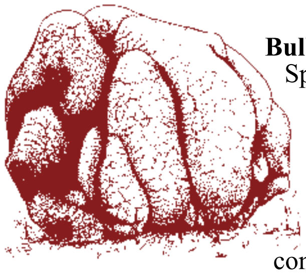
Tree mounds A number of termite species build their mounds high in trees. Most of these are actually soil nesting species, but after their colony has been flourishing underground for a while, some take to the trees and build a mound there, retaining a connection to the ground via covered runways. These mounds are more common in coastal areas. The same termite species, when living in drier, inland regions tend to restrict themselves to underground nests. The rounded mounds are created largely from semi-digested wood and organic matter but may have an earthen shell, depending on species. Some species prefer smooth-barked trees, others prefer rough-barked trees such as ironbarks and stringybarks where the tunnels connecting the nest to the ground can be hidden in the bark.

Mound variations

Mound shapes vary greatly according to local conditions. It has been speculated that, since mound-building behaviour may be largely genetically inherited, different species, with similar appearances, may be involved.

Possibly evolution in termites has expressed itself in various mound shapes rather than variations in body form.

Female **lace monitor lizards** (*Varanus varius*) excavate nesting holes in termite mounds in trees and on the ground. After they have deposited their eggs, they leave the termites to seal up the hole again, cementing the eggs in. The constant temperature maintained by the termites incubates the eggs and it is thought that the mothers return to the nest at hatching time to help their offspring escape. The young are a bright cobalt blue with yellow stripes.



Bulbous mounds Spinifex termites (*Nasutitermes triodiae*) construct some of the biggest mounds in the world, containing in excess of a million termites. The largest, reaching over 6m in height, are found in an area north of Pine Creek in the NT.

However, mound shapes associated with this versatile termite vary considerably, from tall flanged forms to squat bulbous rounded ones. As the colony grows, the termites build on extensions in the form of bulging 'buds'. They are generally to be found around the edges of floodplains, on higher ground than the magnetic mounds.

These termites are harvesters, feeding on grass which they carry back to the mound in 1cm lengths. They move along underground tunnels and build earthen structures around grass tussocks on which they are feeding.

Bulbous mound illustration by Geoff Thompson © Queensland Museum

Dome mounds Tree-piping termites (*Coptotermes acinaciformis*) construct mounds at the base of trees, particularly eucalypts. The termites enter a tree from below ground level and, with the help of soldiers which produce wood-solvent chemicals, create hollow pipes through the trunk and branches, filling the gaps with soil. The tree is weakened but not killed. These termites, which occur throughout Australia, are unpopular with the timber industry, but their activities create hollows for other animals to nest in — and benefit didgeridoo makers.

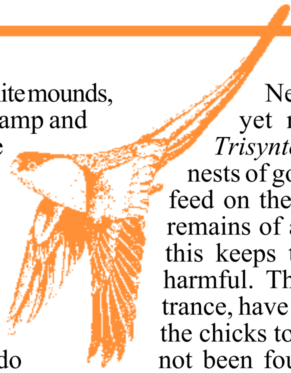
A large number of **beetles** live in termite nests, some of them producing a secretion which is eaten by the termites. Some of these, as larvae, are looked after by the termite workers as if they are colony members. Other larvae ride on the termites' backs. One beetle species is able to expand its abdomen, projecting it over its head, so that it mimics a termite worker.

Other **invertebrates** living in termite nests include silverfish, bugs and earthworms, which retreat into termite mounds when the ground becomes saturated.

The fat-tailed antechinus (*Pseudantechinus. macdonnellensis*), which is found in drier areas from south-west Queensland to WA, lives in bulbous termite mounds of the spinifex termite in some areas.

One species of gecko (*Gehyra pilbara*) lives inside bulbous termite mounds from the Pilbara Plateau (WA) to the Tanami Desert (NT). At night these geckos move on to the surface of the mounds but during the day they live in tunnels inside. Certain pythons (*Liasis* spp) have been found in termite mounds, chasing and feeding on the geckos there.

Squatters



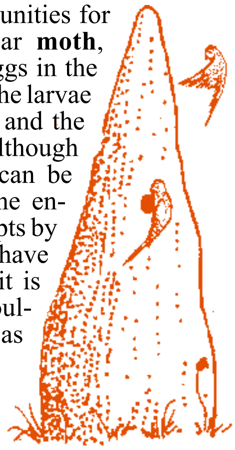
Golden-shouldered and **hooded parrots*** nest in termite mounds, digging into them with their beaks when they are damp and soft, during or just after the wet season. The choice of mound type is influenced by the timing of active termite construction, which varies from species to species. Parrots aim to avoid this period, when their eggs would be in danger of being incorporated into the mound by its industrious inhabitants. Hooded parrots, which live in southern and eastern Arnhem Land, use the bulbous mounds of the spinifex termite (*Nasutitermes triodiae*). These termites do most of their building in humid periods before and after the wet season but not during it when torrential rain makes the mud too soft. This, therefore, is the period used by the parrots, which generally begin laying between January and March.

Golden-shouldered parrots, found in a small area of the Cape York Peninsula, begin laying their eggs somewhat later, in March. They therefore avoid the bulbous mounds where post-wet construction is underway, instead targeting the conical, 'witches hat', mounds, of *Amitermes scopulus* (right), a termite which by that time has completed most of its building. Even so, eggs laid early in the season are sometimes glued down by the termites. Inexperienced birds sometimes attempt to excavate holes in the sides of magnetic mounds but soon find themselves coming out the other side of these thin-walled constructions. Nonetheless, a few manage to dig tunnels from the narrow end, and nest successfully.

The termites repair the hole after nesting is finished. However, although no sign of damage can be seen on the surface of the mounds, the interior of at least some takes longer to be restored. The parrots generally avoid mounds which have been used previously, giving the termites at least five or six years between invasions.

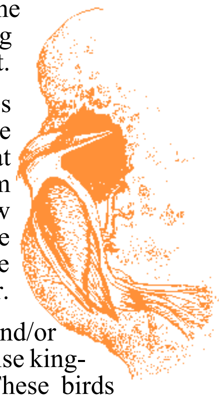
**Closely related paradise parrots, now feared to be extinct, also nested in termite mounds.*

Goannas are attracted to birds' nests in termite mounds. Tree goannas (*Varanus tristis*) have been observed eating golden-shouldered parrot nestlings and one was found in a hooded parrots' nest with a stomach full of eggs.



Nesting holes provide opportunities for yet more animals. A particular **moth**, *Trisyntopa scatophaga*, lays its eggs in the nests of golden-shouldered parrots. The larvae feed on the young parrots' droppings and the remains of any nestlings which die. Although this keeps the nest clean the moths can be harmful. Their pupae, situated near the entrance, have been known to block attempts by the chicks to leave the nest. The moths have not been found in any other nests so it is thought that they depend on golden-shouldered parrots and may, therefore, be just as endangered as their hosts are.

The maggots of **blowflies** have also been found feeding on droppings and dead young and **green frogs** have been known to share the nesting hole which makes an ideal sounding chamber! After the young chicks have left the nest, crickets, spiders (including redbacks) and casemoth larvae have been found in the hole, before it was refilled by the termites. A northern quoll was found taking a snooze in a disused hooded parrot nest.



Termite mounds are used as nesting sites by most Australian **kingfishers**. To create a hole, the birds sometimes fly head-on at the hard mound and occasionally die from the impact. Once completed, the burrow may be left vacant for a while to allow the termites to seal off the tunnel on the inside and protect the nest from dust and drying air.

Most **kingfishers** also use tree hollows and/or stream banks but the buff-breasted paradise kingfisher chooses only termite mounds. These birds return from New Guinea in early November each year, to nest in north-eastern Queensland, between the tip of Cape York and Townsville. Generally choosing ground-level mounds, they spend three or four weeks creating a tunnel about 150mm long leading to a chamber about 130mm high.

When fires sweep through the landscapes, termite mounds act as shelters for animals such as quolls, bandicoots, rodents, goannas, frill-necked lizards and other reptiles.

Predators

Termite nests are an important source of food for animals in the dry tropics

The emergence of winged termites, the potential kings and queens, from their mounds, provides a feast for a number of animals, including birds, lizards, snakes, frogs, ants and other insects. The sheer numbers of winged termites released at these times are probably necessary to ensure that some survive the hungry mouths.

Ants are termites' worst enemies. However from the ants' point of view, termites represent a major source of food, allowing the Top End savannas to support one of the richest and most abundant ant faunas in the world. They even move into termite mounds, using them as a home. The termite soldiers fight bravely against this invasion, but often lose the battle. Nevertheless, the termites are able to seal off at least part of the nest, affording their colony some protection.

Frill-necked lizards feed largely on termites. Geckos, legless lizards and skinks also benefit from this abundant food source. Indeed, it is thought that termites may be largely responsible for the great diversity and abundance of lizards in arid parts of Australia.

A number of **blind snakes** — burrowing, worm-like snakes — are commonly found under termite mounds or below termite inhabited wood where they feast on their favourite food.

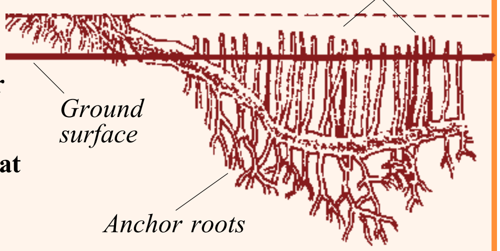
Termites are eaten by the **golden bandicoot**, found in north-west WA and by **bilbies**. The entrances of a bilby tunnel are often found next to a termite mound. One species of reduvid, or **assassin bug**, is a termite predator. These insects are able to pierce the walls of termite tunnels with specialised elongated mouthparts and suck in their prey.

Echidnas feed on termites as well as on ants. They use their strong claws to break into mounds and then lap up the insects with long tongues, covered with sticky saliva. These are then ground down between a horny pad at the back of the tongue and a hard palate before being swallowed.

Termites are an important part of the diet of various small **carnivorous marsupials** like dunnarts. Numbats, which live in south-west WA, depend almost entirely on termites for food. Using their strong sense of smell to locate their food, they dig up galleries in the soil and in dead branches but are unable to break into mounds.

Questions & Answers

Q It is often said that mangrove plants produce their weird and wonderful root systems, poking above the mangrove mud, in order to collect oxygen from the air because it is unavailable in the water-logged mud. We are told that plants use the carbon dioxide component of air so what do they need the oxygen for?



A Plants need oxygen as well as carbon dioxide. During the day, the process of photosynthesis requires carbon dioxide for its carbon content. This is combined with hydrogen and oxygen (derived from water) to produce sugar glucose, the basic food for plants.

However, photosynthesis is not the only process taking place. Plants respire, day and night, taking in air through leaves and through special breathing cells called lenticels, on the roots and trunks. Oxygen absorbed is used as a fuel, as it is in our bodies, for various processes such as growth and repair of tissues.

During the day, while it is photosynthesising, a plant is a net producer of oxygen, as carbon dioxide is split by the plant into carbon (which is utilised) and oxygen, which is expelled. However, at night when there is no sunlight to fuel photosynthesis plants take in oxygen for respiration and expel carbon dioxide which is not needed during the hours of darkness. In this respect, they act rather like animals at night.

In the case of mangroves, the lenticels are connected to a spongy tissue within the above-surface roots. When the roots are covered with water, pressure in this spongy tissue falls as the plant uses up the oxygen. As a result, when the tide falls and the root is uncovered again, the negative pressure leads to air being drawn in through the lenticels.

Grey mangroves growing in coarse coral sand, with lots of air spaces, have been shown to survive when their breathing roots (pneumatophores) were cut off. However, grey mangroves growing in poorly aerated mud died when their pneumatophores were permanently covered with water or sediment.

Grey mangrove

Q Which mosquitoes bite, the males or the females?

A It is the females which bite, because they need the blood for egg production. Not all species feed on human blood — some go for bird, frog, reptile or fish blood and some prefer mammals. The males frequent flowers, feeding on nectar and plant sap.

Tourist talk

ENGLISH	GERMAN	JAPANESE	
termite	Termite	shiroari	シロアリ
mound	Termitenhügel	tsuka	塚
colony	Kolonie	koroni	コロニー
magnetic	magnetisch	jiki no aru	磁気のある
king	König	ou	王
queen	Königin	jou ou	女王
worker	Arbeiter	roudoushya	労働者
soldier	Soldat	heishi	兵士
cellulose	Zellulose	seniso	繊維素
recycle	wiederverwerten	resaikuru	リサイクル

Facts and stats

There are over 2300 species of termites in the world. There are about 350 in Australia, approximately 100 of them living in the Top End. Only about 20 Australian species are pests.

Although most termite species are found in the tropics and sub-tropics, a few species live in Tasmania and some above 1000m in south-east Australia. Soil type seems to play a part in their distribution. The less fertile the soil, the more abundant the termites and vice versa.

Fossil-like termite mounds, thought to be about 13,000 years old, have been found in the Simpson Desert.

There are at least three exotic termite species in Australia while several Australian species have spread overseas, notably to New Guinea and New Zealand, probably carried in timber.

Soldiers and workers of some termite species are known to live for between two and four years.

The most primitive living termite known (*Mastotermes darwiniensis*) is an Australian endemic. It is the only living species in its family — its closest relatives are ancient fossils. It is also one of the greatest pests for humans and, indeed, thrives where there is human disturbance. It has a taste for plastic, leather, wool, bitumen, rubber and even ivory as well as wood and crops. It is also capable of ringbarking trees.

Materials from termite mounds have been crushed and used to pave tennis courts and houses.

Termites in Africa and Asia cultivate fungus gardens, the fungus breaking down plant materials into digestible food. However, these termites are not found in Australia. Fruiting bodies of fungi are sometimes seen sprouting from the sides of Australian mounds, but whether the 'body' of the fungus is used by the termites is uncertain.

Termites can be an aviation hazard, not because they fly but because their mounds can appear almost overnight in the middle of a bush landing strip.

Termites are blamed for adding a considerable amount of methane — one of the greenhouse gases — to the atmosphere. Methane is also produced by cattle and sheep, as food breaks down inside them.

Termite control can take advantage of the insects' habit of removing dust particles by licking each other. Finely powdered toxins, introduced into the colony, cling to termite bodies and are thus ingested by the inhabitants.

Out and about

Tropical Savanna CRC The Cooperative Research Centre for the Sustainable Development of Tropical Savannas funded this issue of *Tropical Topics*. The Centre brings together multi-disciplinary teams of researchers and stakeholders to achieve sustainable conservation and use of Australia's tropical savannas.

Australia's tropical savannas are the vast areas of dense grass and scattered trees that cover almost a quarter of the continent ranging from Townsville on the east coast, across the Gulf of Carpentaria and the Top End over to the Kimberley in WA. The region is home to a rich variety of plants and animals, and its industries of grazing, mining and tourism generate $7.5 billion in income for Australia each year.

Tropical Savannas CRC was established in 1995 under the Commonwealth Government's CRC Program. It is one of 67 CRCs now in operation around Australia. Find out more on the website: <savanna.ntu.edu.au>

Oriental pratincoles arrive in Australia in November and December from their Asian breeding grounds in the northern hemisphere. They spread out across the continent, north of the tropic of Capricorn, and can be seen in large numbers particularly on flat areas surrounding lakes and swamps. These birds are insect feeders, swooping and wheeling on long streamlined wings just a metre or so above the ground, snapping up prey in a manner reminiscent of a swift or swallow. They generally do best on plains country where insects such as grasshoppers can be picked up above the short grass, but are also attracted to recently harvested cane fields in coastal north Queensland which provide similar conditions. Mostly brown in colour, these birds are difficult to see when resting, stationary, on the ground.

On 24 August an 8m **Bryde's whale** died on the mud flats just 2km from central Cairns. An autopsy conducted by the Queensland Parks and Wildlife Service showed that the whale's stomach was tightly packed with plastic. This included supermarket bags, food packaging, three large sheets of plastic 2m x 50cm and fragments of garbage bags. When laid out flat on the floor it covered an area of over four square metres. There was no food in its stomach.

Bryde's whales, like minkes and humpbacks, feed by taking large amounts of water into their mouths and filtering out small fish and other food from it. Unfortunately, plastic and other rubbish in the water is also swallowed and since it cannot be digested or passed, it stays there.

Please be careful with your rubbish, both at sea and on land — a plastic bag dropped in the street can quickly find its way into a stormwater drain which takes it straight to the sea. Please pass this message on to your passengers and let's keep plastic out of the ocean.

Display for loan

The plastic found in the whale has since been cleaned and mounted in a perspex display case. Measuring 85cm by 115cm, this is available for loan to teachers in the Cairns area (transport is the responsibility of the borrower). It is accompanied by a poster showing photos of the stranded whale and the plastic when found at autopsy. Call QPWS on 4046 600 to make a booking.

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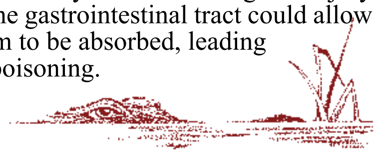
Cocky apple (*Planchonia careya*) trees flower throughout summer. Common in tropical woodlands, these small trees are often to be found in the understorey. Their large white tasselled flowers open at night and are likely to be pollinated by moths. Soon after sunrise they wither and drop to the ground. The green fruits, which follow, look rather like slightly lemon-shaped apples.

The roots and bark from this tree, when crushed and added to pools of water, act as a fish poison. They contain saponin which acts on the respiratory organs of the fish, interfering with their ability to absorb oxygen. The stupefied fish rise to the surface and can be easily scooped out and eaten. Saponins are more toxic to fish than to mammals. When the fish is eaten, the saponins bind to food and are destroyed by stomach enzymes as they pass through the human digestive system — although an injury in the gastrointestinal tract could allow them to be absorbed, leading to poisoning.



Estuarine crocodiles are nesting at the moment. Egg-laying starts in late October and continues for about six months. The female croc builds a mound of vegetation, usually within 10m of permanent water, which helps to keep the eggs above flood levels.

On average, about 50 eggs are laid. The sex of the hatchlings depends on the heat of the nest, produced by decaying vegetation. At 32deg. both sexes are produced but most are male. Higher and lower temperatures result in increasing numbers of females until only females hatch from eggs incubated at temperatures below 30deg. or above 33deg.

The female stays around her nest and digs out the babies when their chirping indicates their readiness to hatch. She then carries them to water where they stay close for about two weeks before beginning to disperse. It is estimated that out of 500 eggs, only two or three will become adult crocs. The rest are eaten by birds of prey, fish (including barramundi), long-necked turtles and other crocodiles, providing a food source for the rest of the ecosystem.

Photo courtesy of The Cairns Post

Bookshelf

Termites of the Top End
A. Andersen and P. Jacklyn
CSIRO press (1993)

This very readable, 32-page booklet is packed with information and good photographs relevant to our region.

Termites (Isoptera) from the Australian Region
G.F. Hill
CSIR, Melbourne (1942)

This is the 'bible' of termite taxonomy and is the only book that attempts an Australia-wide survey of all termite species. Some of the termite names are outdated.

Australian Termites
F.N. Ratcliffe, F.J. Gay and T. Greaves
CSIRO, Melbourne (1952)

A popular survey of the more significant termite species. Useful information on several northern termites.

The Insects of Australia
CSIRO Melbourne University Press (1991)

The first volume has a useful chapter on termites.

Bush Medicine
Tim Low
Angus and Robertson(1990)

This book contains information on traditional medicinal uses of termite mounds.

Nature Australia Vol26 No10
A matter of time
Jim Allen

This article on dating human occupation of Australia, mentions the confusing role of termites.

Australian Journal of Zoology **39**: 569-577 1991
Evidence for adaptive variation in *Amitermes* mounds in northern Australia.
Jacklyn, P.M.

Oecolgia **91**: 385-395 1992
"Magnetic" termite mound surfaces are oriented to suit wind and shade conditions.
Jacklyn, P.M.

Two articles on magnetic mounds.

This newsletter was produced by the Environmental Protection Agency with funding from the Cooperative Research Centre for the Sustainable Development of Tropical Savannas, the Wet Tropics Management Authority and the Great Barrier Reef Marine Park Authority.

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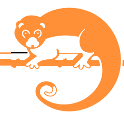

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