Australian Government Bureau of Rural Sciences



Mangroves are important and widespread coastal ecosystems in the intertidal zone of tropical, subtropical and protected temperate coastal rivers, estuaries and bays. Individual species have characteristic tidal-zone or preferred upriver estuarine locations. Australia has around 980 000 hectares of mangrove forests, which is less than 1% of Australia's total forest cover.¹

Australian mangrove forests comprise 41 species from 19 families of plants, which vary with degree of tidal inundation and latitude. More than half the world's mangrove species occur naturally in Australia.

Mangroves live in a constantly changing environment. Typically they are inundated by seawater at high tide, exposed at low tide, and might receive flushes of fresh water, especially during periods of high rainfall. Apart from rapidly altering salinity levels, such influxes of fresh water are often accompanied by significant changes in water temperature.

Mangrove species have specialised dispersal mechanisms. The seeds of many germinate on the tree and remain attached through early development, before falling into the ocean to be washed to distant shorelines, where they may lodge and grow.

White mangrove (*Avicennia marina*) is Australia's most widespread and common mangrove tree species. Several other salt-tolerant species grow in mangrove forests, such as the mangrove palm (*Nypa fruticans*), which occurs in tropical mangrove forests, and the mangrove fern (*Acrostichum speciosum*), which inhabits the mangrove forest floor. In tropical areas, ferns and orchids often grow on the trunks and branches of mangrove trees.

The structure and height of mangrove forests vary with the environment. Mangrove trees are usually between two and 10 metres in height, but in high rainfall areas of far north Queensland they can grow to 30 metres. Mangroves can form dense, almost impenetrable stands of closed forests, often dominated by only one or two species, as well as less dense stands characterised as open forests and, to a lesser extent, woodlands. Closed mangrove forests, which comprise about

1 Australia's definition of forest is 'an area dominated by trees having usually a single stem and a mature or potentially mature height exceeding 2 m and with an existing or potential crown cover of overstorey strata about equal to or greater than 20%.'



Mangrove forest, Lockhart River, northeast Cape York, Queensland.

56% of the total mangrove forest estate, provide coastal protection from storm and wave action. Mangrove trees can live for up to 100 years.

A forest assessment revised the area of mangroves upwards from 749 000 hectares in 2003 to 980 000 in 2008 (Table 1). This is largely explained by an improvement in forest measurement technology, particularly the increasing availability of highresolution remotely sensed data.



Mangrove closed forest.



Dealing with salt

Mangrove species are adapted to tidal inundation and high salinity in coastal estuaries, inlets and bays. They deal with salinity in three ways: by excluding the dissolved salt as their roots absorb water; by absorbing the salt and then exuding it through special glands in their leaves; and by concentrating the salt in bark or older leaves, which carry it with them when they are shed. Some mangroves use only one of these methods, others two or more. A number of features serve to prevent water loss from mangrove plants. These include a thick waxy surface layer, and dense hairs on the leaf to reduce the loss of water through transpiration.



Source: Environmental Protection Agency, Queensland.

Table 1: Area of mangrove forest, 2003 and 2008 ('000 hectares)

	2003	2008	Difference	Difference %
Mangrove forest	749	980	+231	+31

Source: NFI (2003), MIG (2008).

Where are Australia's mangrove forests?

Mangrove forests are widespread in tropical, subtropical and some temperate regions of the world. In Australia, most mangrove forests are located across the tropical north. But there are also isolated stands of one species, the white mangrove, in Victoria, South Australia and temperate Western Australia (Figure 1). The southernmost occurrence of mangroves in Australia is at Wilson's Promontory, Victoria.

In tropical regions, mangrove forests are more diverse and widespread than those in the temperate zone, with the greatest concentration of species along the northeastern coast of Queensland. The number of species decreases further south as a result of lower winter temperatures, and from east to west across the tropics with decreasing rainfall. Some experts consider mangroves to be a special form of tropical rainforest because the two forest types have many families of plants in common. In Australia, however, mangroves are usually considered to be a separate forest type.

Mangrove roots

All plant roots need oxygen to survive. The soft sediments in which mangroves grow, however, are frequently low in oxygen. To cope with this, most mangroves have developed aerial roots (pneumatophores) that rise above the surface of the mud. These take in oxygen, which is then transported to the deeper roots, where water and nutrients are absorbed. The shapes of the aerial roots vary enormously, but the three most conspicuous types are pencil roots (found in Avicennia species), knee roots (found in Bruguiera species) and stilt roots (found in Rhizophora species). The true root systems of mangrove trees are shallow, extending less than two metres below the mud surface, but they spread horizontally in a dense mass over large distances. Many mangrove species have a greater proportion of plant material below the surface than above, a feature that helps them to remain anchored in the soft mud and sand.



Stilt roots, mangrove forest Northern Territory.

Ownership and management

Queensland has the largest area of mangrove forest (44%), while the Northern Territory (37%) and Western Australia (17%) have most of the remainder. More than 34% of the total area is on private land, including Indigenous land (Table 2).

Mangrove management today falls under a wide range of legal jurisdictions. It has been estimated that approximately 18% of Australia's mangrove forest communities are protected in



Mud crab (Scylla serrata), an example of a species living and breeding in mangroves.

national parks and other forms of reserves (MIG 2008). In Queensland, all mangroves are completely protected under the *Fisheries Act 1994*.

Values and uses

Wood

Historically, many mangrove forests have provided useful products such as tannin, poles, firewood, charcoal and, occasionally, milled timber. Australian mangrove forests, however, are no longer harvested commercially for timber.

Environmental

Mangroves play important roles in the ecology of wetlands and estuaries. By reducing the speed of currents and trapping sediments, mangroves protect the shoreline from erosion and help to reduce silt accumulation in adjacent marine habitats. In addition, river-borne nutrients and chemicals are trapped and recycled within these communities. Mangroves are highly valued for their unique biodiversity. They provide habitat and breeding sites for a wide variety of birds, fish, amphibians, insects, small mammals and other aquatic fauna. Several rare species are found in mangrove ecosystems, such as the rusty monitor (*Varanus semiremex*), which utilises the hollows of mature or dead mangrove trees in northeastern Queensland.

The lesser noddy (*Anous tenuirostris melanops*), a sea bird that builds a platform nest out of leaves in mangrove trees, is listed as vulnerable under Australia's *Environment Protection and Biodiversity Conservation Act 1999*.

Table 2: Tenure of mangrove forest, by state and territory, 2008 ('000 hectares)

Tenure	NSW	NT	Qld	SA	Vic.	WA	Australia
Leasehold land	0	56	74	0	0	13	143
Multiple-use public forests	0	0	0	0	0	0	1
Nature conservation reserves	2	5	57	3	2	35	104
Other Crown land	0	5	89	1	0	114	210
Private land	1	248	83	0	0	2	335
Unresolved tenure	2	44	132	10	0	0	188
Total	5	359	436	14	2	164	980

Note: Totals may not tally due to rounding. The six forest tenure categories above are defined in MIG (2008, pp xvii–xviii). Source: MIG (2008).

Indigenous uses

Mangroves are an important resource for Indigenous people, particularly in the Northern Territory, providing honey, fruit and medicines. Mangrove worms, found within decaying mangrove wood, are collected for food. The timber is used for implements, firewood and construction. Indigenous Australians harvest many edible fish and shellfish from mangrove ecosystems.

Shell middens

Shell middens are places hundreds to thousands of years old where the debris from shellfish and other food has been discarded by Indigenous people over very long periods. Middens in mangroves contain shellfish remains, the bones of fish, birds and land and sea mammals, charcoal from campfires, and tools made from stone, shell and bone.

Other uses

One of the key beneficiaries of mangroves is the fishing industry. Mangrove forests constitute breeding nurseries for a high proportion of Australia's commercial and recreational fish catch, including barramundi (*Lates calcarifer*) and banana prawn (*Penaeus merguinensis*). An estimated 75% of the fish and prawns caught for commercial and recreational purposes in Queensland spend at least part of their lifecycles in mangroves.

Mangroves also provide protection for both the natural and built environments from waves and storm surges.

Some species have leaves that are palatable for livestock when other food is unavailable.

Mangrove forests provide a focus for tourism in some coastal communities. Boardwalks in particular are popular with tourists and provide an opportunity for educating people about the ecological and economic importance of mangroves.

Mangrove forests in a changing environment

Mangrove forests are naturally dynamic environments, subject to periodic fluctuations in climate and ever responsive to changes in sea level. Because of the longevity of individual mangrove trees they can provide a record of the effects of past changes in environmental conditions and of human influence in their structure and composition.

Mangrove communities interact closely with other tidal vegetation, such as saltmarsh. There is evidence that these two ecosystem types cycle from one to the other depending on the amount of freshwater flushing that occurs, which in turn depends on changes in rainfall over nearby land.

The future of mangrove forests in Australia is uncertain. While they demonstrate extraordinary adaptations to the estuarine environment, it is expected that changes such as sea level rise and increased storm severity as a result of climate change will challenge their existence in some areas. They also face increasing pressure from coastal urbanisation.

References and further reading

Boland D, Brooker M, Chippendale G, Hall N, Hyland B, Johnston R, Kleinig D, McDonald M and Turner J (2006). *Forest Trees of Australia*, 5th edition, CSIRO Publishing, Australia.

Duke N (2006). *Australia's Mangroves: The Authoritative Guide to Australia's Mangrove Plants*, University of Queensland, Brisbane.

FAO (2007). *The World's Mangroves*, FAO Forestry Paper 153, Food and Agriculture Organization of the United Nations, Rome, Italy.

Lovelock C (1999). *Field Guide to the Mangroves of Queensland*, Australian Institute of Marine Sciences, Townsville.

MIG (Montreal Process Implementation Group for Australia) (2008). *Australia's State of the Forests Report 2008*, Bureau of Rural Sciences, Canberra.

NFI (National Forest Inventory) (2003). *Australia's State of the Forests Report 2003*, Bureau of Rural Sciences, Canberra.

Northern Territory Government (2002). *Mangrove Management in the Northern Territory*, Department of Infrastructure, Planning and Natural Resources, Darwin.

Websites

www.aims.gov.au

www.daff.gov.au/forestsaustralia

www.epa.qld.gov.au/nature_conservation/habitats/wetlands/ wetlands_habitats/mangroves

© Government of Australia 2008

The Australian Government acting through the Bureau of Rural Sciences has exercised due care and skill in the preparation and compilation of the information and data set out in this publication. Notwithstanding, to the maximum extent permitted by law, the Bureau of Rural Sciences, its employees and advisers disclaim all liability, including expense or cost incurred by any person as a result of accessing, using or relying upon any of the information or data set out in this publication.

This is one in a series of profiles on Australia's major forest types. It has been compiled by the Bureau of Rural Sciences (lead authors: Kirsty Wilkes and Adam Gerrand) using information from the Australia's State of the Forests Report series. The latest in this series, *Australia's State of the Forests Report 2008*, and the profiles, can be obtained from:

BRS Publication Sales

 GPO Box 858, Canberra ACT 2601

 Ph:
 1800 020 157

 Fax:
 02 6272 4747

 Email:
 salesbrs@brs.gov.au

 Web:
 www.brs.gov.au

Contact details Bureau of Rural Sciences

GPO Box 858, Canberra ACT 2601

Other titles in this series are: Acacia, Australia's forests, Callitris, Casuarina, Eucalypts, Melaleuca, Plantations, Rainforest.

More information on forest issues is available at www.daff.gov.au/forestsaustralia