

Chapter 6: Biodiversity

6.1 Summary and indicators

6.1.1 Summary

Biodiversity is a measure of the number and abundance of different species. These measures reflect the health and stability of ecosystems. It is much more than a tally of rare or threatened species. However, there is little data compiled on the abundance of each species and therefore care needs to be taken when using species number as an indicator of biodiversity. Data are required on the relative abundance of species.

State

Southeast Queensland (SEQ) and the City of Gold Coast have a large range of ecosystems and habitats. The Gold Coast contains many areas of ecological significance to SEQ and the World; is possibly the most biodiverse city in Australia and has more bird species than Kakadu. In total there are at least 2680 vertebrate animal and vascular plant species on the Gold Coast and in the surrounding marine and freshwater environments. There are also many invertebrate species (insects etc.) and non-vascular plants (fungi etc.) but data on these species is less prevalent.

This biodiversity is underpinned by the extensive areas of remnant bushland on the Gold Coast. There is currently some 72,250ha, or approximately 50% of the Gold Coast, covered by remnant bushland. Most of this area is considered to have regional ecological significance to SEQ and is in large or interconnected parcels. Of the total bushland only around 10% is committed to development, but a further 28% is highly likely to be affected by development of some kind. The conversion rate of land to urban uses appears to be around 300ha per year. Some 35% of the vegetation is completely protected by State and Council provisions and the remaining 27% is not likely to be developed.

Pressure

Despite these encouraging statistics there are many species that are rare, threatened or endangered in the City. There are 76 known animal species and around 160 known plant species recognised, under legislation, as being at risk.

Clearing and habitat destruction, which is the primary threat to biodiversity, is often associated with the growth of the City. This growth is largely due to the lifestyle and leisure-based development of the City. Road traffic and inappropriate fire regimes are examples of a number of other factors associated with urban and non-urban land management practices that threaten biodiversity.

Response

There are a range of levels of protection afforded to the biodiversity of the area by governments, including Federal laws and agreements, State laws and Crown land, National parks and reserves, Council local laws and policies. The most effective protection of biodiversity, other than quarantining land into parks and reserves, was found to be local structure plans, open space provisions, and the incorporation of

environmental objectives into the strategic plan. In addition to vegetation protection, the Council also actively controls declared pest animal and plant species on Council-owned and Crown lands in catchments and waterways.

The Council is also developing a new Planning Scheme, vegetation policies, fire management plans and a Nature Conservation Strategy which are consistent with the conservation of biodiversity in the City. There are other groups working to conserve the biodiversity of the City as well as Council. This includes community groups, private research foundations and State Government Departments. Their work contributes extensively to the knowledge base of the area and to the recovery of several threatened species.

Conclusion

Recent studies have shown the Gold Coast to have a higher diversity of land based species than Kakadu. Other studies have listed many species that exist in the waterways of the City. However, the level of knowledge and understanding that exists about these species is mainly restricted to vertebrates and vascular plants. To gain a clearer picture on the biodiversity of the City information is required on identifying key species, functions and relationships between them and their relative abundance. Information is also required on invertebrates animals, non-vascular plants and marine and aquatic organisms. There are also problems in identifying the relevant authorities for recovery plans for threatened species.

6.1.2 Indicators

Sub-theme	Indicators
State- ⇒ Current diversity, range, abundance and conservation status of native species.	Local native plants and animals (list and chart by category eg. vulnerable etc.) Natural vegetation cover (total ha, and % remaining, no and size of fragments). Corridors and high sensitivity habitat (total ha, no. and size of fragments, condition and integrity, conservation status. Indicating changes over time)
Pressure- ⇒ Introduced species	Species diversity (no. and % of total species, range and abundance of introduced, naturalised plant (weed) and pest animal species.
Pressure- ⇒ Land Clearing	Area of native vegetation proposed for clearing Disturbance of wildlife corridors
Pressure- ⇒ Hunting/ fishing/ harvesting of native species, river dredging, Wetland draining, recreational activity, noise etc.	Annual catch/harvest (by estimated total no. / area affected)
Pressure- ⇒ Fire	Fires (cause/extent/intens./freq./ man.)potential impact on native vegetation and fauna
Current Response- ⇒ Reservation and planning controls	Listed areas of local, state, national or world heritage significance Area protected by planning controls as a % of total. Area not yet protected under threat from development
Current Response- ⇒ Recovery plans	Funds for species/habitat conservation, by source, annual total and area
Current Response- ⇒ Fire management plan	Areas affected by fire management plans methods of hazard reduction used
Current Response- ⇒ Introduced species control plan	Annual funding and area affected

6.2 Introduction

Biodiversity is a measure of the number and abundance of different species and reflects the health and resilience of ecosystems (Odum 1972). It is not the same as counting the number of rare and threatened species, although there is often a relationship. The loss of a single species, while undesirable, may not significantly affect the biodiversity of an area. However, the reasons that species are threatened may indicate threats posed to the overall biodiversity of an area, eg, clearing of remnant bushland which reduces the habitat available to native species.

Southeast Queensland (SEQ) has a large range of ecosystems and is home to a wide variety of species. These systems have evolved on the underlying geology and in response to altitude, aspect and climate. They comprise a wide variety of habitats and niches for plants and animals and include rainforest, eucalypt forest and woodland, melaleuca forest and woodland, heath-lands and mangrove wetland, as well as littoral zones, and freshwater and marine environments (Catteral and Kingston 1993, M. Maher and assoc. *et al.* 1997).

On-land, these habitats are largely associated with remnant vegetation especially bushland. Although different to natural systems, urbanised systems can also be surprisingly biodiverse. Prior to European settlement much of SEQ was forest or bushland of some type. Large scale clearing for agriculture has removed much of this cover and significantly reduced the area of bushland. Currently there are about 656,800ha of remnant bushland in SEQ, or about 35% of the 1,879,60ha area (Catteral and Kingston 1993). Remnant bushland is critical in stabilising and increasing genetic, species and ecosystem diversity. Such an action is also believed to be essential to the overall survival of human kind (Miller 1992).

The City of the Gold Coast is comprised of the former Albert Shire and the former Gold Coast City. It occupies the southeastern corner of SEQ. The Gold Coast is recognised to contain key areas of SEQ's remnant vegetation and environment. It contains representatives of many of the habitats of the region from estuarine and marine, to coastal dunes and floodplains, and to coastal hills and mountains. The Gold Coast also lies within a zone called the Macleay Overlap (Burbidge 1960) where many tropical species can be found as well as temperate. This overlap occurs because the climate of the area is influenced by both temperate and tropical weather systems. As a consequence of this, the Gold Coast has one of the widest diversity of species in SEQ.

The key to the maintenance of this biodiversity lies in the protection of the habitats of these plants and animals. These habitats exist in the areas of remnant bushland, including the forests, mangroves and the seagrass beds, and offshore in the bays, waterways, beaches and the reefs. Indicators for biodiversity generally relate to the area of habitat available, as well as to the number and abundance of key species.

This chapter discusses key indicators for the biodiversity of the City using the State-Pressure-Response model, while there is coverage of all ecosystems there is a particular emphasis on land based ecosystems.

6.3 State

6.3.1 Species diversity

It should be noted that species diversity is only one component of biodiversity. The other main component being relative abundance of different species. Unfortunately there are few data on this and most data relate to single species or vegetation communities. Data is required on the relative abundance of species on the Gold Coast

The Gold Coast is possibly Australia's most biodiverse city. There are a total of some 2,680 known plants and animal species in the City. This figure excludes fungi and invertebrates (insects, shellfish and crustaceans) and non-vascular plants (fungi, mosses and lichen) but does include 641 land and freshwater vertebrate species in 127 families (including marine mammals and reptiles), 674 marine fish species in 123 families, and 1,638 plant species in 157 families. Table 6.1 presents the number of known vertebrate species from the Gold Coast by order and by conservation status eg, endangered, vulnerable, rare and common. Table 6.2 presents equivalent information for vascular plants. The data in Tables 6.1 and 6.2 demonstrate the variety and significance of the regions biological resources.

Invertebrate and non-vascular species were not included in Tables 6.1 and 6.2 because of the scarcity of reliable data.

However, there are at least three invertebrates of particular significance in the City. These are:

- Illidge's Ant-blue Butterfly (*Acrodipsas illidgei*). Endangered species that lives near mangroves;
- Richmond Birdwing Butterfly (*Ornithoptera richmondia*). A vulnerable species of rainforest dependant on *Aristolochia praevenosa* and *A. leheyana*; and,
- Lamington Spiny Crayfish (*Euastacus sulcatus*). A spectacularly blue coloured crayfish the lives in mountain streams in the rainforests of the McPherson range.

The Wet Tropics of North Queensland has been shown to have the greatest variety of vertebrate species than anywhere else in Australia. The next most diverse area was Southeast Queensland (Pianka and Schall 1981).

It is not possible to distinguish between the two major cities in SEQ, Gold Coast and Brisbane, as to which may be the most biodiverse. The Gold Coast exceeds even Kakadu in terms of bird species (323 different species) and Brisbane in terms of rainforest mammals. However, Brisbane has a greater range of species from more western areas that move along the Brisbane River Valley (M. Maher and assoc. *et al.* 1997). Details of these species can be found in the Nature Conservation Strategy documents by M. Maher and assoc. *et al.* (1997) for the City of Gold Coast.

The Gold Coast is also home to 76 known rare or threatened animal species (Appendix 6A) and 158 known plant species (Appendix 6B). Some of these species are unique to the Gold Coast, such as the Golden Swamp Wallaby on South Stradbroke.

Table 6.1: Number of vertebrate-fauna species in the Gold Coast area

Data format : Expected
(observed)

Adapted from M. Maher and assoc. *et al.* (1997) and CFA Research Foundation Project report 1993-1996.

Class	Introduced species	Common	Species of special significance	Rare*	Vulnerable*	Endangered*	Total species	No. of Families
Amphibians	1 (1)	32 (25)	0	6 (5)	3 (1)	2 (2)	44 (34)	3
Birds	6 (6)	289 (258)	53 (42)	18 (10)	9 (6)	5 (1)	380 (323)	81
Mammals (including marine)	11 (9)	66 (57)	3 (3)	4 (2)	2 (1)	0	84 (72)	24
Reptiles (including marine)	1 (0)	89 (64)	0	6 (6)	0	1 (1)	96 (71)	12
Freshwater Fish	4 (3)	33 (22)	0	N/A	N/A	N/A	37 (25)	19
Marine Fish (observed only)	0	674 (674)	0	N/A	N/A	N/A	674 (674)	123
Total Vertebrates (Terrestrial and Freshwater only)	22 (19)	509 (426)	56 (45)	32 (23)	14 (8)	8 (4)	641 (525)	139
Total Vertebrates (including marine fish)	22 (19)	1183 (1100)	56 (45)	32 (23)	14 (8)	8 (4)	1315 (1199)	262

* Status based on statewide distribution may or may not be less common on the Gold Coast

Table 6.2: Number of vascular plant species observed in the Gold Coast area

Adapted from M. Maher and assoc. et al. (1997), Ecograph and M. Maher and assoc. et al.(1997), and information from the Queensland Herbarium.

Class	Introduced species	Common	Species of special significance	Rare*	Vulnerable*	Endangered*	Total species	No. of Families
Angiosperms (flowering Plants)	10	1362	34	53	45	14	1506	128
Gymnosperms (Conifers)	2	4	0	1	0	0	5	3
Pteridophytes (Ferns)	0	122	2	3	0	0	127	26
Total	200	1488	34		45	14	1838	157

* Status based on statewide distribution may or may not be less common on the Gold Coast

Furthermore the Gold Coast includes an area of wallum heath (Pine Ridge Reserve) which supports unique frogs and fish, and areas of high-altitude rainforest adjoining the McPherson Range which is the richest area for rainforest species, outside the wet tropics, in Australia. These rainforest areas are home to some unique animals and are of National and International significance.

The waters of the Gold Coast also contain over 674 vertebrate marine species (CFA Fisheries Research Foundation 1996). The City incorporates significant marine and estuarine habitats, particularly the Ramsar listed wetlands of the Moreton Bay Marine Park.

6.3.2 Remnant bushland

The biodiversity of the Gold Coast area, both natural and urban, is underpinned by the high proportion of remnant bushland. The City of Gold Coast represents only about 7.2% of the area of SEQ, but it contains 7.8% of SEQ 's remnant bushland (Catteral and Kingston 1993). Compared to other local authority areas in the region the City of Gold Coast has quite a high proportion, nearly 50%, of its total area covered by remnant bushland (M. Maher and assoc. *et al.* 1997). Table 6.3 below divides the area of the City of Gold Coast into that cleared for use by man, and that remaining under remnant bushland and other natural systems such as sea grasses etc.. Areas of mangrove are considered as remnant bushland. National parks and reserves comprise only 9% of the City's total area and represent 18% of the remnant bushland.

Table 6.3: Summary of vegetation cover within the City of Gold Coast

(Adapted from M. Maher and Assoc. 1996, Table 3, p16)

Vegetation type	Area (ha)	% of City area
Remnant Bushland*	72,405	49.9
Other Natural Systems**	3,482	2.4
Cleared/Human dominated	69,213	47.7
Total	145,100	100.0

*may include regenerated bushland containing native or in some cases exotic species.

** seagrass beds and naturally bare areas such as beaches, wetlands and mudflats.

This remnant vegetation is comprised of 11 different community types as described by M. Maher and assoc. *et al.* (1997). Table 6.4 presents the major community types represented in the Gold Coast remnant bushland. The most extensive are the Eucalypt forests which cover over one third of the City.

Table 6.4 Area of the Gold Coast occupied by each major vegetation community type

(Adapted from M. Maher and Assoc. 1997, Table 5 p.18)

Major community type	Area within City (ha)	% of City	% of Undisturbed area
Mountain Heath	14	0.01	0.02
Black She-oak &/or Wattle Forests and Scrub	17	0.01	0.02
Freshwater Wetlands	108	0.08	0.14
Naturally Bare Areas	139	0.10	0.18
Melaleuca Forests	1,108	0.80	1.47
Riparian Complexes	2,071	1.40	2.74
Coastal Complexes (including wallum heath)	2,340	1.60	3.09
Rainforests	8,619	5.90	11.41
Estuarine Complexes	8,938	6.20	11.81
Eucalypt Forests	52,267	36.00	69.11
Disturbed Communities	69,473.9	47.90	N/A
TOTAL	145,100.0	100.00	100.0

The remnant vegetation of the Gold Coast contains many species which are rare or threatened in Southeast Queensland (SEQ) but which may be relatively prevalent in this City. Table 6.5 presents the areas of remnant vegetation in the Gold Coast that represent SEQ ecosystems with different regional conservation status ie, either endangered, vulnerable, or concern, or no concern at present. Over 52% of the Gold Coast is covered by native bushland, although this figure includes regrown bushland and native plantations. It was not possible to separate regrowth from true remnants at the scale of the study undertaken. The data in this table demonstrate the relative importance of the bushland of the Gold Coast to conservation in SEQ. The slight differences in the area attributed to human dominance in Table 6.5, compared with Table 6.3, is due to shifts in classification of vegetation. For example, areas of plantation timber are of no-concern but also form part of SEQ vegetated ecosystems. These were included as non-remnant bushland in Table 6.3. It should be noted that areas currently of no concern may contain endangered species or species critical to the survival of other vulnerable or rare species.

Table 6.5: Area of Gold Coast remnant vegetation that represents Southeast Queensland (SEQ) ecosystems of different endangered status(adapted from M. Maher and assoc. *et al.* 1997, Table 6, p20)

SEQ Regional conservation status	Area (ha)	% of City area	% of Remnant vegetation
Endangered	10,156	7.0	13.3
Vulnerable	1,016	0.7	1.1
Of Concern	6,820	4.7	9.0
No Concern at present*	58,766	40.5	76.7
Total of Remnant Vegetation	75,758	52.9	100.0
Human Dominated Area	69,342	47.1	N/A
Total Area of City	145,100	100.0	N/A

* includes native and exotic plantations

Table 6.6 combines the information from the preceding tables and presents the remnant bushland City of Gold Coast in terms of their ecological significance. This is based on the criteria given at the base of the table. Nearly 45% of the City is covered in regionally significant vegetation. This statistic highlights the importance of the biological assets of the Gold Coast area to the City, and to the region.

Table 6.6 Ecological significance of remnant vegetation to Gold Coast
(adapted from M. Maher and assoc. *et al.* 1997, Table 8, p.24)

Ecological significance	Area (ha)	% of City area	% of Remnant vegetation
Regionally Significant Natural Areas	65,021	44.9	86.3
Core Ecological Areas	4,098	2.8	5.4
Major Remnants, Corridors and Other Natural Areas	6,261	4.3	8.3
Isolated Small remnants and Urban Woodland	191	0.1	0.3
Total of Remnant Vegetation	75,381	52.1	100.0
Human dominated areas	69,151	47.8	N/A
Total Area of City	145,100	100.0	N/A

- **Regionally significant natural areas**

- fragment >500ha or,
- an endangered regional ecosystem and an area >2ha or,
- within remnant >5ha or,
- within Cluster >50ha or,
- estuarine Complexes.

- **Core ecological areas-**

- fragment between 25ha and 500ha or,
- vulnerable /of concern regional ecosystem >5ha.

- **Major remains, corridors and other natural areas**

- remnant size 5-25ha or,
- community diversity >2 species or,
- vulnerable /of concern regional ecosystem <5ha or,
- Riparian Complexes or,
- wetland Complexes or,
- rocky intertidal areas or,
- cluster size >50ha,
- not urban woodland.

- **Isolated small remnants and urban woodland**

- urban Woodland or,
- all remaining

6.4 Pressure

6.4.1 Species diversity

The number of non-native species that exist in the City apply pressure to the ecosystem and affect the sustainability of the environment.

There have been 22 non-native vertebrate species introduced to SEQ. These include the fox, pig, cat, dog, and cane toad. Introduced species represent 4% of the total number of terrestrial and freshwater vertebrates in the region.

There are some 100 species in SEQ that are considered environmental weeds in SEQ (QLD Herbarium 1997). There are a further 20 species identified as noxious weeds (Dept of Natural Resources 1997). This represents 11% of the total plant species of the region.

Table 6.7 lists the weed species that are declared under the provisions of the Rural Lands Protection Act 1985 and are considered to be established in the City.

Table 6.7 Declared weed species (Rural Lands Protection Act 1985) considered to be established in the City of Gold Coast

Plant	Infestation	Comment
Groundsel Bush (<i>Baccharis halimifolia</i>)	Moderate	Decreasing area affected Successful control program
Annual Ragweed (<i>Ambrosia astemisiifolia</i>)	Moderate	Drought suspected of giving false impression of the problem
Fireweed (<i>Senecio madagascariensis</i>)	Moderate/Significant	Newly established weed which is difficult to control. Possibly increasing
Giant Ratstail Grass (<i>Sporobolus pyramidalis</i> and <i>S.natalensis</i>)	Light	Recently established weed Potential for increase if not checked. Little evidence of increase at this stage.
Bitou Bush (<i>Chrysthanemoides monilifera</i>)	Negligible	Very successful control program
Salvinia (<i>Salvinia molesta</i>)	Moderate	Decreasing. Successful control program.
Water Hyacinth (<i>Eichornia crassipes</i>)	Moderate/Significant	Control program less effective due to nature of plant.
Water Lettuce (<i>Pistia Stratiotes</i>)	Negligible	Successful control program
Senagal Tea Plant (<i>Gymnocoronis spilanthoides</i>)	Negligible	Newly established weed. Successful control program keeping the plant in check.

6.4.2 Habitat destruction

Australia's State of the Environment Report for 1996 (SOE 1996) identified a number of threats to Australian vertebrate species. Table 6.7 provides this list. The impacts of clearing and habitat destruction are identified as affecting the largest number and range of species (M. Maher and Assoc. 1997).

Table 6.8: Threats to the survival of native Australian vertebrates
(adapted from SOE 1996)

Threat	Threat	Threat
Habitat Clearance, destruction and/ or fragmentation	Environmental weeds	Exploitation
Altered fire regimes	Forestry and agricultural operations	Visitor disturbance
Grazing and/or trampling and pasture development	Changed Hydrology	Urbanisation
Fishing	Climate variations	Mining and removal of bush rocks
Disease	Shortage of nest sites	Loss of genetic diversity
Pollution and water quality	Predation and competition	Road kills
Erosion and soil degradation	Introduced exotic and native species	Geomorphoc alterations

Much of the clearing in SEQ, and on the Gold Coast, occurred as many as 100 years ago when land was being cut for timber and developed for agriculture throughout the state. At that time the low-fertility, the non-alluvial soils of the coastal lowlands were not considered productive and mostly remained uncleared, as did the less accessible areas of the ranges and mountains. None-the-less, today large areas of bushland are still being cleared. This clearing is mainly for urban development and is mainly in the lowland areas of bush on freehold land adjacent to the Coast (Catteral *et al.* 1995).

Some 300ha per year is developed for urban uses. However, only some of this is derived from remnant vegetation. There is no clear data as to the rate of land clearing, or the amount proposed to be cleared each year. However, Table 6.9 identifies the area of remnant vegetation that is likely to be affected by development. This data was derived from a spatial analysis of the remnant vegetation and the different levels of planning protection afforded under the various Federal, State and Local Government controls. These data show that one third of the remnant bushland is not at risk of being affected by development and a further 27% of the bushland is likely to be unaffected. However, just over one third of the remaining bushland is either committed to development or highly likely to be developed.

The development of the Pacific Motorway up-grade is expected to result in some disturbance to wildlife corridors, particularly around the Smith Street area. However, as the highway will be using the existing road easements disturbance will be minimised. However, extra traffic and noise may make the highway a greater barrier than it already is.

In specific locations, however, the upgrading will improve the function of key corridors, such as the Pimpama River and Coombabah Creek, through the design of wildlife underpasses (Rust PPK 1997). It should be noted that the performance of these corridors has been compromised by the existing rail and road corridors.

Table 6.9: The area regional significance and likelihood of remnant bushland being developed on the Gold Coast.

(adapted from M. Maher and assoc. *et al.* Vol 1 Table 15, p.42)

Likelihood of development	Highest level of Ecological significance to SEQ	Area (ha)	% of City area	% of Remnant bushland
Already Committed	Regional and Core	7,375.3	5.1	10.1
High Likelihood	Regional	20,418.2	14.1	28.2
Low Likelihood	Regional	19,694.9	13.7	27.3
No likelihood	Regional	24,762.5	17.3	34.6
Other Bushland	Isolated	154.0	0.1	0.2
TOTAL		72,404.9	49.9	100

Another form of habitat disruption in the Gold Coast is through the regular dredging of the Nerang River and other estuaries. This dredging serves to rejuvenate the coastal beaches, establish navigation channels and to maintain the functionality of the canals and waterways. However, the operation can be extremely disruptive to benthic plants and animals that live on the bottom of the waterways.

There are no quantitative data on the impacts of these practices on the Gold Coast. Anecdotal evidence suggests that there has been significant disruption to the sea grass beds of the Broadwater since first settlement due to a combination of practices. All canals are dredged every three years on a rotational basis. Most of the dredging in the rivers and estuaries is in the tidal deposits in estuary mouths. This may allow time for benthic organisms to re-establish between dredging operations, or they are used to regular disruption due to storm and tidal flows.

The Gold Coast, like many coastal towns and cities along the eastern seaboard has many significant wetland areas. In the past many of these areas were drained for agriculture and have subsequently been developed as urban areas. While there are currently no plans to drain existing wetlands there is still considerable pressure on these areas, particularly where they are adjacent to areas of urban development. Figure 6.2 shows the extent of wetland areas on the Gold Coast. These areas include the six fish habitat areas of the Southern Moreton Bay (Fisheries Act 1994) and some Ramsar sites.

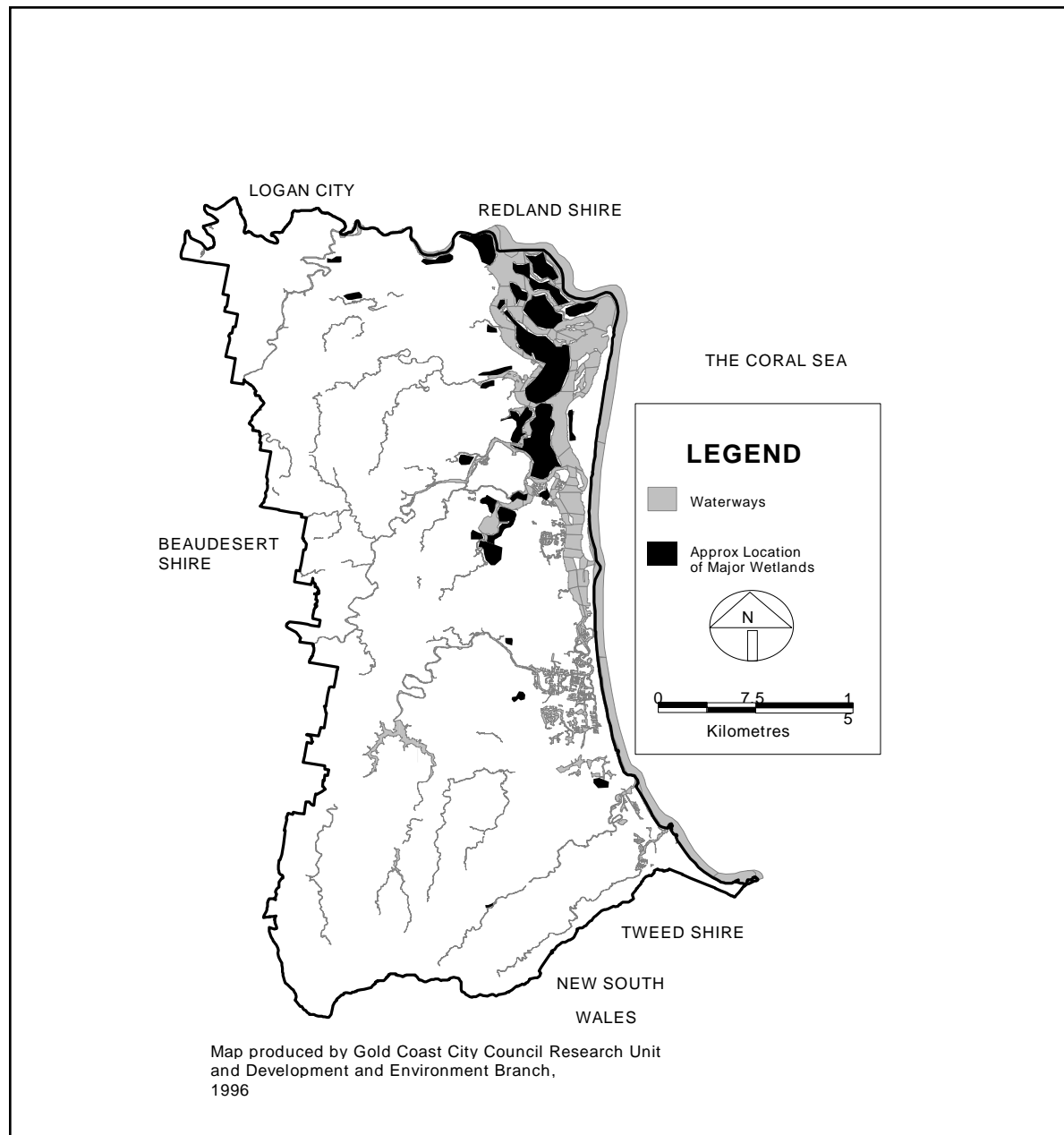


Figure 6.2: The wetland areas of the Gold Coast.

6.4.3 Hunting/fishing/harvesting of native species (including injured animals)

The main form of harvesting native species on the Gold Coast is by fishing. There is no significant hunting of land-based native species in the City. There is both commercial and recreational fishing practised along the coast. However, the scale of the commercial operation is small by comparison to Moreton Bay. None-the-less significant commercial catches of fish are made along the coast between Jumpinpin and Cook Island, and in Southern Moreton Bay. These catches include crustaceans, mullet, bream, flathead, whiting, garfish, John Dory, mackerel, luderick, sharks and rays (QFMA 1997). The data from commercial fishing is ambiguous due to changes in methods and equipment being used to catch the fish. However, the data appear to indicate a slow decline in catch for flathead (*Platycephalus australis*), non-trawled whiting (*Sillago* species) and luderick (*Girella tricuspidata*). Catches for other species appear steady. There are few reliable data for the recreational fisheries (QFMA 1997).

Some data on recreational catches from charter boats operating off the Gold Coast has been gathered by a private research group. Table 6.10 presents a summary of catch data for popular fish species from charter vessels over the period from July 1993 to September 1996.

Table 6.10: Catch data for popular fish species on the Gold Coast (Cook Island to Jumpinpin) for the Period July 1993 to Sept 1996

(Source: CFA Research Foundation project Report 1993-1996)

Statistic	Number
Trips Undertaken	3,107
Net Anglers Fishing	16,533
Weighted Angler Hours	78,474
Total Catch number*	83,933
Fish/ Angler hour	1.07

*Snapper, Pearl Perch, Jobfish, Teraglin, Yellowtail Kingfish, Others

Snapper was the most frequently caught fish (38,599 or 46% of catch) followed by teraglin (10,526), pearl perch (8,937), yellowtail kingfish (2,934) and jobfish (2,790). There were 20,137 fish caught of a variety of other species. There are limited data on the impacts of these pressures on the resource.

Table 6.11 compares the number of specimens brought into the Currumbin Sanctuary by the public from 1989 to 1995. These animals are often injured and the data show a dramatic increase in the number being brought in recent years. This increase may be due to levels of development and traffic on the Gold Coast. However, there has also been an increased awareness of, and concern for, native and introduced fauna. Hence, it is difficult to draw clear conclusions from these data other than there has been a significant increase in animal donations over recent years. These data do not include those animals taken to David Fleays Wildlife Park, volunteer groups or Dreamworld.

Table 6.11: The number of public donated specimens and species given to the Currumbin Sanctuary for the Period 1989-1995 (Source Currumbin Bird Sanctuary)

Year	Number of species	Number of specimens
1989	155	887
1990	157	1030
1991	170	1275
1992	190	2088
1993	205	2663
1994	226	3733
1995	225	3913

The City Council is obliged to control the mosquito population in and around urban areas under the Health Act 1937 (Health Regulation of 1996, part 8) which places the onus on Local Authorities to control mosquitoes for health reasons. The high growth rates in the City's population and the increased level of development adjacent to waterways increases the risk to human health of mosquito borne diseases. However, to control the mosquitos sometimes requires the use of chemicals which can harm other species.

To reduce the likelihood of non-target species being affected, the Council's Pest Management Unit uses integrated pest management techniques and is trialing a range of different chemicals as well as trialing non-chemical methods of control such as habitat modification to reduce the number of mosquitoes. The Council also spends around \$1,000,000 per year in controlling mosquitos in the City.

6.4.4 Fire

The cause of bushland fires on the Gold Coast have been identified as being:

- re-ignition of previous fires
- drought
- vandalism
- sparks from other fires
- lightning strike
- burn-off

Table 6.12 lists the location and nature and area of bushfires on the Gold Coast for the period July 1995 to June 1996. There were a total of 50 fires over this period, 14 burn offs, 3 scrub fires, 31 bushfires and 2 grass fires. There is little data on the intensity of these fires.

6.5 Response

6.5.1 General governmental response

The biodiversity of the Gold Coast is protected through the protection of critical species from hunting and removal from the wild, and through the preservation of vegetation and habitat. Biodiversity in the City is protected to varying degrees by legislation and policy of Federal and State Governments and the Gold Coast City Council.

The Commonwealth Government has established strategies for ecologically sustainable development, which have as a basic principal the conservation of biological diversity. There are many other agreements and laws at the Federal level which foster this aim, such as the Inter-Governmental Agreement on the Environment, the Ramsar Convention on Wetlands, and the Japan-Australia and the China-Australia Migratory Birds Agreements (JAMBA and CAMBA). However, many Federal laws devolve responsibility to State and Local Government.

The Queensland Nature Conservation Act (1992) seeks to conserve the nature-based assets of the State through:

- gathering of information and community education;
- dedication , declaration and management of protected areas;
- protection of native wildlife and its habitat;
- ecologically sustainable use of protected wildlife and areas;
- recognition of interest and involvement of Aboriginal and Torres Strait Islanders in conservation;
- cooperative involvement of landholders;
- community participation.

Table 6.12 : Location, date type and extent of bushfires in the City of Gold Coast for July 1995-June 1996 (Source Gold Coast rural Fire brigade)

Location	Date	Type	Area (ha)
Bonogin Valley	August 1995	Bush Fire	0.5
	April 1996	Scrub Fire	115.0
Cedar Creek/Wolfdene	August 1995	Bush Fire	n/a
	September 1995	Bush Fire	40.0
	October 1995	Burn Off	n/a
	April 1996	Bush Fire	25.0
Coomera Valley	January 1995	Bush Fire	0.5
	August 1995	Scrub Fire	
Gilston - Advancetown	September 1995	Burn Off	n/a
	October 1995	Burn Off	n/a
	October 1995	Bush Fire	n/a
	April 1996	Burn Off	n/a
	April 1996	Bush Fire (x8)	n/a
Lower Beechmont	April 1996	Bush Fire	30.0
	April 1996	Bush Fire	200.0
Ormeau	July 1995	Bush Fire	n/a
	August 1995	Burn Off	n/a
	September 1995	Burn Off	n/a
	October 1995	Burn Off	n/a
Rocky Point	April 1996	Bush Fire	2.0
Springbrook	July 1995	Burn Off (x2)	n/a
	August 1995	Bush Fire	14.0
	October 1995	Burn Off	n/a
	November 1995	Burn Off	n/a
	November 1995	Bushfire	n/a
	October 1995	Bushfire (x2)	n/a
	April 1996	Burn Off (x2)	n/a
April 1996	Bushfire (x2)	n/a	
Tallebudgera Valley	July 1995	Burn Off	n/a
	July 1995	Bush Fire	20.0
	August 1995	Bush Fire (x2)	n/a
	September 1995	Bush Fire	1.0
Wasp Creek	July 1995	Scrub Fire	n/a
	October 1995	Bush Fire (x2)	n/a
	April 1996	Bush Fire	n/a

In addition to specifically protecting a number of species, the Act covers a range of protected areas from National and Conservation Parks, to Resource Reserves and Nature Refuges, to Conservation and Wilderness Areas, to World Heritage and International Agreement Areas.

Some other important State Government Acts and plans that affect the biodiversity of the area include the Moreton Bay Strategic Plan, SEQ2001, Fish Habitat Areas (QLD Fisheries Act 1994), Rural Lands Protection Act, Environment Protection Act, Soil Conservation Act and the Water Resources Act.

Table 6.13 lists the most important areas of biological interest on the Gold Coast and attempts to identify the current avenues under which these particular areas are protected. The table reinforces the findings of M. Maher and assoc. *et al.* (1997) that there are already many instruments to protect natural areas but that some are more effective than others and some more effectively used than others.

There are also a range of planning tools which can be used by local government in Queensland to protect wildlife. These tools operate by reinforcing federal and state laws. For example, the Gold Coast Planning Scheme recognises that some areas are protected explicitly such as National Parks, Conservation Parks while other areas, such as urban areas, are only protected through explicit Council based tools such as zoning, public open-space contributions, and development agreements, conditions and guidelines.

The existing instruments used by the City of Gold Coast for protecting biodiversity are listed below:

- **Statutory Measures:** Strategic Plans, Structure Plans, Development Control Plans, Local Planning Policies and Provisions, Vegetation Conservation by-law, Open Space Provisions, Development Provisions, Agreements and Contributions, Management Local Laws, Development Assessment Process
- **Non-Statutory Measures:** Community and Environment Activities, Bushfire Management Strategy, Open Space Preservation Levy.

M. Maher and assoc. *et al.* (1997) found that the most effective planning controls, under the current planning scheme and protecting biodiversity outside National Parks etc, were the structure plans, the open space (environmental) zone, and the incorporation of environmental objectives into the Strategic Plan. They also identified that there were at least five areas where clearer policies or planning statements would be beneficial. These areas were:

- waterways and associated riparian areas;
- ridge lines;
- rural areas supporting extensive tracts of significant vegetation;
- amore rigorous and transparent development assessment process;
- landholder incentives to retain, manage or rehabilitate significant vegetation.

Table 6.14 divides different land uses up against five levels of planning protection offered by the various levels of Government and the instruments used to achieve that protection. In addition to explicit protection such as Crown and Council owned land there are a number of levels of protection afforded by various Acts and Local Laws.

As discussed in section 6.4, just over one third (35%) of the City's remnant vegetation is explicitly or highly protected. Some loss is therefore likely over the remaining 65% of the vegetation. The Southern Hinterland and Northern Coastal Islands are relatively well protected by the State Government Reserve Systems, and the Hinterland Density measure applies to 40% of the City and offers some protection, mainly to the vegetation in the mountains and foothills (M. Maher and assoc. *et al.* 1997).

6.5.2 Acquisition of open space

The Council has a program that acquires open space for the community through the administration of the Open-Space Preservation Levy (green levy). Between 1992 and 1994 the Council has acquired a total of 630ha. There have been at least three significant purchases of land since 1994.

Table 6.13: Significant areas for biological diversity on the Gold Coast
(source: M. Maher and assoc. *et al.* 1997)

Location	Significance	Protection method
Coastal heath (mosaic of sedgeland, heath and low shrubs)	Once widespread ecosystem now confined to only a few places eg. Pine Ridge and Jacob's Well. Home for vulnerable species (Wallum froglet: <i>Crinia tinnula</i>).	Only when in conservation park Nature Conservation Act
Southern Moreton Bay and South Stradbroke Island - intertidal and sub-tidal areas	Key fish and migratory bird habitats	RAMSAR convention Fisheries Act Planning Scheme
South Stradbroke Island	Saline and Freshwater wetlands, habitat for rare Golden Swamp Wallaby (<i>Wallabia bicolor welsbyi</i>), near-intact, coastal sand-dune vegetation, Remnant palm swamp, <i>Casuarina glauca</i> forest, <i>Acrornychia imperforata</i> communities	Nature Conservation Act Conservation Parks Planning Scheme
Upland rainforest areas such as Springbrook, Tamborine and Lamington	World heritage listed rainforest areas of diverse species including many rare and threatened.	World Heritage Listing Nature Conservation Act National Parks, Conservation Parks Planning Scheme
Vine forests of the Northern Darling Range.	Rare and threatened species	Nature Conservation Act Council Reserve
Burleigh Head	Last significant remnant of littoral rainforest. National park within densely populated area. Rare and Threatened Species	Nature Conservation Act National Parks Planning Scheme
Tallebudgera and Currumbin Valleys	Tallebudgera Creek flows to the sea adjacent to Burleigh Head.	Nature Conservation Act National Parks Conservation Parks, Currumbin Sanctuary, David Fleay's Wildlife Park, Council Reserves
East Coomera area	Freshwater and saline wetlands	Fisheries Act, Planning Scheme
Mouth of Behms Creek, Jacobs Well	Wetlands	Planning Scheme, Council Environmental Reserve, Vacant Crown Land
Bahrs Hill and Surrounds	Vine forest of regional significance and rare and threatened species	Nature Conservation Act Conservation Park
Coomabah Creek, Lake and surrounds	Saline wetlands and mangroves, Linked to hinterland environments and Nerang State Forest	Conservation Park, Council Reserves, Nature Conservation Act, Fisheries Act Nature Refuge

Table 6.14: Summary of planning instruments and level of protection afforded to biodiversity.

(Source: M. Maher and assoc. *et al.* 1997)

Planning instrument	Levels of planning protection				
	Explicit	High	Moderate	Minimal	Not protected
Crown or Council Land	<ul style="list-style-type: none"> National Park Conservation park Gazetted Catchment Area for Hinze Dam 	<ul style="list-style-type: none"> State Forest Council Freehold, Trust Council Reserves for Public open space 			
Strategic Plan		<ul style="list-style-type: none"> Special Use¹ 		<ul style="list-style-type: none"> Rural Rural Conservation Special Use² 	<ul style="list-style-type: none"> Urban⁴ Industry Extractive industry Agriculture
Hinterland Density Formula			Subdivision ratio: 0.05 and 0.15.	Subdivision Ratio: 0.25 & 1.25	
Structure Plans		<p><u>East Coomera:</u></p> <ul style="list-style-type: none"> Tidal and Intertidal areas (Category A) Tidal and Intertidal Fringes (Category B) High Terrestrial Conservation Significance (Category C) <p><u>Springbrook</u></p> <ul style="list-style-type: none"> Nature Conservation Nature Conservation Link 		<p><u>East Coomera</u></p> <ul style="list-style-type: none"> Moderate terrestrial conservation significance (Category D). Rehabilitation and Wetlands (Category E). <p><u>Stapylton/Yatala</u></p> <ul style="list-style-type: none"> Public open space 	<p><u>East Coomera</u></p> <ul style="list-style-type: none"> General Development (Category F) potential Sugarcane land Sugarcane land
Town Plan Zones	<ul style="list-style-type: none"> Public Open Space (environmental) 			<ul style="list-style-type: none"> Special Purposes⁵ Special facilities Multi-zone Special Use³ privately-owned open space 	<ul style="list-style-type: none"> Future Urban Residential zones Comprehensive development Commercial

1. Special use areas such as Numinbah prison Farm and Canungra Land Warfare Centre.

2. Special use areas such as sewage treatment works and rubbish tips buffer.

3. Special use areas of other special uses by Council/Government

4. Urban areas, including urban residential, residential, village.

5. Special Purposes areas, including South Stradbroke, Coomera, Woongoompa, Kangaroo and Eden Islands.

Category A = Tidal and intertidal areas requiring State Government Ministerial approvals prior to works.

Category B = Land fringing tidal and intertidal areas requiring Council approval prior to works and at least a 20m

Category C = Areas of high terrestrial conservation significance subject to Zero-Net-Loss provisions.

Category D = Areas of moderate conservation value subject to tree preservation and other clearing by-laws.

Category E = Areas suitable for rehabilitation may be subject to Zero-Net-Loss compensation and 100 m buffers.

Category F = Areas of general development.

(East Coomera Structure Plan - Albert Shire Council Planning Scheme 1995)

6.5.3 Introduced and pest species control plans

There is coordinated control of introduced plants on the Gold Coast. Under the Rural Lands Protection Act certain species are declared as weeds and must be controlled. Those of importance to the Gold Coast are listed in section 6.4. It costs the City \$700,000 per year to control these pest species on Council owned or maintained lands. Private landholders are also required to control these pest species on their land.

The Council also control the growth of waterweeds in the lake systems. These plants, often natives (Table 6.15), require periodic clearing from the waterways for mainly aesthetic reasons. Some 300M³ of weed is removed each month at a cost of \$230,000 per year. There are no similar coordinated approaches to the control of introduced animals on the Gold Coast.

Table 6.15 : Aquatic plants removed from Gold Coast lakes

Common name	Latin name
Salvinia (Declared pest species)	<i>Salvinia molesta</i>
Hydrilla	<i>Hydrilla verticillata</i>
Duckweed	<i>Spirodela spp.</i>
Water nymph	<i>Najas tenuifolia</i>
Reed Sweetgrass	<i>Phragmites australis</i>
Common Reed	<i>Glyceria maxima</i>

6.5.4 Marine research on the Gold Coast

There are a variety of groups and organisations undertaking research into the marine environments of the Gold Coast.

The Queensland Department of Primary Industries (Fisheries) are mapping the areas of sea-grass bed and, in conjunction with the Queensland Fisheries Management Authority, are recording detailed catch-data from the commercial fisherman of Moreton Bay (QFMA 1997).

Club Fish Australia (CFA) Fishery Research Foundation is a private group that is conducting research into the fisheries of the Gold Coast. This work is done in close cooperation with, fishermen, charter boat operators, and consultation with State Government fisheries researchers, and the University of Queensland's Centre for Conservation Biology. Some of the research they are undertaking between Cook Island and Jumpinpin and in the waters of Southern Moreton Bay are:

- Rocky Reef Fish Catch Data Analysis (Snapper, Pearl Perch, Teraglin and Jobfish);
- Habitat Survey - Project Starfish (documenting and developing a database of fish species);
- Dolphins (database of sightings, and population study);
- Hard Substrate Mapping Project (detailed mapping of reefs);

Deep Water Temperature Project (linking fish and mammal behaviour with water temperature and depth)

6.6 Conclusions and possible future responses

6.6.1 Nature Conservation Strategy

Stemming from the City's Corporate Plan and its vision of becoming a sustainable city, the Nature Conservation Strategy seeks to facilitate the identification, protection and management of the City's natural heritage values. As well as a framework for conserving the natural assets of the City, the Strategy included detailed identification and mapping of the City's vegetation and extensive community consultation. The Strategy deals with all aspects of managing the City's biodiversity with particular focus on terrestrial vegetation and habitat (M. Maher and assoc. *et al.* 1997).

The Strategy is designed to operate in conjunction with other Council programs and policies such as the Planning Scheme, Open Space Acquisition, and Vegetation Management Local Law.

6.6.2 Bushfire Management Strategy

Fire management in the City is mainly focussed on prevention and control. Little emphasis has been placed on the frequency of fires to ensure the biodiversity of the area is maintained. The Council is currently developing a Bushfire Management Strategy for the City. This Strategy will address the issue of biodiversity as well as the issue of safety.

Fires in non-urban areas are managed by a number of different authorities. Queensland Forests and the Department of Environment control fires occurring in areas under their control. Whereas rural fires are controlled by the Gold Coast Rural Fire Brigade and, where necessary, the Council provides bulldozers, graders and water tankers to assist. The Queensland Fire Service have the responsibility of deciding if a fire has reached the level of a state of emergency, and the State Emergency Service provide helicopters, if required.

Management techniques usually centre on back-burning and establishing fire breaks and controls. Some effort is placed in direct fighting.

6.6.3 Species recovery plans

There are only two current recovery programs that apply to the Gold Coast area. These are for the Mary River Cod, which once naturally occurred in a number of rivers in SEQ, including the Coomera, Albert and Logan rivers and *Austromytus gonoclada*. These programs are being conducted by the State Government with the cooperation of local councils.

However, there are a number of plant and animal species that have been suggested as requiring recovery plans in the Nature Conservation Strategy. These are listed below in Tables 6.16 (Plants) and 6.17 (Animals).

Table 6.16: Plant species suggested for recovery and threat abatement plans

(Source: Ecograph and M. Maher and assoc. 1997, Table 13.1)

Species	Common name	Rem rks
<i>Diploglottis campbellii</i> *	Small-leaved Tamarind	Endangered / highly localised / lowland rainforest / riparian habitat / threatened habitat
<i>Austromyrtus fragrantissima</i> *	Sweet Myrtle	Endangered / lowland riparian / habitat / rainforest / threatened habitat
<i>Corchorus cunninghamii</i> *		Endangered / highly localised / threatened habitat
<i>Brachychiton sp.</i> *	Ormeau Bottle Tree	Highly restricted distribution / undescribed species / threatened habitat
<i>Eucryphia jinksii</i> *	Springbrook Leatherwood	Extremely rare / extremely localised / one known specimen at Springbrook
<i>Pararistolochia praevanosa</i>	Richmond Birdwing Butterfly Vine	Conservation status pending / critical for Richmond Birdwing Butterfly (endangered)
<i>Syzygium hodgkinsoniae</i>	Smoothbark Rose Apple	Vulnerable / extremely restricted distribution / threatened habitat
<i>Syzygium moorii</i>	Durobby	Vulnerable / extremely restricted distribution / threatened habitat
<i>Endriandra floydii</i>	Crystal Creek Walnut	Rare species recently discovered at Wyangan Creek Park and recreation reserve (G. Mc Donald pers.com. 1996).
<i>Austromyrtus gonoclada</i>		Endangered / extremely restricted distribution / riparian / threatened habitat /recovery program under way in Logan City

* top priority

Table 6.17: Animal species suggested for recovery and threat abatement plans

(Source: Ecograph and M. Maher and Assoc. 1997, Table 13.1)

Species	Common name	Remarks
<i>Calyptrorhynchus lathamii</i> *	Glossy Black-Cockatoo	Vulnerable / restricted distribution / restricted habitat requirements / threatened habitat
<i>Litoria freycineti</i> , <i>Litoria olongburensis</i> , <i>Crinia tinnula</i> , <i>Litoria cooloolensis</i> *	Wallum frogs	Vulnerable or rare / extremely restricted distribution / threatened habitat / highly dependant on large tracts of coastal lowland <i>Eucalypt</i> communities
<i>Phascolarctos cinereus</i> *	Koala	Culturally significant / restricted habitat requirements / threatened habitat / highly dependant on large tracts of coastal lowland <i>Eucalypt</i> communities.
<i>Acrodipsas illidgi</i> *	Illidge's Ant-Blue Butterfly	Endangered / extremely restricted distribution / highly restricted habitat requirements
<i>Ornithorhynchus anatinus</i>	Platypus	Culturally significant / restricted habitat requirements (indicator of high water and riparian condition) / sensitive to human activities
<i>Erythrorchis radiatus</i>	Red Goshawk	Endangered / threatened habitat / requires large home range
<i>Haematopus fuliginosus</i>	Sooty Owl	Rare / restricted habitat requirements / one of the least known birds of prey
<i>Ninox strenua</i>	Powerful owl	vulnerable / restricted habitat requirements / requires extremely large amounts of habitat / threatened habitat
<i>Rallus pectoralis</i>	Lewins Rail	Rare, restricted habitat requirements / threatened habitat
<i>Ornithoptera richmondia</i>	Richmond Birdwing Butterfly	Vulnerable / restricted habitat requirements (ie. the vines <i>Aristolochia preaevenosa</i> and <i>A. deltantha</i> / restricted distribution.
<i>Pseudechs porphyriacus</i>	Red Bellied Black Snake	Threatened lowland habitat / decline supposed from introduction of <i>Bufo marinus</i> (cane toad)

* top priority

There is active work being undertaken in the Gold Coast area to ensure the survival of many of these species. This work is being done by groups such as the Wildlife Preservation Society and its branch focussing on the Glossy Black Cockatoo.

6.7 References

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APPENDIX 6A

Significant and rare and threatened animal species of Southeast Queensland

Latin name	Common name
Mammals	
<i>Aepyprymnus Rufescens</i>	Rufous bettong
<i>Cercartetus nanus</i>	Eastern Pygmy possum
<i>Dasyurus hallucatus</i>	Northern quoll
<i>Dasyurus maculatus</i>	Spotted tailed quoll
<i>Dugong dugong</i>	Dugong
<i>Kerivoula papuensis</i>	Golden tipped bat
<i>Macropus agilis</i>	Agile wallaby
<i>Macropus dorsalis</i>	Black striped wallaby
<i>Macropus giganteus</i>	Eastern grey kangaroo
<i>Nyctimene robinsoni</i>	Queensland Tube-nosed bat
<i>Ornithorhynchus anatinus</i>	Platypus
<i>Petaurus australis</i>	Yellow bellied glider
<i>Petaurus breviceps</i>	Sugar Glider
<i>Petaurus norfolcensis</i>	Squirrel glider
<i>Petrogale penicillata</i>	Brush-tailed rock wallaby
<i>Phascogale tapotafa</i>	Brush-tailed Phascogale
<i>Phascogale cinereus</i>	Koala
<i>Potorous tridactylus</i>	Long-nosed potoroo
<i>Pteropus poliocephalus</i>	Grey-headed flying fox
<i>Soursa chinesis</i>	Indo-pacific hump-backed dolphin
<i>Tachyglossus aculeatus</i>	Short-beaked echidna
<i>Wallabia bicolor welsbyi</i>	Golden Wallaby
<i>Xeromys myoides</i>	False water rat

Reptiles	
<i>Acanthophis antarcticus</i>	Death adder
<i>Caretta caretta</i>	Loggerhead turtle
<i>Cautula zia</i>	Rainforest cool skink
<i>Chlamydosaurus Kingii</i>	Friiled lizard
<i>Coeranoscincus reticulatus</i>	Rainforest burrowing skink
<i>Delma torquata</i>	Collared delma
<i>Hoplocephalus stephensii</i>	Stephen's banded snake
<i>Ophioscincus truncatus</i>	a Burrowing skink
<i>Saproscincus rosei</i>	a Rainforest skink

Aves	
<i>Accipter novaehollandiae</i>	Grey Goshawk
<i>Anas castanea</i>	Chestnut teal
<i>Atrichornis rufescens</i>	Rufous scrub-bird
<i>Burhinus neglectus</i>	Beach thick-knee
<i>Calyptorhynchus lathamii</i>	Glossy black-cockatoo
<i>Climacteris erithrops</i>	Red-browed treecreeper
<i>Cyclopsitta diophthalma</i>	Coxen's fig parrot
<i>Dasyornis brachypterus</i>	Eastern bristlebird
<i>Erythroriorchis radiatus</i>	Red goshawk
<i>Coracina maxima</i>	Ground Cuckoo-shrike
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher
<i>Haliaeetus leucogaster</i>	White-bellied seas-eagle
<i>Lichenostomus melanops</i>	Yellow-tufted honeyeater
<i>Lophoictinia isura</i>	Square-tailed kite
<i>Melithreptus gularis</i>	Black-chinned honeyeater
<i>Menura alberti</i>	Albert's lyrebird
<i>Nettapus coromandelianus</i>	Cotton pygmy-goose
<i>Ninox strenua</i>	Powerful owl
<i>Numenius madagascariensis</i>	eastern curlew
<i>Pachycephala olivacea</i>	Olive whistler
<i>Podargus ocellatus plumiferus</i>	Marble frogmouth
<i>Podiceps cristatus</i>	Great crested grebe
<i>Psittaculirostris diophthalma</i>	double-eyed fig parrot
<i>Rallus pectoralis</i>	Lewin's rail
<i>Rostratula benghalensis</i>	Painted snipe
<i>Sterna albifrons</i>	Little tern
<i>Strictonetta naevosa</i>	Freckled duck
<i>Turnix melanogaster</i>	Black-breasted button-quail
<i>Tyto tenebriscosa</i>	Sooty owl
<i>Xanthomyza phrygia</i>	Regent honeyeater
<i>Xernorhynchus asiaticus</i>	Black-necked stork

Amphibia	
<i>Assa darlingtoni</i>	Pouched tree frog
<i>Crinia tinnula</i>	Wallum froglet
<i>Kyarranus loveridgei</i>	Loveridge's mountain frog
<i>Lechriiodus fletcheri</i>	Fletcher's frog
<i>Limnodynastes salmini</i>	Salmon-striped frog
<i>Litoria Alboguttata</i>	Greenstrip frog
<i>Litoria brevipalmata</i>	Green-thighed frog
<i>Litoria cooloolensis</i>	Cooloola sedgefrog
<i>Litoria ferycineti</i>	Wallum rocket frog
<i>Litoria olongburensis</i>	Wallum sedge frog or tree frog
<i>Litoria pearsoniana</i>	Cascade tree frog
<i>Litoria revelata</i>	Whirring tree frog
<i>Mixophyes iteratus</i>	Giant barred river frog

**APPENDIX 6B: Rare and threatened plant species of Southeast Queensland
(SouthROC area)**

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATION PARK	HABITAT
Ferns			
<i>Lastreopsis silvestris</i>	Aspidiaceae	Lamington	Rainforest
<i>Doodia maxima</i>	Blechnaceae		
<i>Cyathea cunninghamii</i>	Cyatheaceae	Lamington	Rainforest
<i>Schizaea malaccana</i>	Schizaeaceae		Sedgeland
<i>Pneumatopteris pennigera</i>	Thelypteridaceae	Lamington	Rainforest
<i>Thelypteris confluens</i>	Thelypteridaceae		Sedgeland
<i>Antrophyum</i> sp. 'Blue Pool'	Vittariaceae	Lamington	Rainforest

Gymnosperms			
<i>Callitris monticola</i>	Cupressaceae	Lamington, Mt Barney, Main Ra	Closed Shrubland

Angiosperms			
<i>Graptophyllum reticulatum</i>	Acantheceae		Rainforest
<i>Isoglossa eranthemoides</i>	Acantheceae		Rainforest
<i>Cordyline congesta</i>	Agavaceae	Lamington	Open forest
<i>Parsonsia tenuis</i>	Apocynaceae	Lamington	Rainforest
<i>Aristolochia</i> sp. 'Border Ras'	Aristolochiaceae	Lamington	Rainforest
<i>Marsdenia longiloba</i>	Asclepiadaceae	Lamington, Main Ra	Rainforest
<i>Brachyscome ascendens</i>	Asteraceae	Lamington	Woodland
<i>Helichrysum lindsayanum</i>	Asteraceae	Mt Barney, Moogerah Peaks (Mt Greville Moon, Mt Moon)	Mallee Shrubland, Heath
<i>Helichrysum vagans</i>	Asteraceae	Lamington	Rainforest
<i>Helichrysum whitei</i>	Asteraceae	Lamington	Open forest
<i>Hermistepta lyrata</i>	Asteraceae		Open forest
<i>Olearia heterocarpa</i>	Asteraceae	Lamington	Open forest
<i>Olearia hygrophila</i>	Asteraceae		Sedgeland
<i>Podolepis monticola</i>	Asteraceae	Lamington	Woodland, Shrubland, Heath

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATION PARK	HABITAT
<i>Stemmacantha australis</i>	Asteraceae		
<i>Tetramolopium sp Mt Maroon</i>	Asteraceae	Mt Barney (Mt Maroon)	Middle Shrubland, Heath
<i>Pandorea baileyana</i>	Bignoniaceae	Lamington, Mt Barney	Rainforest Open forest
<i>Cassia marksiana</i>	Caesalpinaceae	Lamington, Nicoll Scrub Currumbin	Rainforest
<i>Wahlenbergia sp 'Mt Cordeaux'</i>	Campanulaceae	Lamington, Main Ra	Woodland
<i>Wahlenbergia sp Mt Lindesay</i>	Campanulaceae	Mt Barney (Mt Lindesay)	Woodland
<i>Brasenia schreberi</i>	Cabombaceae		Aquatic
<i>Allocasuarina emuina</i>	Casuarinaceae		Mallee Shrubland Heath
<i>Corynocarpus rupestris</i>	Corynocarpaceae	Springbrook (Natural Bridge)	Rainforest
<i>Cyperus rupicola</i>	Cyperaceae	Lamington	Mallee shrubland, Heath
<i>Gahnia insignis</i>	Cyperaceae	Lamington, Mt Barney, Springbrook (Warrie)	Open forest Mallee shrubland Heath
<i>Davidsonia sp 'Mullimbimby'</i>	Davidsoniaceae		Rainforest
<i>Hibbertia hexandra</i>	Dilleniaceae	Lamington, Mt Barney, Moogerah Peaks (Mt Greville)	Rainforest Open forest Mallee shrubland, Heath
<i>Hibbertia monticola</i>	Dilleniaceae	Mt Barney	Mallee shrubland, Heath
<i>Leucopogon sp 'Echo Point'</i>	Epacridaceae	Lamington	Mallee Shrubland, Heath
<i>Leucopogon sp 'Mt Barney'</i>	Epacridaceae	Mt Barney	Mallee Shrubland, Heath

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATION PARK	HABITAT
<i>Gaultheria</i> sp 'Berungutta'	Ericaceae	Lamington	Rainforest
<i>Argoephyllum nullumense</i>	Escalloniaceae	Lamington, Springbrook (Warrie Mt Cougal)	Rainforest
<i>Austrobuxus swainii</i>	Euphorbiaceae	Springbrook (Warrie, Mt Cougal)	Rainforest Open forest
<i>Baloghia marmorata</i>	Euphorbiaceae	Tamborine (Palm Grove, Joalah, McDonald)	Rainforest
<i>Bertya pinifolia</i>	Euphorbiaceae		Open forest Mallee shrubland, Heath
<i>fontainea australis</i>	Euphorbiaceae	Springbrook (Natural Bridge)	Rainforest
<i>Fontainea venosa</i>	Euphorbiaceae		Rainforest
<i>Infigofera baileyi</i>	Fabaceae		Open forest
<i>Isotropsis foliosa</i>	Fabaceae		Open forest
<i>Milletia australis</i>	Fabaceae	Lamington, Mt Chinghee	Rainforest
<i>Pultenaea pycnocephala</i>	Fabaceae	Lamington	Mallee shrubland, Heath
<i>Pultenaea whiteana</i>	Fabaceae	Mt Barney	Mallee shrubland, Heath
<i>Sophora fraseri</i>	Fabaceae	Lamington, Main Ra (Mt Mistake)	Rainforest
<i>Cooperookia scabridiuscula</i>	Goodeniaceae	Mt Barney	Mallee Shrubland, Heath
<i>Goodenia arenicola</i>	Goodeniaceae		Strand
<i>Myriophyllum implicatum</i>	Haloragaceae		Open forest Sedgeland
<i>Hydrocharis dubia</i>	Hydrocharitaceae		
<i>Plectranthus alloplectus</i>	Lamiaceae	Mt Barney, Main Ra, Moogerah Peaks (Mt Greville, Mt Moon)	Open forest Mallee shrubland/Heath
<i>Plectranthus argentatus</i>	Lamiaceae	Lamington, Main Ra	Mallee shrubland/Heath
<i>Plectranthus suaveolens</i>	Lamiaceae	Lamington, Main Ra	

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATION PARK	HABITAT
<i>Prostanthera sp Mt Tinbeerwah</i>	Lamiaceae		Mallee shrubland /Heath
<i>Westringia blakeana</i>	Lamiaceae	Lamington, Mt Barney	Open forest Mallee shrubland/Heath
<i>Westringia rupicola</i>	Lamiaceae	Lamington, Springbrook (Warrie, Gwongorella)	Mallee shrubland/Heath
<i>Westringia sericea</i>	Lamiaceae	Moogerah Peaks (Mt Edwards, Mt Greville), Main Ra	Open forest
<i>Cryptocarya foetida</i>	Lauraceae	Lamington, Burleigh Head	Rainforest
<i>Endiandra globosa</i>	Lauraceae	Nicoll Scrub, Currumbin	Rainforest
<i>Endiandra hayesii</i>	Lauraceae	Springbrook (Warrie), Burleigh Head	Rainforest Open forest
<i>Endiandra introrsa</i>	Lauracea	Springbrook (Warrie)	Rainforest
<i>Muelleriana myrtifolia</i>	Loranthaceae	Main Ra	Rainforest Open forest
<i>Owenia cepiodora</i>	Meliaceae	Lamington	RF
<i>Tinospora tinosporoides</i>	Menispermaceae	Burleigh Head	RF
<i>Acacia acrionastes</i>	Mimosaceae	Moogerah Peaks (Mt French), Mt Barney	Open forest Mallee shrubland/Heath
<i>Acacia attenuata</i>	Mimosaceae	Burleigh Knoll	Open forest Heath
<i>Acacia orites</i>	Mimosaceae	Lamington, Main Ra, Springbrook (Mt Cougal, Warrie, Gwongerella)	Rainforest Open forest
<i>Acacia perangusta</i>	Mimosaceae		Open forest
<i>Acacia saxicola</i>	Mimosaceae	Mt Barney	Open forest Mallee shrubland/Heath
<i>Archidendron muellerianum</i>	Mimosaceae	Springbrook (Warrie, Natural Bridge)	Rainforest
<i>Ardisia bakeri</i>	Myrsinaceae	Springbrook (Warrie, Naturel Bridge, Mt Cougal)	Rainforest

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATION PARK	HABITAT
<i>Austromyrtus fragrantissima</i>	Myrtaceae	Nicoll Scrub	Rainforest
<i>Austromyrtus gonoclada</i>	Myrtaceae		Rainforest
<i>Austromyrtus</i> sp. 'Blackall Ra'	Myrtaceae	Lamington, Main Rainforest	Rainforest
<i>Austromyrtus</i> sp. 'Border Ras'	Myrtaceae	Lamington	Rainforest
<i>Eucalyptus approximans</i>	Myrtaceae	Lamington, Mt Barney, Springbrook (Warrie)	Mallee shrubland/Heath
<i>Eucalyptus dunnii</i>	Myrtaceae	Lamington, Main Rainforest	Open forest
<i>Eucalyptus michaeliana</i>	Myrtaceae	Mt Barney	
<i>Rhodamnia maideniana</i>	Myrtaceae	Springbrook (Natural Bridge)	Rainforest
<i>Syzygium hodgkinsoniae</i>	Myrtaceae	Springbrook (All sections)	Rainforest
<i>Syzygium moorei</i>	Myrtaceae	Nicoll Scrub	Rainforest
<i>Uromyrtus</i> sp 'McPherson Ra'	Myrtaceae	Lamington	Mallee shrubland/Heath
<i>Notelaea lloydii</i>	Oleaceae		Rainforest
<i>Acianthus amplexicaulis</i>	Orchidaceae	Lamington	Rainforest
<i>Acianthus ledwardii</i>	Orchidaceae		
<i>Bulbophyllum argyropus</i>	Orchidaceae	Lamington	Rainforest
<i>Bulbophyllum globuliforme</i>	Orchidaceae	Lamington	Rainforest
<i>Bulbophyllum weinthalii</i>	Orchidaceae	Lamington	Rainforest
<i>Chiloglottis sphyroides</i>	Orchidaceae		
<i>Dendrobium scheiderae</i>	Orchidaceae	Lamington, Main Ra	Rainforest
<i>Dipodium pulchellum</i>	Orchidaceae	Main Ra	
<i>Genoplesium rufum</i>	Orchidaceae		Heath
<i>Genoplesium sigmoideum</i>	Orchidaceae	Lamington	Mallee shrubland/Heath
<i>Papillilabium beckleri</i>	Orchidaceae	Main Ra	Rainforest
LATIN NAME	FAMILY	NATIONAL	HABITAT

	NAME	PARK/ CONSERVATION PARK	
	<i>Pterostylis bicornis</i>	Orchidaceae	Mt Barney (Mt Maroon)
	<i>Pterostylis</i> sp. 'Coomera Valley'	Orchidaceae	
	<i>Rhizanthella slateri</i>	Orchidaceae	Lamington
	<i>Sarcochilus fitzgeraldii</i>	Orchidaceae	Lamington, Main Ra Rainforest
	<i>Sarcochilus hartmanni</i>	Orchidaceae	Lamington, Main Ra Woodland
	<i>Sarcochilus Weinthalii</i>	Orchidaceae	Lamington, Main Ra Rainforest
	<i>Helmholtzia glaberrima</i>	Philydraceae	Lamington, Springbrook (Warrie, Gwongerella, Mt Cougal, Natural Bridge) Rainforest
	<i>Pittosporum oreillyanum</i>	Pittosporaceae	Lamington Rainforest
	<i>Arundinella grevillensis</i>	Poaceae	Moogerah Peaks (Mt Greville, Mt Moon), Main Ra Open forest
	<i>Arundinella montana</i>	Poaceae	Main Ra, Mt Barney Mallee shrubland/Heath
	<i>Paspalidium grandispiculatum</i>	Poaceae	Open forest
	<i>Comesperma breviflorum</i>	Polygalaceae	Mt Barney, Moogerah Peaks (Mt Greville, Mt Moon) Mallee shrubland/Heath
	<i>Comesperma esulifolium</i>	Polygalaceae	Lamington, Mt Barney, Springbrook (Warrie) Open forest Mallee shrubland/Heath
	<i>Polygonum elatius</i>	Polygonaceae	Lamington, Springbrook (Warrie) Rainforest
	<i>Alloxyion pinnatum</i>	Proteaceae	Lamington, Mt Barney Mallee shrubland/Heath
	<i>Banksia conferta</i>	Proteaceae	Lamington, Mt Barney Mallee shrubland/Heath
	<i>Floydia praealta</i>	Proteaceae	Springbrook (Warrie) Rainforest
	<i>Grevillea linsmithii</i>	Proteaceae	Moogerah Peaks (Mt Greville, Mt Moon), Main Ra, Mt Barney Mallee shrubland/Heath
	<i>Helicia ferruginea</i>	Proteaceae	Lamington, Springbrook (Warrie, Mt Cougal) Rainforest
	<i>Hicksbeachia pinnatifolia</i>	Proteaceae	Sprinbrook (Mt Cougal) Rainforest

LATIN NAME	FAMILY	NATIONAL PARK/	HABITAT
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	NAME	CONSERVATION PARK	
<i>Macadamia integrifolia</i>	Proteaceae	Nicoll Scrub	Rainforest
<i>Macadamia ternifolia</i>	Proteaceae		Rainforest
<i>Macadamia tertaphylla</i>	Proteaceae	Lamington, Nicoll Scrub, Springbrook (Natural Bridge)	Rainforest
<i>Persoonia volcanica</i>	Proteaceae	Mt Barney	
<i>Persoonia</i> sp. 'Helidon Hills'	Proteaceae		Open forest
<i>Triunia robusta</i>	Proteaceae		Rainforest
<i>Clematis fawcettii</i>	Ranunculaceae	Lamington, Mt Barney	Rainforest
<i>Randia moorei</i>	Rubiaceae	Burleigh Head, Nicoll Scrub	Rainforest
<i>Acronychia baeuerienii</i>	Rutaceae	Lamington	Rainforest
<i>Bosistoa monostylis</i>	Rutaceae		Rainforest
<i>Bosistoa transversa</i>	Rutaceae	Springbrook (Natural Bridge)	Rainforest
<i>Phebalium gracile</i>	Rutaceae	Moogerah Peaks (Mt Greville, Mt Moon)	Mallee shrubland/Heath
<i>Zieria collina</i>	Rutaceae	Tamborine (Palm Grove, The Knoll)	Open forest
<i>Zieria</i> sp. 'Border Ras'	Rutaceae	Lamington	Open forest Mallee shrubland/Heath
<i>Zieria</i> sp. 'Mt Barney'	Rutaceae	Mt Barney, Moogerah Peaks (Mt French)	Open forest
<i>Zieria</i> sp. 'Mt Warning'	Rutaceae	Lamington	Mallee shrubland/Heath
<i>Cupaniopsis newmanii</i>	Sapindaceae	Lamington, Rosins Lkt	Rainforest
<i>Cupaniopsis shirleyana</i>	Sapindaceae		Rainforest
<i>Cupaniopsis tomentella</i>	Sapindaceae		Rainforest
<i>Dipolglottis campbellii</i>	Sapindaceae		Rainforest

LATIN NAME	FAMILY NAME	NATIONAL PARK/ CONSERVATIO	HABITAT
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N PARK			
<i>Dodonaea rupicola</i>	Sapindaceae		Open forest Mallee shrubland/Heath
<i>Lepiderema pulchella</i>	Sapindaceae	Lamington, Nicoll Scrub, Springbrook (Warrie, Mt Cougal, Natural Bridge)	Rainforest
<i>Amorphospermum whitei</i>	Sapotaceae	Springbrook (Mt Cougal)	Rainforest
<i>Planchonella eerwah</i>	Sapotaceae		Rainforest
<i>Euphrasia bella</i>	Scrophulariaceae	Lamington, Mt Barney	Mallee shrubland/Heath
<i>Solanum callium</i>	Solanaceae	Mt Chinghee, Main Rainforest	Rainforest
<i>Rulingia salvifolia</i>	Sterculiaceae	Lamington, Mt Barney	Open forest Mallee shrubland/Heath
<i>Symplocos baeuerienii</i>	Symplocaceae	Springbrook (Mt Cougal, Natural Bridge)	Rainforest
<i>Pimelea umbratica</i>	Thymelaeaceae	Main Ra	Open forest
<i>Corchorus cunninghamii</i>	Tiliaceae		Rainforest Open forest