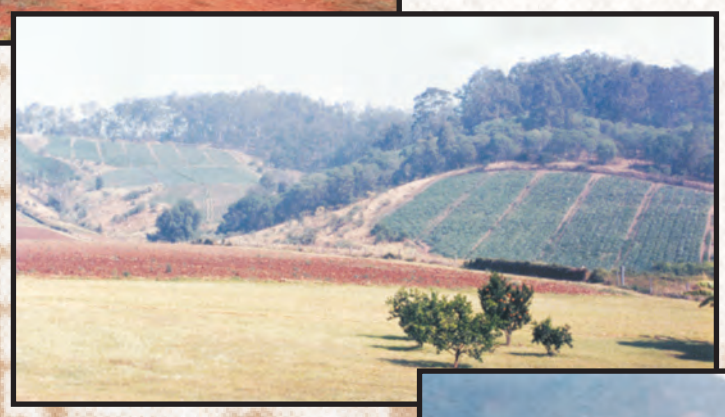
DNRQ00114

Mary River Catchment

Resource Atlas



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and
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Queensland Government
Department of Natural Resources

MARY RIVER CATCHMENT RESOURCE ATLAS

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MARY RIVER CATCHMENT RESOURCE ATLAS

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PREFACE

The production of the Mary River Catchment Resource Atlas is a National Heritage Trust (NHT) funded initiative of the Mary River Catchment Coordinating Committee and the Department of Natural Resources. Its purpose is to document available resource information for the Mary River catchment and disseminate it to government departments, local authorities and other decision makers to assist in the planning and management of the catchment. The resource atlas gives decision makers a comprehensive list of the many elements which together make up the Mary River catchment, and assist them in understanding how changes will influence its function.

1. INTRODUCTION

The information presented in this atlas has been collected from many sources and has been referenced accordingly to allow further, more detailed investigation if required. Every endeavour has been made to collect all the information available for the catchment, however it was discovered that some of the information was not suited to include in this type of report. Where this is the case, references are included in the report for further investigation if required.

The resource atlas information is currently stored in a Geographic Information System (GIS, ARCVIEW Version 3.1) format, and is expected to be continually updated and expanded as new spatial information becomes available. This information can be queried to produce a range of different outputs to assist in informed decision making. Where necessary, data has been clipped to the catchment boundary, so as to only show that within the catchment.

With time, the contents of this report will eventually become superseded as information is constantly being updated and revised. However, the setting up of a central repository for this data will enable the old and the new to be stored in the one place so as to facilitate its use.

People wishing to source Atlas information should contact the Department of Natural Resources, Gympie Office.

2. CATCHMENT AREA

2.1 LOCATION (MAP 1)

The Mary River catchment covers an area of approximately 9400 square kilometres (940 164 ha), and is located in the south-east corner of Queensland. The catchment stretches 173 kilometres from north to south and 102 kilometres from east to west (overall extent). The catchment at its widest part (east-west line) is approximately 88 kilometres, and at its longest part (north-south line) is approximately 170 kilometres.

The largest towns in the catchment are Maryborough and Gympie with many smaller towns and rural residential communities scattered throughout the catchment. The highest density of towns is in the eastern and southern regions of the catchment. This is possibly due to the close proximity to the coast and plateau regions (lifestyle choices), within commuting distance to the two largest towns (for services, markets), reliable water supply of the nearby streams and high rainfall, favourable conditions for agriculture, and proximity to infrastructure and major transport routes (Map 1 - Locality).

2.2 POPULATION (MAPS 2 AND 3)

Gympie and Maryborough are the largest population centres in the catchment, supporting a considerable percentage of the catchment's estimated 81 000 population (Australian Bureau of Statistics 1996). In June 1997, Maryborough's population was 24 933 (Maryborough City Council pers. comm., Dec.1999). While in 1996, Gympie's population was 11 798 (Cooloola Shire Council pers. comm., Dec.1999). Population centres are constantly expanding throughout the catchment as people are discovering the favourable climate and living conditions that prevail in the region.

Populations of local government areas are shown on Map 2 - Local Government Estimated Populations. Estimated populations of postcode areas are shown on Map 3 - Estimated populations of postcodes.

Gympie, one of the largest population centres in the catchment.

2.3 ADMINISTRATIVE DIVISIONS (MAPS 4 AND 5)

Thirteen local governments operate within the Mary River catchment, the areas of which are outlined in Figure 1. State electoral areas covering the catchment are Glass House, Nanango, Nicklin, Noosa, Gympie, Callide, Maryborough and Hervey Bay. Federal electoral regions covering the catchment are Wide Bay, Blair, Fairfax and Longman.

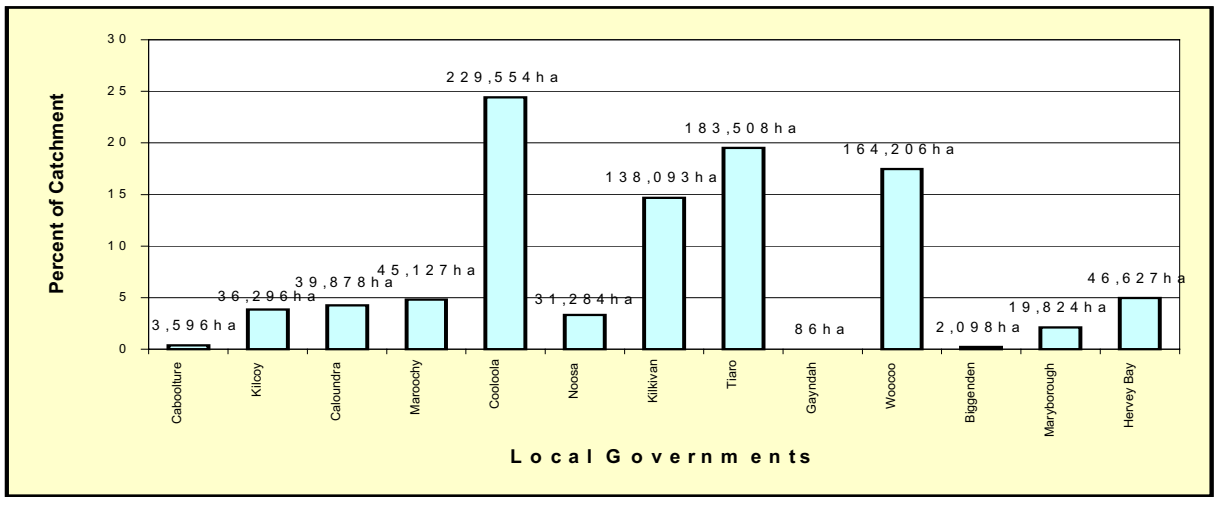


Figure 1. Percentage of Mary River catchment occupied by each local government area.

The Electoral boundaries covering the Mary River catchment are shown on Map 4 – Administrative Divisions. As an adjunct to the administrative divisions, cadastral boundaries show the extent and locations of property boundaries within each of the local government areas. Due to their detailed and constantly changing nature, cadastral boundaries and their relevant attributes were unable to be supplied in this report, but can be viewed at most Queensland Department of Natural Resources offices. Cadastral data are held on the Digital Cadastral Data Base (DCDB) and are available electronically or as a hard copy from DNR.

2.4 NATIVE TITLE APPLICATIONS (MAP 5)

Native title claims lodged within the catchment are shown on Map 5. Claims have been lodged by the following people/tribes (Queensland Department of Natural Resources, 1999);

- Wakka Wakka
- Wakka Wakka Jinda
- Jinibara
- Butchulla

The claims included are as of August 1999. Subsequent claims information is available from Department of Natural Resources.

2.5 LAND USE (MAP 6)

The major land uses in the catchment, as at 1997, are shown on Map 6 and include beef grazing, forestry, residential development, dairying, sugar cane, national parks and horticulture (Pointon 1998). Figure 2 shows the proportion of land uses covering the Mary River catchment. Land uses within the catchment are controlled to a large extent by the climate. Extensive grazing industries and native forestry dominate in the drier western parts of the catchment, while plantation forestry, residential, horticultural and intensive livestock pursuits are conducted in higher rainfall areas in the south and east. The land use survey recorded total areas being utilised for each particular land use (including storage sheds, headlands, dams, access tracks) not just the areas under a particular crop.

Of all the land uses being undertaken in the catchment, beef grazing currently occupies 455 841 hectares or 48.5% of the catchment, the largest area under one particular land use. Beef cattle country consists of 69% native pastures, 30% forested native pastures and 1% introduced fodder/forage crops.

Dairying was once the dominant primary industry in the catchment, but was replaced by beef grazing during the 1970s. Dairying currently occupies 28 667 hectares, or 3% of the catchment. The majority of dairy farms are located along the major tributaries, thereby facilitating irrigation schemes and utilisation of the fertile alluvial flats for crop production. Dairying country consists of 72% native pastures, 25% fodder/forage crops and 3% forested native pastures.

Forestry remains an important industry with almost one third of the catchment designated as State forest. Forestry occupies 269 861 hectares or 28.7% of the catchment. These forests are significant for their recreational values, leasehold grazing and timber production. Timber production relies on native hardwood forests, native pine plantations and highly productive exotic pine plantations. Remnant vegetation on private land occupies 85 262 hectares, or 9% of the catchment.

Sugar cane is one of the major agricultural crops grown in the catchment, predominately in the Tiaro, Woocoo, Maryborough and Hervey Bay regions. Sugar cane production covers 17 214 hectares or 1.8% of the catchment. There are 182 cane growers, with an average farm size of 77 hectares, supplying the Maryborough Sugar factory. Other common crops grown in the catchment include: pineapples, beans, zucchinis, macadamias, mangoes, papaws, citrus, maize and sorghum.

As with many coastal areas, urbanisation has increased in recent years. Areas within commuting distance to towns and have been subjected to the greatest residential development. Residential areas are mostly found along the eastern half of the catchment and cover 54 710 hectares or 5.8%. Rural residential land use is the forth-largest land use after beef grazing, forestry and remnant vegetation. Rural residential land use is significant in areas surrounding Maryborough, Cooroy, Pomona, Mary Valley, Maleny and Gympie.

Horticulture is one of the bigger money earners in the catchment.

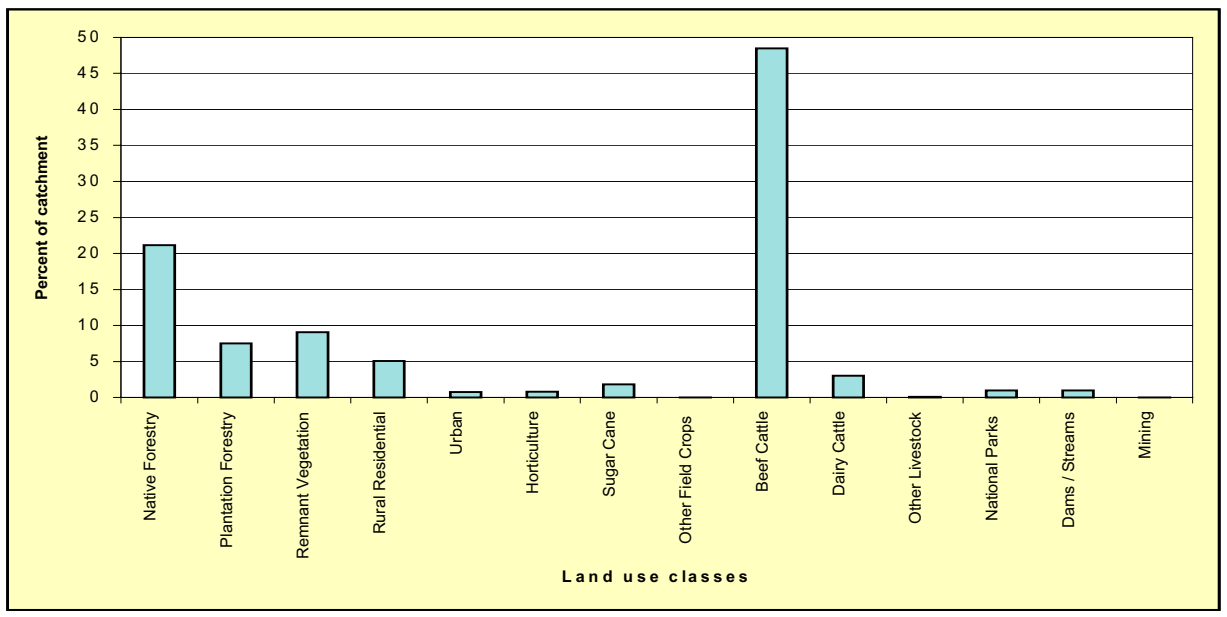


Figure 2. Land use proportions of the Mary River Catchment.

2.6 LAND DISTURBANCE (MAP 7)

Disturbance ratings are determined by recording the extent of change from the natural state. Map 7 - Land Disturbance, displays broad categories of disturbance that have occurred in the Mary River catchment. Figure 3 shows the catchment area affected by each different class of disturbance. Figure 3 shows that the majority of the Mary River catchment has undergone either limited clearing or extensive clearing. Extensive clearing is mostly associated with beef and dairy grazing, while limited clearing has occurred in areas of beef grazing, remnant vegetation and state forest. The dominant land use in the tree crops non-irrigated category is mostly plantation forestry, while areas remaining in their natural state were generally restricted to within National Parks. Highly disturbed areas are commonly associated with urban and rural residential development, dams, mining sites and other areas where there has been a substantial change from the natural state.

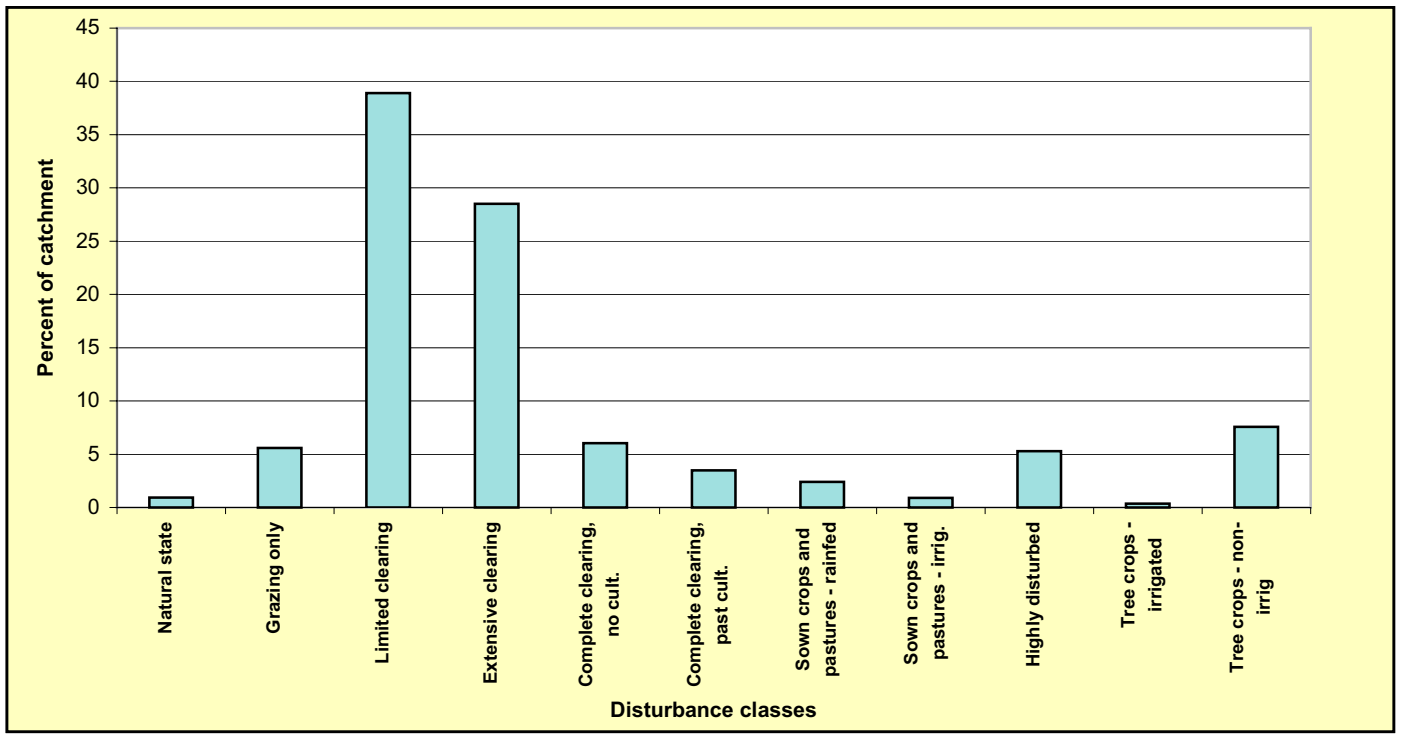


Figure 3. Disturbance ratings of the Mary River catchment (by disturbance class).

The major land uses in the Mary River catchment are grazing and forestry.

3. CLIMATE

Climate is a major factor determining the pattern of land use in the catchment. The seasonal variation of rainfall and temperatures in this area is such that they restrict where and when various agricultural land uses are carried out. The western parts of the catchment are much drier and experience greater temperature extremes than those in the southern and eastern parts. The most striking difference is the amount of rainfall received; Kilkivan receives little more than one third of the amount of Maleny rainfall. This affects the type of agricultural enterprises suited to the areas. Many require regular supplies of rainfall to remain viable, limiting the western part of the catchment to a narrow range of agricultural pursuits unless irrigation water is available.

3.1 RAINFALL AND MOISTURE INDEX (MAP 8)

The catchment is predominantly sub-tropical, being moist sub-tropical toward the south and coastal ranges, and dry sub-tropical in the western areas. The rainfall varies from around 2000 mm at Maleny and the ranges on the south and coastal side of the catchment, to 880 mm at Kilkivan and the western side of the catchment (Willcocks and Young 1991, Bureau of Meteorology 1997) (Figure 9). The bulk of rainfall is received in the December to March period, however substantial falls can occur throughout the year.

Available data on mean, monthly evaporation exists only for Gympie and Nambour (Nambour is just to the south of the catchment). The 'Moisture Index', a measure of effective rainfall, is calculated by subtracting the quantity of water that can be evaporated, from the rainfall received.

Figure 4 shows that during the middle and latter half of the year evaporation exceeds the mean monthly rainfall for Gympie. Only between the months of January to March does rainfall exceed evaporation for the area. This pattern of the moisture index explains why large proportions of crops grown in the area are irrigated in order to achieve optimum growth.

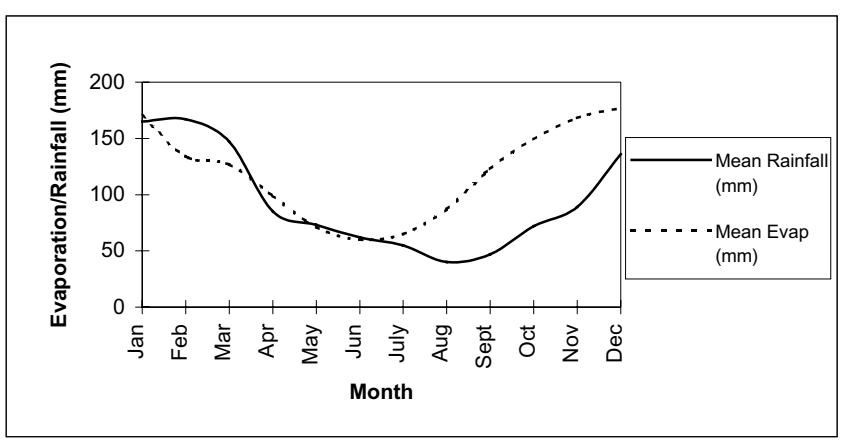


Figure 4. Mean monthly moisture index for Gympie.
Source: Bureau of Meteorology, 1997

Nambour's moisture index pattern indicates that mean monthly rainfall exceeds evaporation between the months of January to July (Figure 5). Suggesting the need to irrigate crops is not as imperative as it is in the Gympie area.

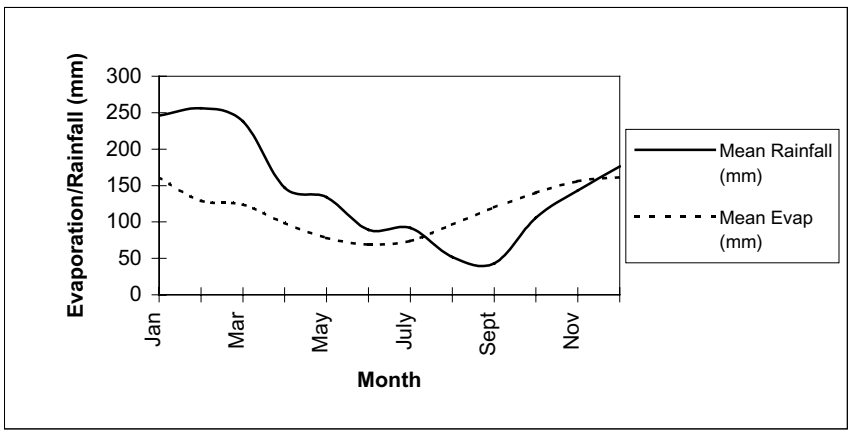


Figure 5. Mean monthly moisture index for Nambour.
Source: Bureau of Meteorology, 1997

3.2 FROSTS

Frosts are a limiting factor in the region with crop selection in the winter months being dependent on slope position and aspect. Frosts being most severe in the lower lying parts of sheltered valleys and depressions. Gympie and Nambour generally experience an average of 9 frosts per year (Bureau of Meteorology 1997), with the greatest number occurring in July. Frosts usually occur from mid May to late August. Maryborough experiences the same frost pattern, but only experiences on average 5 frosts each year (Figure 6). Hervey Bay's close proximity to the sea inhibits frost occurrence, due largely to the dampening effect ocean waters have on temperature extremes.

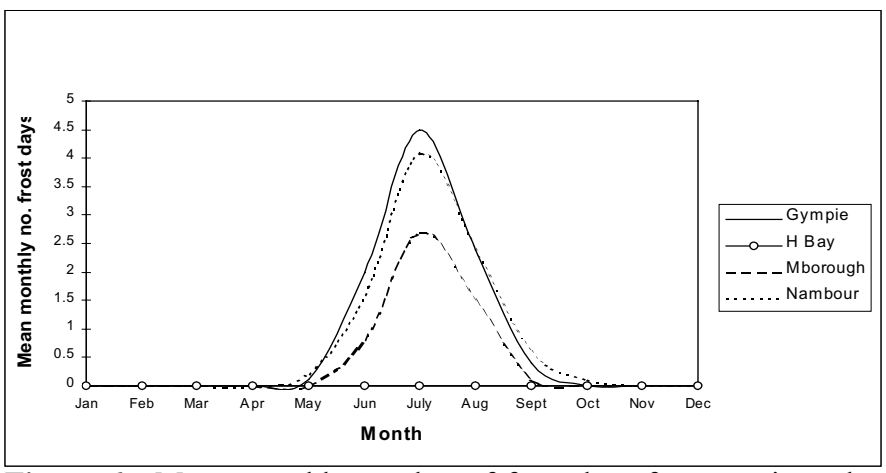


Figure 6. Mean monthly number of frost days for areas in and around the Mary River catchment.
Source: Bureau of Meteorology, 1997

3.3 TEMPERATURE

Available temperature data for Gympie, Nambour, Hervey Bay and Maryborough indicate that mean, monthly maximum and minimum temperatures are similar for each area (Figures 7 and 8).

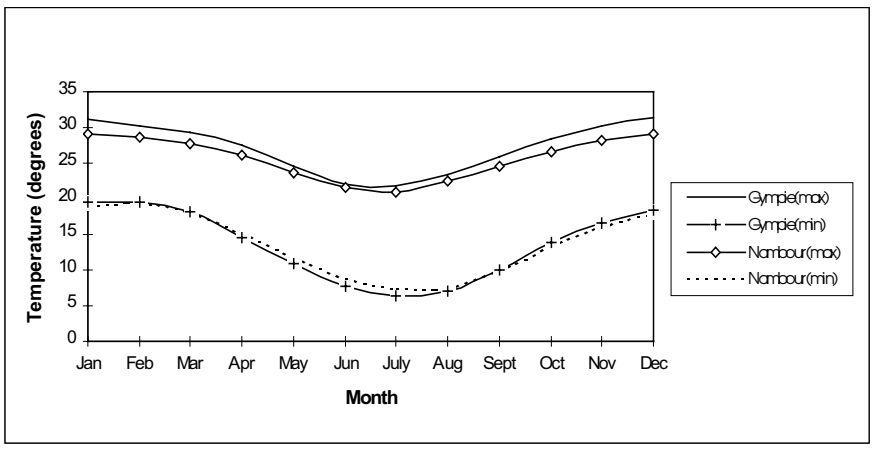


Figure 7. Mean monthly maximum and minimum temperatures for Nambour and Gympie.
Source: Bureau of Meteorology, 1997

Gympie and Nambour generally experience mean, monthly maximum temperatures ranging from the low twenties to the low thirties throughout the year. Mean, monthly minimum temperatures range between 5 °C and 20 °C throughout the year.

Maryborough and Hervey Bay experience similar mean monthly maximum temperatures throughout the year compared to Gympie and Nambour, but experience warmer minimum temperatures. The minimum temperatures for Maryborough and Hervey Bay range from 10°C up to the low twenties, once again due to the tempering effect of the ocean. Appendix 1 contains the base data for centres within the catchment.

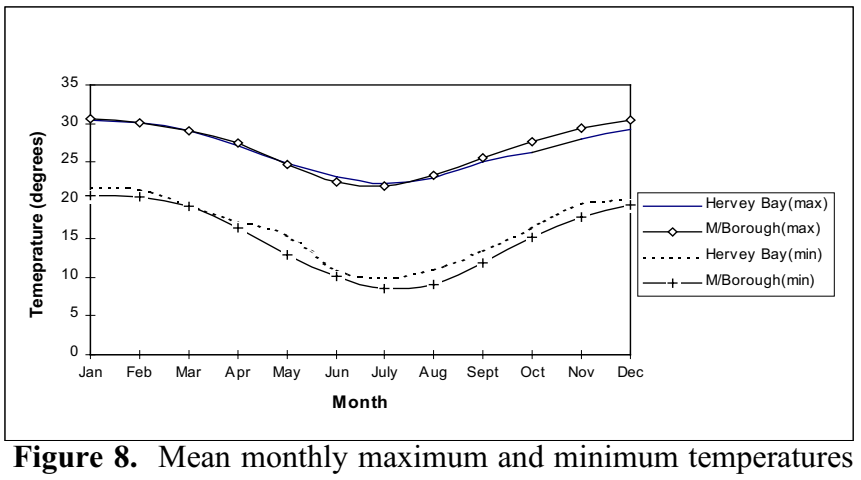


Figure 8. Mean monthly maximum and minimum temperatures for Maryborough and Hervey Bay.
Source: Bureau of Meteorology, 1997

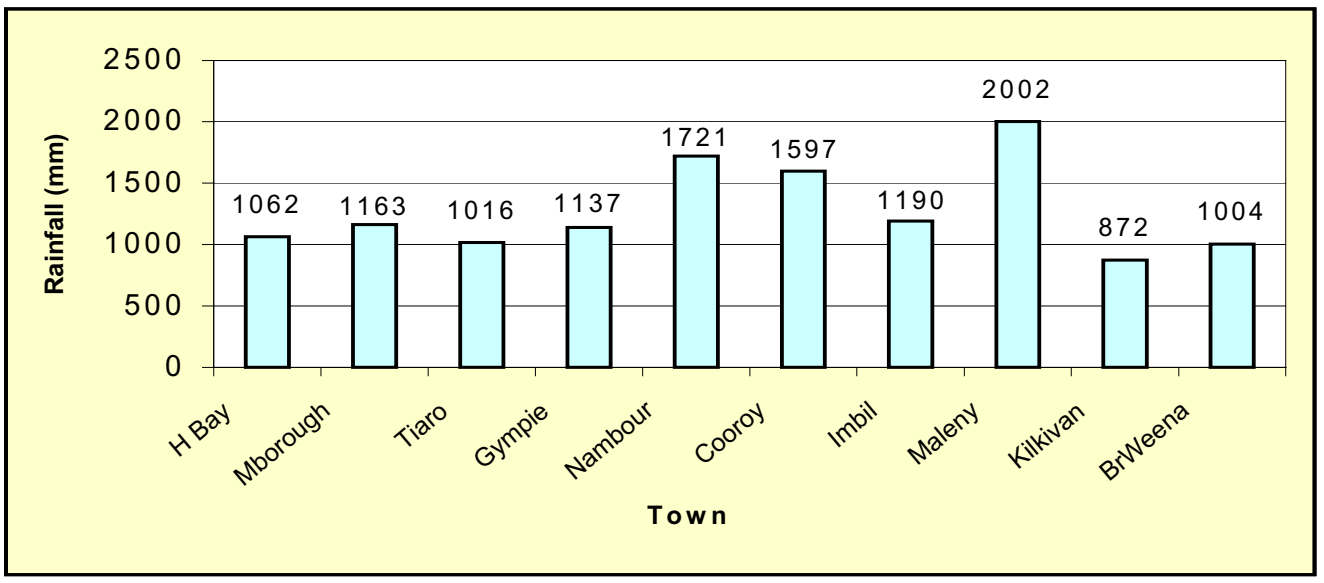


Figure 9. Mean monthly rainfall for locations within and around the Mary River catchment.
Source: Bureau of Meteorology, 1997

South west of Imbil, climatic conditions are suitable for many land uses, including native pine plantations.

4. WATER RESOURCES

4.1 SURFACE WATER (MAPS 9 AND 10)

The Mary River originates in the Conondale Ranges in the south of the catchment, where the river is at an elevation of 500 metres above sea level. The river falls 300 metres in the first 5 kilometres of flow which is a bed gradient of 6%. Upstream of Conondale the bed gradient is 0.62%, this continues to reduce the further the river travels downstream, 0.17% between Conondale and Kenilworth, 0.04% from Kenilworth to the tidal barrage downstream of Tiaro (Department of Primary Industries 1995) (Figure 11). The Mary River empties into the Great Sandy Strait region between Fraser Island and the mainland, traveling a distance of 307 kilometres (AMTD, average middle thread distance).

Major tributaries entering the Mary River from the west include Munna Creek, Wide Bay Creek, Widgee Creek, Amamoor Creek, Kandanga Creek and Yabba Creek. Major tributaries entering from the east include Tinana Creek, Six Mile Creek and Obi Obi Creek. The Susan River enters from the north inside River Heads at the mouth of the Mary River. These are shown on Map 9 – Streams and Dams.

The tributaries within the catchment supply varying amounts of water to the overall discharge of the Mary River; they reflect the range of rainfall and resultant runoff throughout the catchment. Flow volumes for the catchments streams are variable from year to year, dominantly peak flows occur between the months of November to April (Department of Primary Industries 1994). Estimates of the mean annual discharge for several major streams in the area are shown on Map 10 – Estimated Mean Annual Discharge for Major Streams.

Eleven impoundments exist within the catchment, providing both irrigation and urban water supply needs (Table 1). The catchment's water resources are also utilised by the adjoining Sunshine Coast population.

Table 1. Impoundments in the Mary River catchment.

Storage name	Capacity (Ml)	Stream
Tinana Barrage	4 770	Tinana Creek
Mary River Barrage	11 700	Mary River
Teddington Weir	3 590	Tinana Creek
Tallegalla Weir	385	Tinana Creek
Goomeri Weir	22	Kinbombi Creek
Cedar Pocket Dam	725	Deep Creek East
Imbil Weir	46	Yabba Creek
Borumba Dam	46 000	Yabba Creek
Six Mile Creek Dam (Lake McDonald)	8 000	Six Mile Creek
Baroon Pocket Dam	61 000	Obi Obi Creek
Maleny Weir	57	Obi Obi Creek
Total storage	**136 295**	

Major irrigation schemes in the catchment include the Mary Valley Irrigation Project (MVIP) (including the Pie Creek Diversion Scheme), the Lower Mary River Irrigation Area (LMIA) and the Deep Creek Project Area (DCPA).

The MVIP supplies irrigation, industrial, stock and domestic water from Borumba Dam, located 10 km south west of Imbil. The Borumba Dam supplies users along the Mary River, a total distance of 179 km. The LMIA is located between Maryborough and Tiaro. This predominantly sugar cane growing region is supplied irrigation water by pipelines and open channels from the Mary River and Tinana Creek Barrages. The DCPA utilises the Cedar Pocket Dam and releases are made for downstream irrigation of pasture for the dairy farms in the area.

The existing allocation for irrigation from regulated supplies in the Mary River Valley is 29 800 megalitres per annum. Potential demand in the Lower Mary River Irrigation Area could increase by 33 500 megalitres per annum if the area were fully developed. Hence the total irrigation requirements for the year 2041 could reach 70 000 megalitres per annum (Department of Primary Industries 1994). However a consequence of irrigation has been an increase in the evidence of saline scalds in the lower Mary.

In 1993, urban water usage of Mary River catchment sources was approximately 28,781 megalitres. In the future additional water supplies will be required for urban use as illustrated in Figure 10. In particular, Noosa Shire and Hervey Bay City will require augmentation before the turn of the century, and Caloundra City and Maroochy Shire by the year 2010 (Department of Primary Industries 1994).

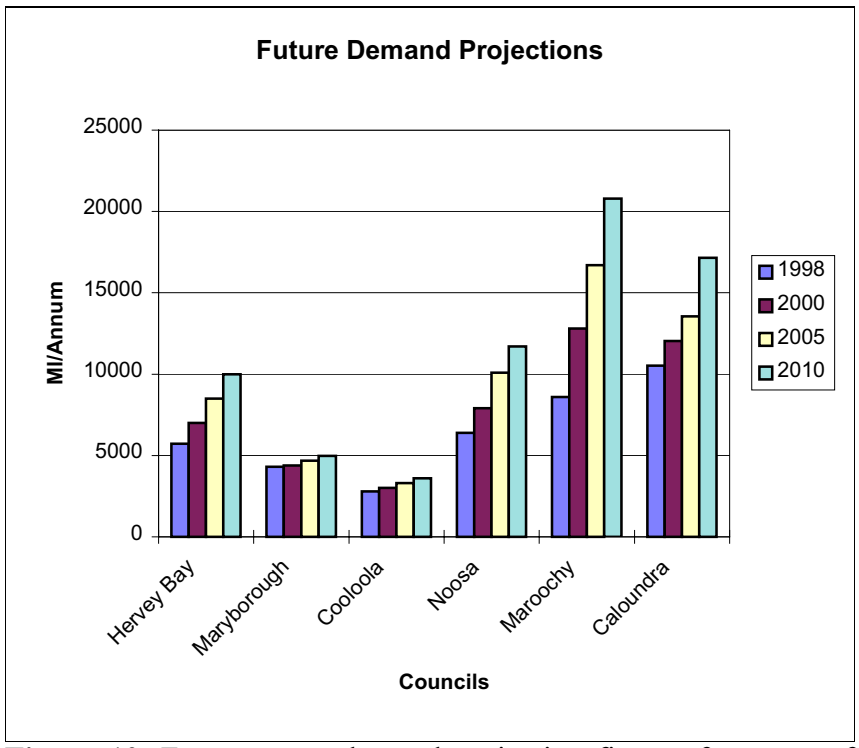


Figure 10. Future water demand projection figures for some of the councils within the Mary River catchment
Source: MRCCC General Meeting No. 50.

4.2 STREAM CONDITION AND WATER QUALITY (MAPS 11 AND 12)

The 'State of the Rivers Report' for the Mary River catchment found that 29% of the catchment's entire stream length was in poor condition, 59% in moderate condition and 12% in good condition. Riparian vegetation along the catchment's stream length rated very poor for 40% and poor for 23%. Stream bank stability was good with 83% of stream banks considered stable although stream bank erosion is common between Conondale and Gympie. The Mary River is assessed to be in poor condition for 88% of its length, although most minor streams were considered to have fairly good scenic, recreational and conservation values (Johnson 1997). Map 12 shows the 'State of the Rivers - Overall Condition' of the major streams and rivers of the Mary River catchment.

A reach of the Mary River.

Water quality monitoring of the Mary River catchment is carried out by the Environmental Protection Agency, the Department of Natural Resources and through the Waterwatch Program. The Environmental Protection Agency monitors the health of the Mary River through its Statewide Ambient Water Quality Monitoring Program. This involves monitoring at a number of sites using a combination of chlorophyll A concentrations, suspended solids concentrations, sediment nutrient concentrations and *in situ* physico-chemical indicators to assess water quality.

The Department of Natural Resources monitors pH, electrical conductivity and temperature levels at various guaging stations throughout the catchment to assess water quality. The Waterwatch Program monitors the health of waterways through the involvement of local schools and communities. Largely funded by the Natural Heritage Trust and local governments, and run by local governments and catchment groups, the Waterwatch Program aims to increase awareness of water quality issues by involving all members of the community in the monitoring programs. Testing includes pH, turbidity, dissolved oxygen, temperature, salinity, phosphates, nitrates and faecal coliforms. Waterwatch groups also assess the health of waterways by sampling for invertebrates and monitoring riverbank vegetation. The location of monitoring sites throughout the catchment can be found on Map 11 – water quality monitoring sites.

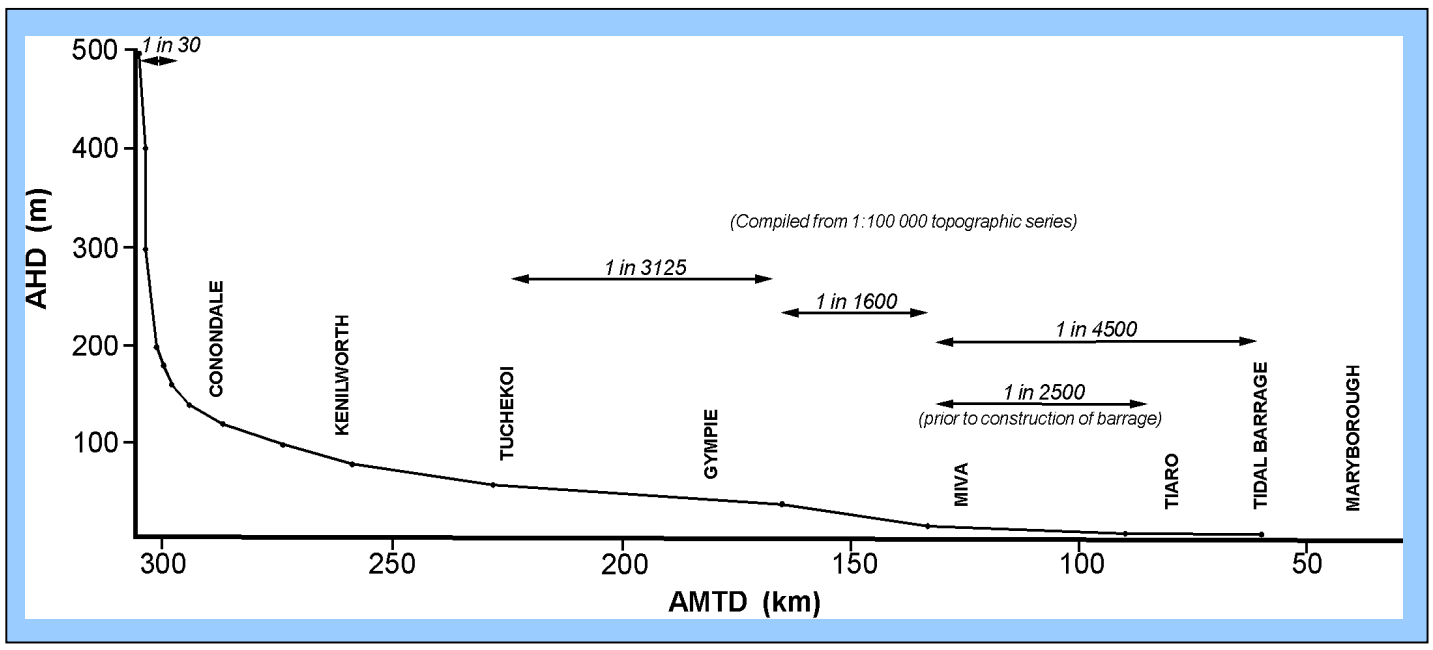


Figure 11. Longitudinal section of the Mary River (Department of Primary Industries 1995).

4.3 FLOODING

Frequent flooding of creek and river flats is a major hazard in the catchment, limiting the potential for development (agricultural or residential) in these areas. Flooding results in damage to riparian zones, residential areas, crops and pastures, reduced bank stability and high sediment loads in streams and rivers. This may affect land and/or stream flow further down stream as a result. Many large flood events have occurred since settlement of the catchment (Figure 12).

Sand deposited by flood waters onto flats of the Mary River.

To give a better indication of the height of some of these large flood events the following are some landmarks around Gympie;

- the bank of the Mary River (near Gympie) is broken at the height of approximately 7 m,
- Kidd Bridge is flooded at 10 m,
- "Madill's garage" floor at 14.6 m,
- Normanby Bridge at 16 m,
- the swimming pool and Mary Street begins to be inundated at the height of 17.3 m,
- homes begin to be inundated at a height of 18.3 m.

Silt left behind after flood waters receded near Fisherman's Pocket.

So as can be appreciated, the 34 floods indicated have done considerable damage to the low-lying areas in the catchment, especially around Gympie.

4.4 GROUNDWATER

Groundwater in the catchment is generally available from alluvial aquifers, and areas of sedimentary and fractured rocks. The salinity of the groundwater varies from low to high, and volumes available are generally low (Baxter *et al.* 1990). Groundwater is generally not plentiful enough for irrigation purposes in the catchment, instead restricted to stock watering and domestic purposes.

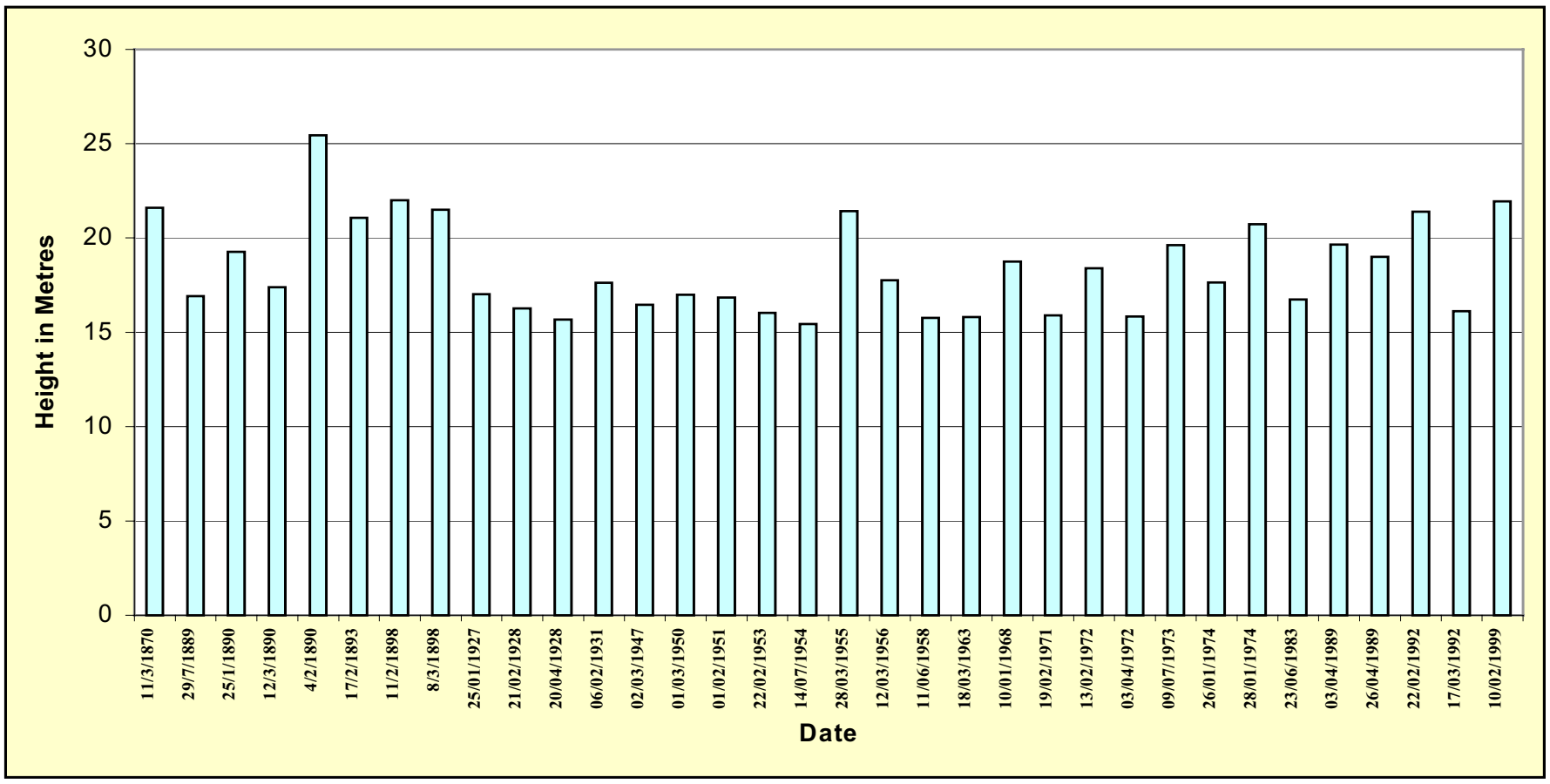


Figure 12. Floods greater than 15m since 1870 for the Gympie guaging station.

The frequency of flooding is such that most decades have recorded at least one flood event greater than 15 m, with some decades experiencing six or seven such as the 1890s, 1950s and the 1970s (Figure 13).

Multiple major floods also appear to occur in the same year, with 1890 (3), 1898 (2), 1928 (2), 1972 (2), 1974 (2), 1989 (2), and 1992 (2) all receiving more than one major flood in the same calander year.

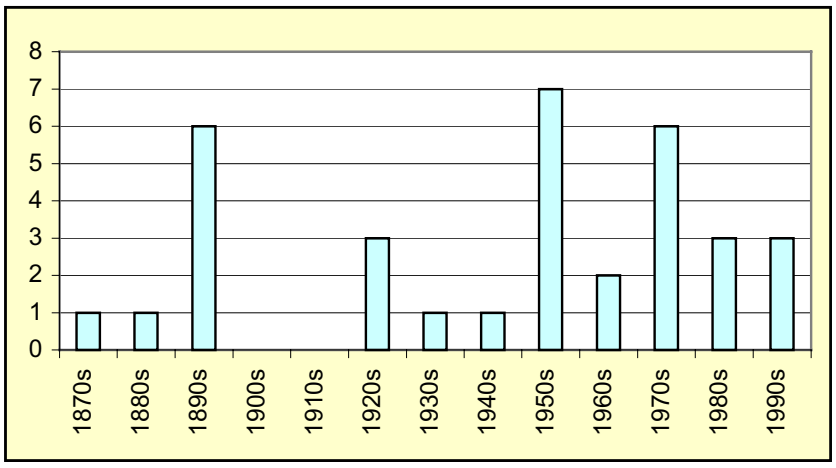
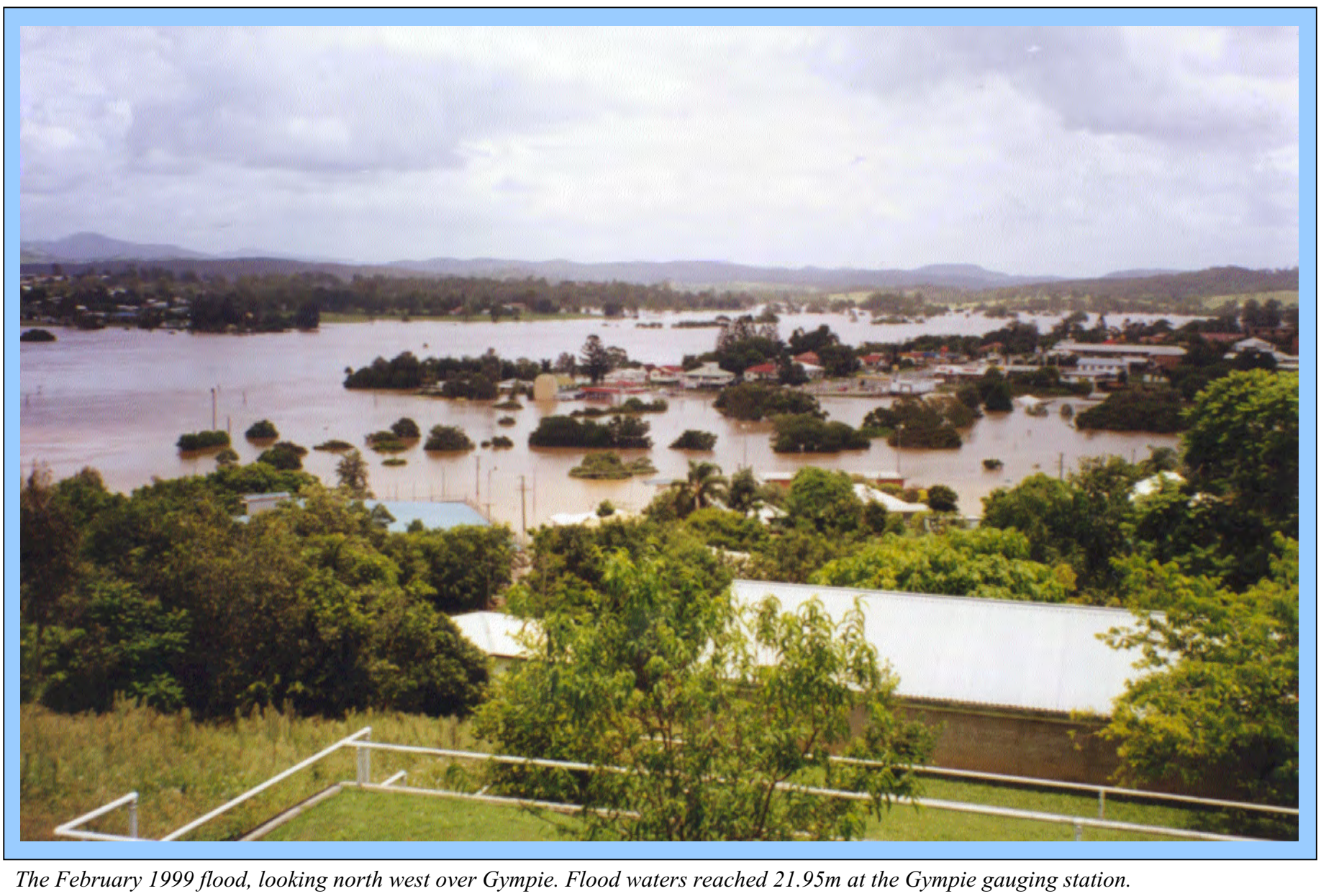


Figure 13. Frequency of major floods per decade



The February 1999 flood, looking north west over Gympie. Flood waters reached 21.95m at the Gympie gauging station.

5. LAND RESOURCES

5.1 TOPOGRAPHY (MAP 13)

The catchment is bounded by the Clifton Ranges in the north-west, the Burnett, Jimna Range in the west and the Conondale, Blackall and Beenham Ranges in the south-west, south and south-east respectively. These bounding ranges support moderately inclined to very steep slopes. The ranges extend inward into the western and southern parts of the catchment, forming an expanse of minor mountain ranges which are dominated by moderately inclined to steep slopes. The highest peaks of the catchment are located in Conondale National Park with Mount Constance at 770 metres, Mount Ramsden at 800 metres and Mount Langley at 868 metres above sea level.

These mountain ranges separate the Mary River Catchment from the Burnett catchment to the north and west, the Brisbane River catchments to the south and west, and the bordering Noosa, Maroochy and Mooloola River catchments in the east. A number of small creeks extending from the north-eastern boundary drain into the Great Sandy Straits.

The alluvial action of the drainage system has produced level to gently undulating terrain along the Mary River and its tributaries. A distinct constriction of the alluvial plain (by two erosion resistant sandstone ridges) can be observed just downstream of Gympie, at Fishermans Pocket, with a large amount of flooding and alluvial deposition occurring upstream as a result. The extensive coastal plains in the north-east of the catchment are generally level to gently inclined. The extent of mountain ranges and low alluvial country are shown on Map 13 - Elevation.

5.2 GEOLOGY (MAP 14)

The eastern part of the continent in which the Mary River Catchment is located was an active tectonic margin for many millions of years. generally, successive fold belt margins were built up and added to the continental margin, and stabilised before the next episode of subduction commenced offshore. This zone is known as the Tasman Fold Belt System (Figure 14). The compression and disruption at each tectonic episode, resulted in rocks that are fragmented into isolated slices, making the activity of each episode difficult to decipher. The Gympie province is part of the easternmost, youngest activity in the Tasman Fold Belt System in Australia (Willmott and Stevens 1988).

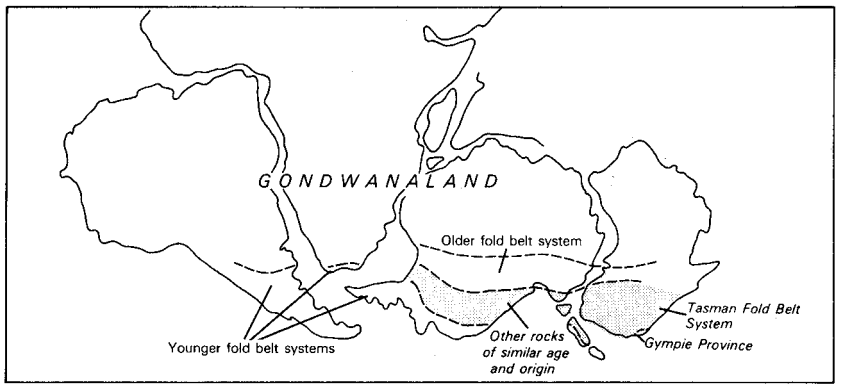


Figure 14. The Tasman Fold Belt System as it was before the break up of Gondwanaland about 170 million years ago (Willmott and Stevens 1988).

A simplified geological and structural map of the region surrounding the Mary River catchment is illustrated in Figure 15. Map 14 – Geology, gives a catchment wide representation of when the major geological units were formed.

5.3 MINERAL RESOURCES (MAP 15)

Mining activities within the Mary River catchment fit into four groups, each mining different minerals and/or rocks;

- gold, copper ore, silver ore, lead ore, zinc ore, manganese ore, nickel ore (1 172.84 ha),
- clay, brick clay, pottery clay, white ware clay, shale (173.10 ha),
- limestone, dolomite (47.29 ha),
- building stone, sandstone, slate (10.07 ha).

The total area of *mining leases* within the catchment is 1403 ha (Department of Mines and Energy, Jan. 2000) (Map 15). Methods of mining range from underground to open cut, depending on mineral resource and location.

Twenty five permits for sand and gravel extraction have been approved at various sites along the Mary River catchment's water courses, predominantly along the Mary River. Numerous 'borrow pits' are scattered throughout the catchment, used mainly for road repairs in the vicinity of the pit.

The Department of Minerals and Energy are in the process of updating mineral resource information to identify mineral occurrence and extractive potential. This is expected to be completed by the year 2005.

5.4 SOILS AND LAND RESOURCE AREAS (MAPS 16 AND 17)

The description and classification of soils across the Mary River catchment has been undertaken at various scales and levels of accuracy by the CSIRO, private consultants, Department of Primary Industries and the Department of Natural Resources.

A shallow soil developed on sandstone, Curra.

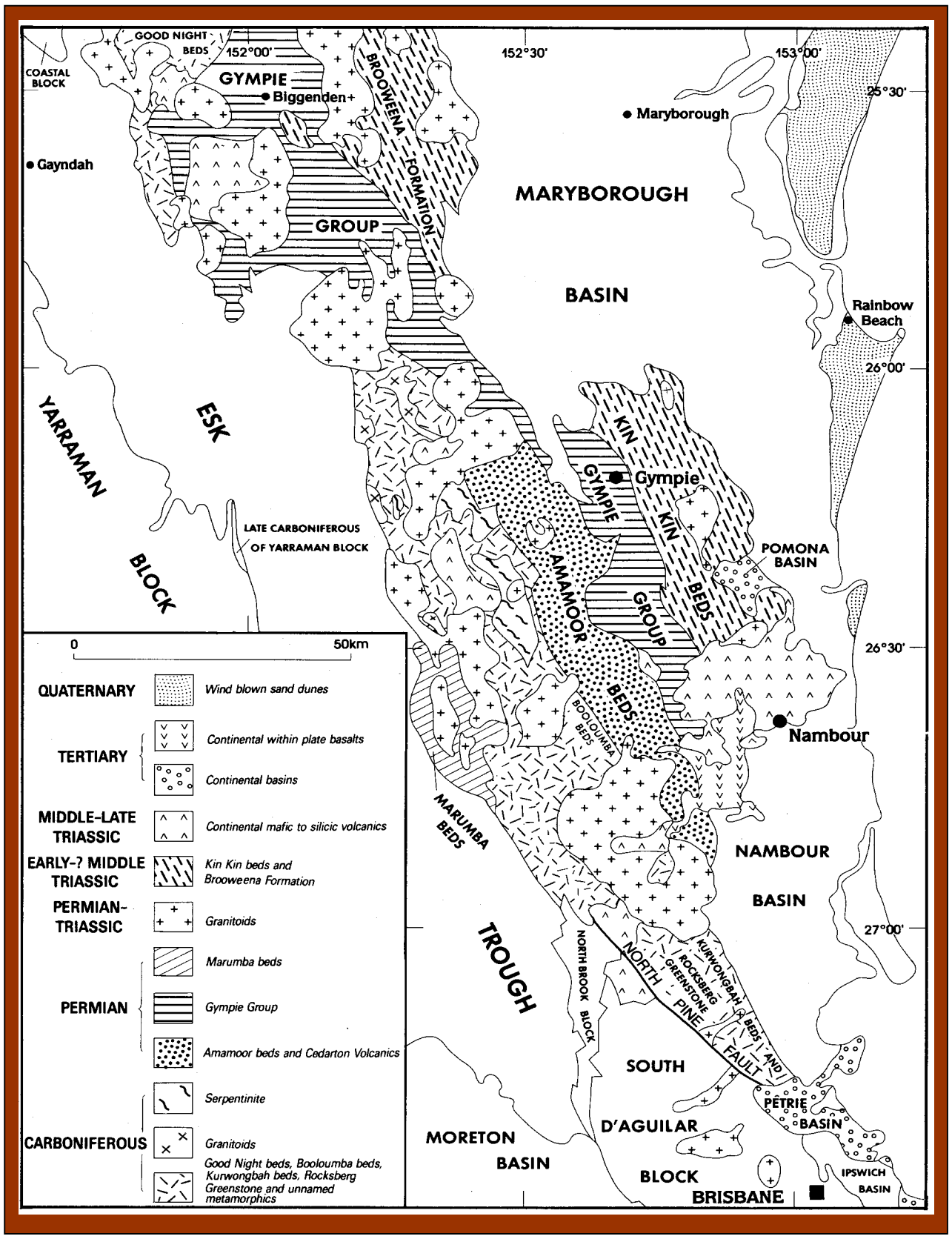


Figure 15. Simplified geological and structural map of the Brisbane-Biggenden area
Source: Geological society of Australia, 1987.

Map 16 shows the catchment's soils described by the CSIRO's Atlas of Australian Soils in 1968. The map describes soils according to the characteristics of a representative soil profile. The CSIRO mapping exercise was conducted at a very broad scale of 1:2 000 000, which restricts its use to overview purposes. Further CSIRO studies of the Mary River alluvia have been undertaken by Thompson (1966, 1973) and Bridges *et. al.* (1990). In 1994, consultants Land Resource Assessment and Management Pty Ltd produced 1:25 000 scale soil maps on Geographic Information Systems (GIS) for the Noosa and Cooloola Shire. Consultant Dames and Moore also undertook a Review of existing soils information in 1993 for the Maroochy Shire.

The Department of Primary Industries – Forestry have undertaken very detailed mapping with one site observation for every four hectares approximately, of only its coastal plantations for plantation management purposes (Osborne pers. comm. 1999).

The Department of Natural Resources began mapping of soils in the Mary River catchment in 1986. These are outlined in Map 17 – Soil survey project areas and Table 2.

The type of survey undertaken effects the use of the information obtained. For example:

- The 1:50 000 land resource assessment surveys aim to map soil types and their associated attributes and limitations. This soil information is used to evaluate mapped areas for their capability to sustain a crop or pasture that is economically viable and also environmentally sustainable. Users of the information can then determine the most suitable land use for any given area that is mapped. The surveys also record landform, vegetation, and land surface information, which is used to gain a more detailed understanding of the soils within mapped areas (Zund pers. comm. 1999). Soil surveys at a scale of 1:50 000 are entered into digital format on geographic information systems and are able to be used for catchment management, large property management, etc.
- 1:100 000 surveys are limited in detail and are used for regional assessment and give a broad description of the land resources present. These surveys are also entered into GIS, but their use is restricted by the scale of mapping.

Table 2. Land Resource Survey project details (Zund pers. comm. 1999).

Survey	Surveyor	Printed Report	GIS Data	Project Progress	Contact
Horticultural Land Suitability Study - Sunshine Coast SouthEast Queensland. 1:100 000	Capelin,	Yes	Yes	Completed 1987.	Maps/Reports: DNR Resource Science Centre. Tel: 3896 9502. Digital data: DNR Resource Science Centre Tel: 3896 9427.
Mary River Catchment Land Resource Assessment Project. 1:50 000	Pointon	Yes	Yes	Report, maps and GIS data available end of 1999.	DNR Gympie. Tel: 5482 6221.
Developing Sustainable Natural Resource Management Systems for Maryborough. 1:50 000	Wilson, Anderson, and Brown	Yes	Yes	Report available September 1999. Maps and GIS Data available now.	DNR Bundaberg, Tel:4153 7888.
Maryborough Tiaro Land Resource Assessment. 1:50 000	Zund, Brown, And Wilson	Yes	Yes	Report, maps and GIS data available 2001.	DNR Maryborough Tel: 4121 1914.

Two Land Resource Area (LRA) studies have been conducted in the Mary River catchment, focusing on the Maryborough and Gympie/Nambour areas. LRAs are broad landscape units made up of groups of different soils developed from related geological units with recurring patterns of topography and vegetation. The LRAs outlined in Table 3 (Gympie/Nambour region) and Table 4 (Maryborough region) give a broad overview of the landscapes encountered across the catchment.

Table 4. Land Resource Areas of the Maryborough district (DPI Staff 1992).

Land Resource Area (LRA)	Description
Alluvium	*Alluvial Plains*
	Generally level, sandy and clayey alluvial plains with some steep overfalls into creeks and rivers; open *Eucalyptus* forest.
Basalt	*Basalt Hills*
	Undulating plains, low hills and plateau remnants of lateritised basalt and olivine basalt; largely cleared for agriculture – formerly vine forest and grassy forest.
Sandplain	*Coastal Lowlands*
	Coastal and estuarine fine sands and muds subject to tidal influences, coastal sand dunes; banksia, tea-tree, heath, and *Casuarina* vegetation.
Coastal Plains	Level to gently undulating plains and low hills on consolidated sediments; layered and grassy forest with small areas of sclerophyll forest.
Uplifted Coastal Plains	Undulating plains, low hills and ridges on consolidated sediments; grassy open forest with silver leaved iron bark and pink bloodwood, spotted gum, ironbarks and *Acacia* spp.
Acid Volcanic	*Hills and Mountains*
	Mountains, low hills with minor undulating plains and rises on acid to intermediate flows, pyroclastics and tuffaceous (volcanic) sediments; open *Eucalyptus* and *Acacia* forest.
Granite	Mountains and undulating to rolling plains and rises on granite, granodiorite and quartz diorite; low, open *Eucalyptus* and *Acacia* forest.
Metamorphic	Mountains and undulating to rolling rises and plains on slate, chert, schist, phyllites, gneiss, greywacke and other metamorphic rock; open, *Eucalyptus* and *Acacia* forest.

Table 3. Land resource areas of the Gympie/Nambour region. (derived from Dwyer, 1990).

LAND RESOURCE AREAS/ GEOLOGY	VEGETATION	SOILS - Great soil groups (Australian classification)*	Topography
LANDSBOROUGH SANDSTONE	Open forest of bloodwood and mahogany.	Red earths (Kandosols), yellow podzolic soils (Chromosols). Lithosols (Rudosols) formed principally on sandstones.	Gently inclined to steep low hills. Some steep uniform slopes.
COASTAL SAND PLAINS	Open woodland of scribbly gum and stringybark, banksia heathland, some closed wet sclerophyll forest.	Yellow earths (Kandosols), yellow and red podzolics (Chromosols) on sandstones. Humic gleys (Hydrosols) and humus podzols (Podosols) in drainage depressions.	Gently to moderately inclined rises.
NORTH ARM VOLCANICS	Open forest of blackbutt. Grey gum and tallowwood closed forests of flooded gum in gullies.	Krasnozems, xanthosems (Ferrosols) Red and yellow podzolics (Chromosols), lithosols (Rudosols) formed on rhyolite.	Moderately rolling rises, low hills to steep mountainous terrain with dissected slopes.
MALENY/BUDERIM PLATEAUX	Rainforest with wet sclerophyll on drier margins.	Krasnozems (Ferrosols) on basalt. Red podzolic soils (Chromosols) with small areas of prairie (Dermosols) and non-calcic brown soils (Dermosols) on rhyolite.	Gentle to moderate hills on plateau. Very steep unstable faces on the margins.
AMAMOOR BEDS	Open forest of iron bark, spotted gum and grey gum. (forest she-oak associations)	Red and yellow podzolic soils (Chromosols). Gradational yellow podzolic soils(Chromosols or Dermosols). Lithosols (Rudosols) developed on shale, mottled red soils.	Undulating low hills to very steep mountains.
WOONDUM GRANITE	Closed forest of bloodwood swamp mahogany and flooded gum.	Lithosols (Rudosols) and red podzolics (Chromosols). Shallow to gritty sands developed on granite.	Moderately steep to very steep hills.
KIN KIN BEDS	Open eucalypt forest of bloodwood, stringybark, ironbark and tallowwood. Closed flooded gum associations in drainage lines.	Red podzolics (Chromosols) and gradational yellow podzolic soils (Dermosols), lithosols (Rudosols), yellow-red latosols (Rudosols) developed principally on phyllite shales and shales.	Gently to steeply undulating hills. Steeply inclined ridges with non-uniform slopes.
GYMPIE GROUP	Mainly closed forest of grey gum, brush box and blue gum. Wattle associations.	Lithosols (Rudosols), podzolics (Chromosols), solodics (Sodosols) developed on shales and siltstones. Prairies soils (Dermosols), krasnozems (Ferrosols) and xanthozems (Ferrosols) developed on andesites and rhyolites.	Low to moderately hilly with many uniform but steeper slopes.
ALLUVIUMS	Forest red gum open forest and tea tree open forest.	Medium and coarse textured alluvium soils(Rudosols). Lateritic podzolic soils (Chromosols), yellow podzolic (Chromosols), and prairie soils (Dermosols).	Gently undulating terrain comprising stream channel and river terraces.
COASTAL SAND DUNES	Casuarina, banksia heathland, wallumheath, swamp she-oak.	Podzols (Kandosols), humic gleys (Hydrosols) and gleyed podzolic soils (Hydrosols). Deep siliceous sands (Tenosols).	Hills and slopes on beaches, low hills adjoining beaches, coastal swamps and higher areas on coastal plains.
KILKIVAN ADAMELITE	Open forest, blue gum, silver leaved ironbark.	Yellow brown solodic (Sodosols) and reddish prairie soils (Dermosols).	Low to moderate hills.
KURWONGBAR BLOCK	Open forest spotted gum, grey ironbark, blackbutt, forest she-oak understorey.	Shallow yellow podzolic soils (Chromosols) and lithosols (Rudosols) developed on chert.	Steep dissected slopes, steep and rolling hills.

*Great Soil Groups according to Stace *et. al* (1972)
Australian classifications according to Isbell (1987)

6. NATURAL ENVIRONMENT

6.1 VEGETATION (MAPS 18, 19, 20, AND 21)

The Mary River catchment's vegetation has been classified according to structural formation (McDonald *et.al*, 1990) by the Department of Natural Resources (Map 18 – Vegetation Cover) (Pointon 1998). This map gives an indication of the type and location of vegetation throughout the catchment. Figure 16 shows the catchment area covered by the different vegetation cover classes. The dominant vegetation type is open forest, covering 401 450 hectares or 42.7%, and is used mostly for beef grazing and forestry land uses. Grassland covers 281 109 hectares or 29.9% of the catchment. Beef and dairy grazing land uses dominate the grassland areas. Woodland covers 138 204 hectares or 14.7% of the catchment, and is mostly used for beef grazing and rural residential. Closed forest covers 101 538 hectares or 10.8% of the catchment, and consists mostly of plantation forestry and remnant vegetation.

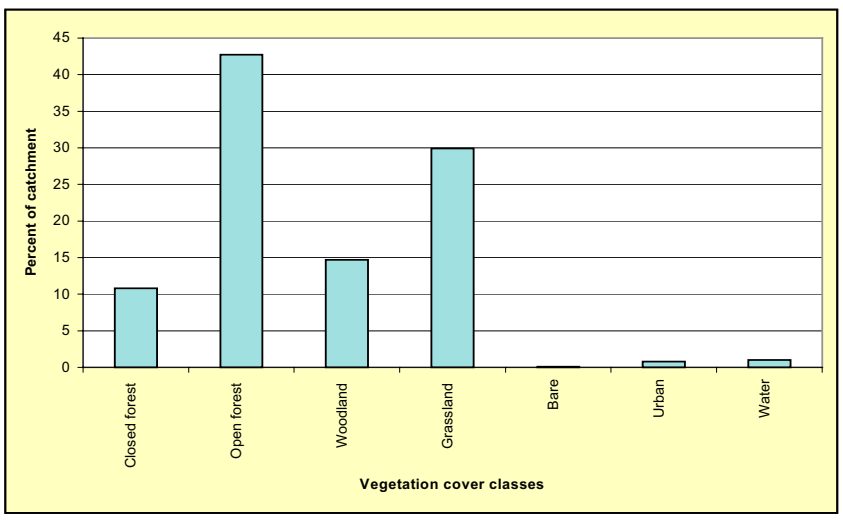


Figure 16. Percentage of Mary River catchment covered by each vegetation cover class.

Vegetation mapping by the Queensland Herbarium from 1995 to 1997 has produced coverages of broad forest types before clearing occurred (Map 19 – Precleared Broad Forest Types). This map was produced through the analysis and interpretation of photos, images, field data, geology, topography, historical survey records and soils.

The Queensland Herbarium vegetation mapping also produced coverages of currently existing broad forest types. Map 20 – Existing Broad Forest Types shows the remaining forests and the extent of forests that have either been cleared or replaced by plantation forestry. The broad forest types *Hoop Pine dominated vine forest* and *complex notophyll vine forest* are rainforest remnants. The *complex notophyll vine forests* have been extensively reduced from their previous extent. Remnants are found on sloping country with better quality soils in the southern half of the catchment. These rainforests are multi-layered and characterised by palms, strangler figs, buttressed trees, vines and epiphytes. The *Hoop Pine dominated vine forests* occur in the middle of the catchment on sloping country from around Mount Bauple National Park in the east, to around Grongah State Forest in the west. These less complex dry rainforests are characterised by a closed canopy with several tree layers, large woody vines and thorny or spiny shrubs.

Wet sclerophyll forests are characterised by tall eucalypts with a rainforest understorey. The broad forest type *high timber value wet sclerophyll forest* occurred in a large area that is now Gympie East, Goomboorian and Wolvi. Remaining patches occur mostly within the areas of state forests. *Flooded Gum dominated wet sclerophyll forest* occur in the southern high rainfall areas on lower slopes and valleys with fertile soils. They are still found in the Pomona, Cooroy and Conondale areas. *Blackbutt dominated wet to mixed forest* may display characteristics of either dry or wet scleropyll forest and is commonly found adjacent to rainforest in the southern parts of the catchment. Blackbutt is an important source of hardwood timber.

Spotted Gum dominated dry forest, *moderate timber value mixed forest*, and *low to unproductive forest or woodland* are the most widespread forest types remaining in the Mary River Catchment. They are valued as grazing lands and for their timber production. These forests are well adapted to fire events, growing in drier conditions and poorer soils.

Native forests make up a significant proportion of the forest areas in the Mary River catchment.

Blue Gum dominated mixed forest has been extensively cleared due to its occurrence on fertile river flats. The largest remaining Blue Gum forests occur in the north along the Susan River, Saltwater Creek, Benarige Creek, Tinana Creek and Ooramera Creek areas. Very small isolated remnants occur along most watercourses throughout the rest of the catchment.

Exotic pine plantations at Tuan, Toolara and Wongi State Forests have replaced much of the low to unproductive coastal forest in the north-east of the catchment. Native Hoop and Bunya Pine plantations have been established in state forests on a stretch of minor mountain ranges extending from the Coast and Jimna Ranges in the south-west corner of the catchment.

Melaleuca forests occur on low, coastal areas along flood plains, marshes, seasonal swamps and stream banks. Melaleuca forests are found along the Susan River, Maryborough area, in the north-east of the catchment.

The *heathland, banksia woodland and mangrove forest* category include coastal forest types less than 5 metres tall. Mangrove forests dominate the intertidal areas towards the mouth of the Susan River and Mary River. Heathland and banksia woodland occur to the east of Maryborough and in small patches within the Toolara State Forest.

Between 1982 and 1984, broadscale surveys were undertaken in the Mary River catchment to identify and map areas of dieback and to quantify and monitor levels of dieback severity among *Casuarina* and *Eucalyptus* at a total of 220 stream sites selected for the study. The results of these surveys have been recorded in the form of a report and map. Map 21 shows the recordings taken at each of the sites (Wylie *et al* 1993).

6.2 FAUNA

The Mary River catchment is home to a wide variety of native fauna. Investigations into the catchment's fauna are being conducted by a variety of groups and individuals. The results of fauna survey work will provide locations of faunal significance and contribute significantly to the catchment's information base.

The Gympie and District Field Naturalists' Club conducts an annual Gympie City bird count and have produced a comprehensive bird list for the city. Fauna surveys are also

regularly conducted in various locations and properties across the Gympie district. These surveys are ongoing and information is being put into the Queensland Department of Environment's 'Nature Search' database. The Nature Search database can be accessed through the Department of Environment's Maryborough office.

A long term fauna survey has been conducted on private property bordering the Glastonbury State Forest, and has identified a total of 286 species (Cooloola Shire Council 1996).

Maroochy Shire Council with assistance from the Queensland Biodiversity Network and volunteers are in the process of documenting the shire's fauna to develop a flora and fauna 'BioMap' database.

The 'Rhythms of Life' program is a community wildlife monitoring project that aims to list and monitor flora and fauna in the Mary, Noosa and Maroochy catchments. This information can be obtained through the co-ordinators on 07 5446 2937.

The study and assessment of the endangered Mary River Cod is conducted by the Mary River Cod Recovery Team. Information about the rehabilitation and protection of Mary River Cod populations can be obtained through the Mary River Cod Conservation Officer via the Mary River Catchment Coordinating Committee.

The Mary River cod is an endangered species.

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8. APPENDIX

Table 1. Mean monthly rainfall, evaporation rate, number of rain days and frost days and daily maximum and minimum temperatures for Gympie (Bureau of Meteorology 1997).

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual	Record Yrs
Mean Rainfall (mm)	165	167	147	85	73	62	55	40	47	72	89	136	1137	127
Mean Evap (mm)	170	134	127	99	71	60	65	87	123	149	168	177	1424	29
Mean No. Raindays	13	14	14	11	10	8	7	6	6	8	10	11	116	110
Mean No. Frost days	0	0	0	0	0.1	2.0	4.5	2.4	0.4	0	0	0	9.4	32
Daily max temp (°C)	31.2	30.3	29.3	27.4	24.6	22.0	21.8	23.3	25.9	28.3	30.3	31.3	27.2	80
Daily min temp (°C)	19.6	19.6	18.1	14.6	10.9	7.8	6.3	7.1	10.1	13.8	16.5	18.5	13.6	81

Table 2. Mean monthly rainfall, evaporation rate, number of rain days and frost days and daily maximum and minimum temperatures for Hervey Bay (Pialba) (Bureau of Meteorology 1997).

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual	Record Yrs
Mean Rainfall (mm)	102	186	125	111	126	56	52	36	34	80	58	97	1062	10
Mean Evap (mm)														
Mean No. Raindays	12	15	16	15	16	9	9	7	6	8	9	11	132	10
Mean No. Frost days	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Daily max temp (°C)	30.4	30.1	29.0	27.2	24.8	23.1	22.2	23.0	25.1	26.3	28.0	29.3	26.5	6
Daily min temp (°C)	21.7	21.5	19.5	17.4	15.5	11.1	9.9	11.1	13.4	16.5	19.6	20.2	16.4	6

Table 3. Mean monthly rainfall, evaporation rate, number of rain days and frost days and daily maximum and minimum temperatures for Maryborough (Bureau of Meteorology 1997).

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual	Record Yrs
Mean Rainfall (mm)	167	174	161	90	78	68	54	40	43	75	86	128	1163	127
Mean Evap (mm)														
Mean No. Raindays	13	14	14	12	10	8	7	6	6	8	9	11	118	110
Mean No. Frost days	0	0	0	0	0	0.8	2.7	1.5	0.1	0	0	0	5.1	40
Daily max temp (°C)	30.7	30.1	29.1	27.4	24.6	22.4	21.9	23.3	25.6	27.7	29.4	30.5	26.9	88
Daily min temp (°C)	20.6	20.5	19.3	16.5	13.0	10.2	8.5	9.1	11.9	15.3	17.8	19.5	15.2	87

Table 4. Mean monthly rainfall, evaporation rate, number of rain days and frost days and daily maximum and minimum temperatures for Nambour (Bureau of Meteorology 1997).

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual	Record Yrs
Mean Rainfall (mm)	246	256	238	147	134	89	92	52	43	106	143	176	1721	44
Mean Evap (mm)	161	129	124	99	78	69	74	96	120	140	156	161	1424	20
Mean No. Raindays	16	17	18	13	12	8	8	7	8	12	12	13	145	39
Mean No. Frost days	0	0	0	0	0.2	1.6	4.1	2.4	0.6	0.1	0	0	8.8	28
Daily max temp (°C)	29.2	28.6	27.8	26.2	23.6	21.6	21.0	22.5	24.6	26.6	28.2	29.0	25.7	36
Daily min temp (°C)	19.1	19.5	18.1	15.2	11.8	8.9	7.4	7.6	10.1	13.5	16.1	18.0	13.8	35

Table 5. Mean monthly rainfall and number of rain days for Brooweena, Cooroy, Imbil, Kilkivan, Maleny and Tiaro (Bureau of Meteorology 1997).

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual	Record Yrs
Brooweena:														
Mean Rainfall (mm)	155	148	131	65	56	47	54	33	37	71	87	115	1004	50
Mean No. Raindays	9	10	10	6	6	4	5	4	4	6	7	7	78	49
Cooroy:														
Mean Rainfall (mm)	237	240	236	144	116	95	76	47	54	88	111	160	1597	103
Mean No. Raindays	13	14	15	11	10	8	7	6	7	8	9	11	118	93
Imbil:														
Mean Rainfall (mm)	179	173	148	93	71	65	55	37	40	81	102	143	1190	78
Mean No. Raindays	10	10	10	7	6	5	5	4	5	7	8	8	84	75
Kilkivan:														
Mean Rainfall (mm)	133	120	96	57	49	46	43	33	38	68	73	116	872	118
Mean No. Raindays	9	9	9	6	6	5	5	4	4	6	7	8	77	108
Maleny:														
Mean Rainfall (mm)	288	311	299	198	142	107	94	56	59	107	134	196	2002	81
Mean No. Raindays	14	15	16	12	10	8	7	6	7	9	10	11	123	66
Tiaro:														
Mean Rainfall (mm)	154	151	129	72	61	54	48	33	38	65	81	128	1016	101
Mean No. Raindays	9	9	9	6	6	5	4	4	4	6	6	8	76	95