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Shaun B. Grein

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Native Vegetation Handbook for the Shire of Augusta - Margaret River



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Copies of the Native Vegetation Handbook for the Shire of Augusta-Margaret River are available by contacting:

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**Cover: The Shire of Augusta-Margaret River in relation to the Blackwood
Catchment**

**NATIVE VEGETATION HANDBOOK
FOR THE SHIRE OF AUGUSTA-MARGARET
RIVER**

Shaun B. Grein

Spatial Resources Information Group

Division of Regional Operations

Agriculture Western Australia

Produced by the Western Australian Department of Agriculture and Greening
Western Australia with the assistance from the Commonwealth Government through
Environment Australia's Save the Bush Program.

April, 1997

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The Native Vegetation Handbook for The Shire of Augusta-Margaret River is one of a series covering the agricultural region of Western Australia. Other Handbooks in the series are:

The Avon Catchment

**The Shire of Beverley
The Shire of Brookton
The Shire of Bruce Rock
The Shire of Corrigin
The Shire of Cunderdin
The Shire of Kellerberrin
The Shire of Merredin
The Shire of Northam
The Shire of Pingelly
The Shire of Tammin
The Shire of Toodyay
The Shire of Trayning
The Shire of Wyalkatchem
The Shire of York**

The Blackwood Catchment

**The Shire of Boyup Brook
The Shire of Bridgetown-Greenbushes
The Shire of Broomhill
The Shire of Dumbleyung
The Shire of Katanning
The Shire of Kent
The Shire of Kojonup
The Shire of Narrogin
The Shire of Wagin
The Shire of West Arthur
The Shire of Wickepin
The Shire of Williams
The Shire of Woodanilling**

The Shire of Mingenew

Shire of Augusta-Margaret River

Introduction

Purpose of this Booklet

This project has arisen from the need to provide data to people in rural communities, land conservation districts (LCDs) and local government authorities who manage the remnant native vegetation within rural areas, whether on a regional, catchment or local basis.

This booklet is one of a series covering the Blackwood River Catchment in the south-west of Western Australia. The management of native vegetation and rural land is closely related. It is vital that both native vegetation and rural land issues are considered within the context of their ecological areas of influence. Both have a wide range of effects on each other and as a consequence should be managed together. For example, native vegetation has an effect on the hydrology of rural land and nutrients can be transferred from rural land to remnants of native vegetation.

This booklet provides rural land managers with information relating to the natural resources of the Shire of Augusta-Margaret River including the existing vegetation, drainage systems and soils. Some of the problems relating to the management of natural resources in the Shire of Augusta-Margaret River and possible solutions to these problems are also discussed. By providing this information, it is hoped this booklet will contribute to the long term viability of the rural landscape and the conservation of native vegetation within the Shire.

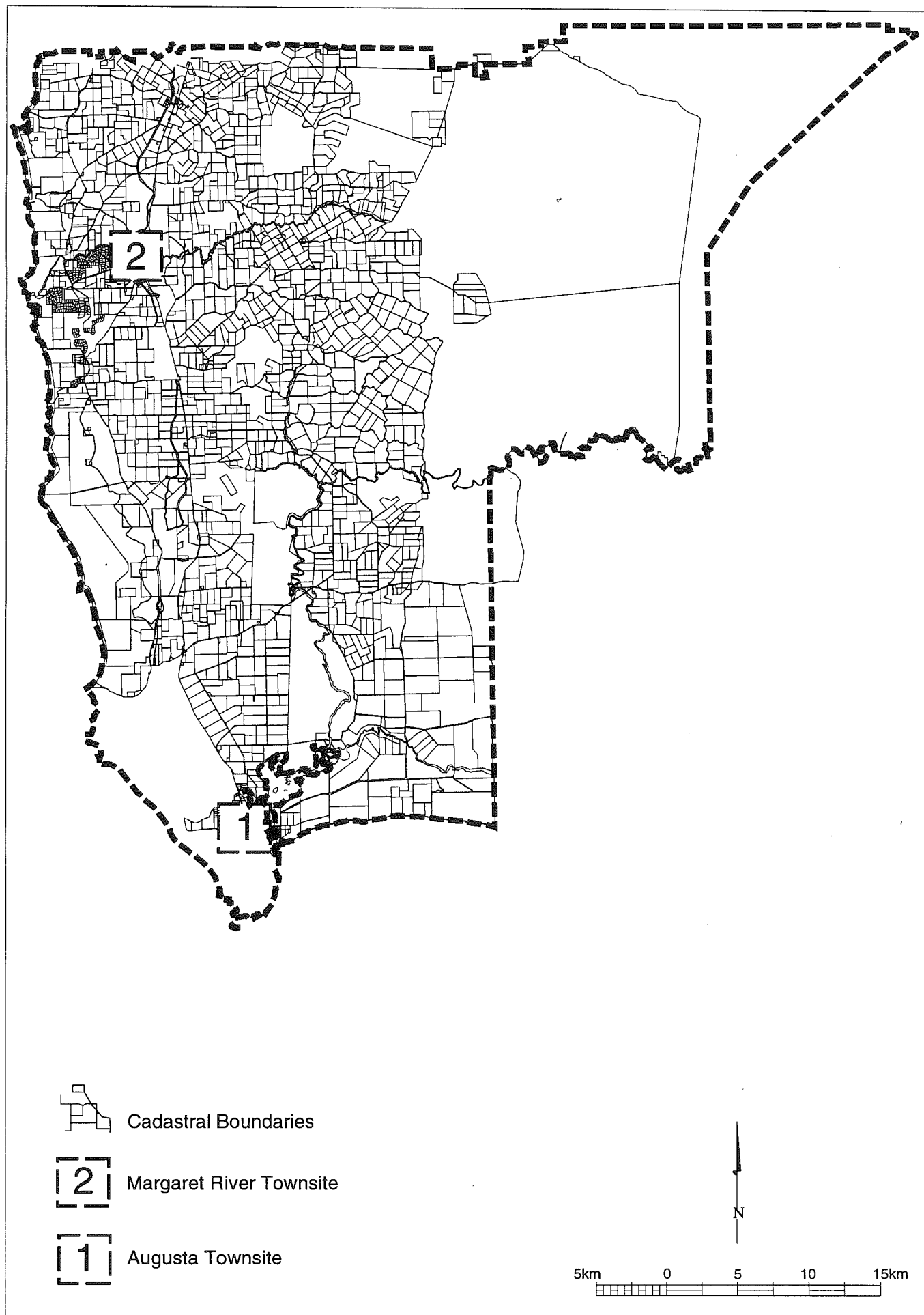


Figure 1: Cadastral Boundaries for the Shire of Augusta - Margaret River.

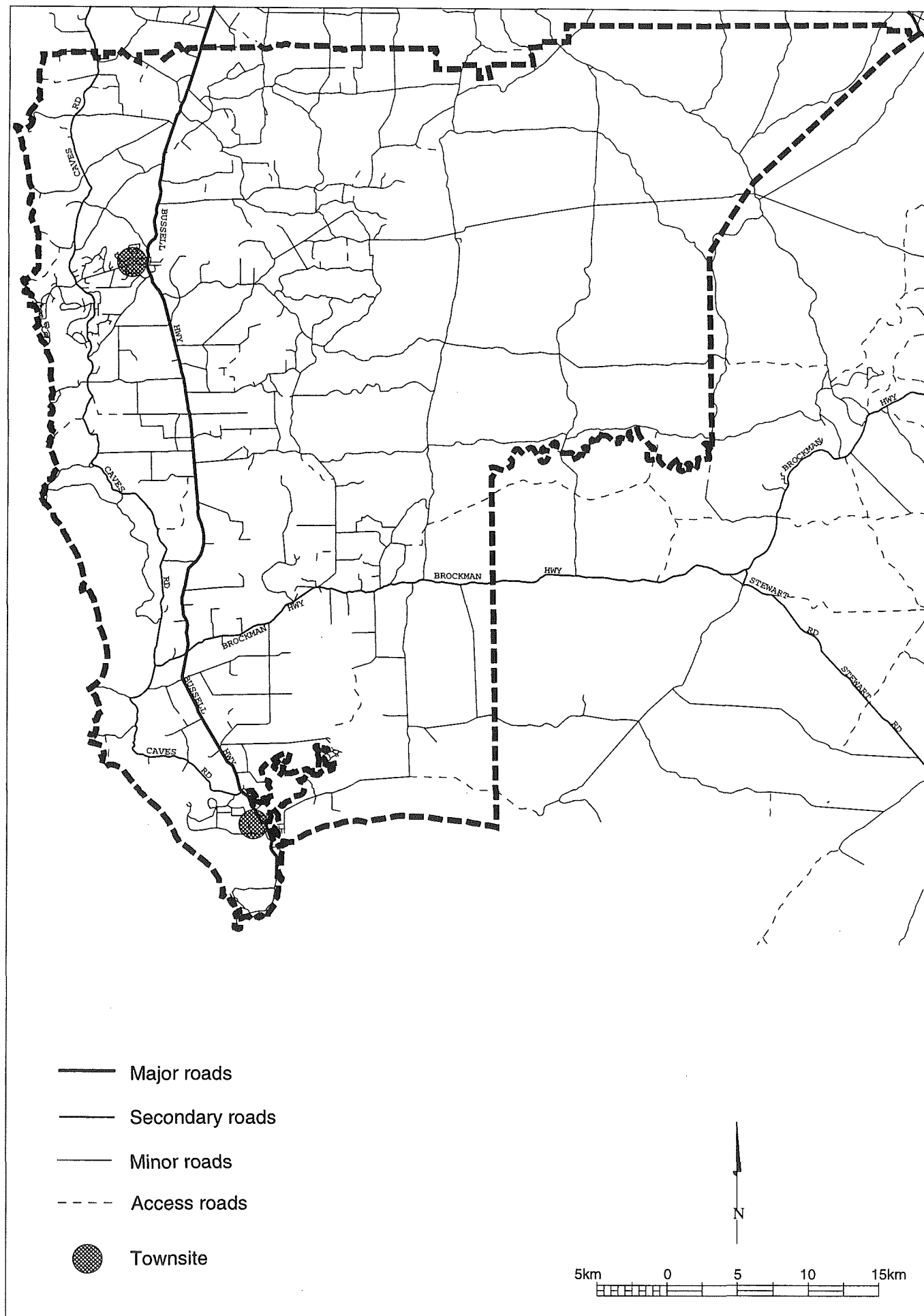


Figure 2: Major, Secondary, Minor and Access Roads for the Shire of Augusta - Margaret River.

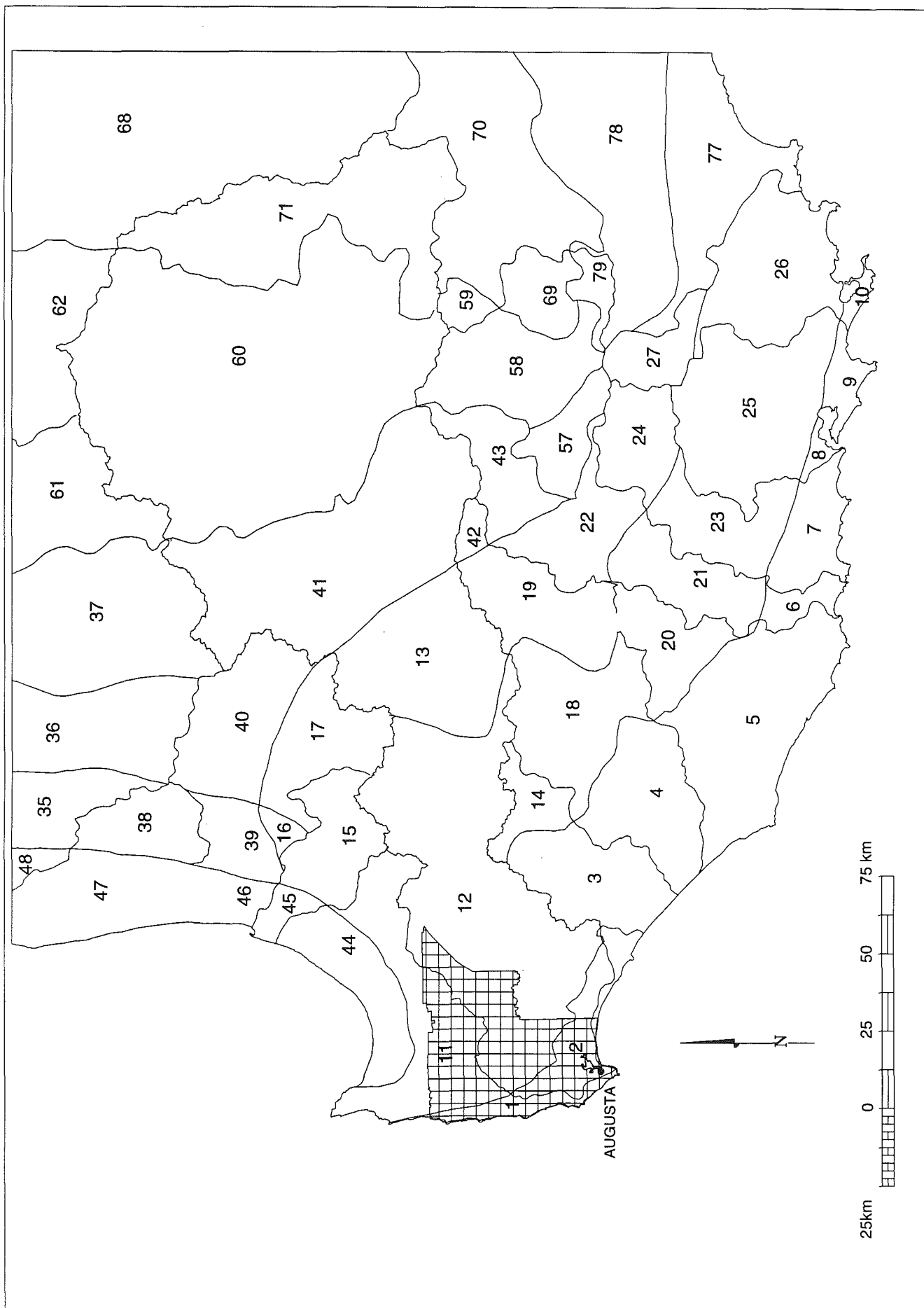


Figure 3: The Shire of Augusta - Margaret River in Relation to the Natural Resource Zones of the South - West Land Division of Western Australia.

Shire of Augusta-Margaret River

The Shire of Augusta-Margaret River, covers an area of 222,718 hectares. The south-western half of the Shire is located in the Blackwood River Catchment (see cover map) and is drained via the Blackwood River into the Hardy Inlet. The northern region of the Shire is largely covered by the Margaret River Catchment. The main townsites in the Shire include Augusta, Karridale and Margaret River (Figure 1).

The Shire's climate is regarded as Mediterranean, with cool, moist winters and hot, dry summers. Margaret River receives, on average, 1152 mm and Augusta 1003 mm rainfall per annum. Average maximum temperatures for Margaret River range from 28.2°C in February to 16.3°C in August, while average minimum temperatures range from 15°C in January to 8.0°C in August. The population of the Shire in 1993 was 5,100, but this is expected to increase significantly over the coming years (W.A. Municipal Directory, 1992/93). A major expansion of the horticultural industry took place during the 1970's, to the extent where such industries contribute more than one fifth of the total gross value of agricultural production for the Shire, which has averaged between \$25 million and \$50 million over the past 4 years. Other major local industries include dairying, beef, sheep, fishing, timber and viticulture. The cadastral boundaries in the Shire are shown in Figure 1, while all 1090 kilometres of road network in the Shire are shown in Figure 2.

The South-west of Western Australian has been divided into districts (called Natural Resource Zones) on the basis of their natural resources ie. vegetation type, drainage/catchment system and rainfall (Allison *et al.*, 1993). The Shire of Augusta-Margaret River contains parts of four natural resource zones (No. 1, 2, 11, 12) (Figure 3) making it a mosaic of two vegetation subdistricts (Menzies and Warren Subdistricts) and three catchments (Blackwood River, Margaret River, and Busselton Coast drainage systems) within an area receiving between 700 and 1100 mm rainfall annually.

The Lower Blackwood Land Conservation District (LCD) was formed in 1992 and is based on the Shire's boundaries.

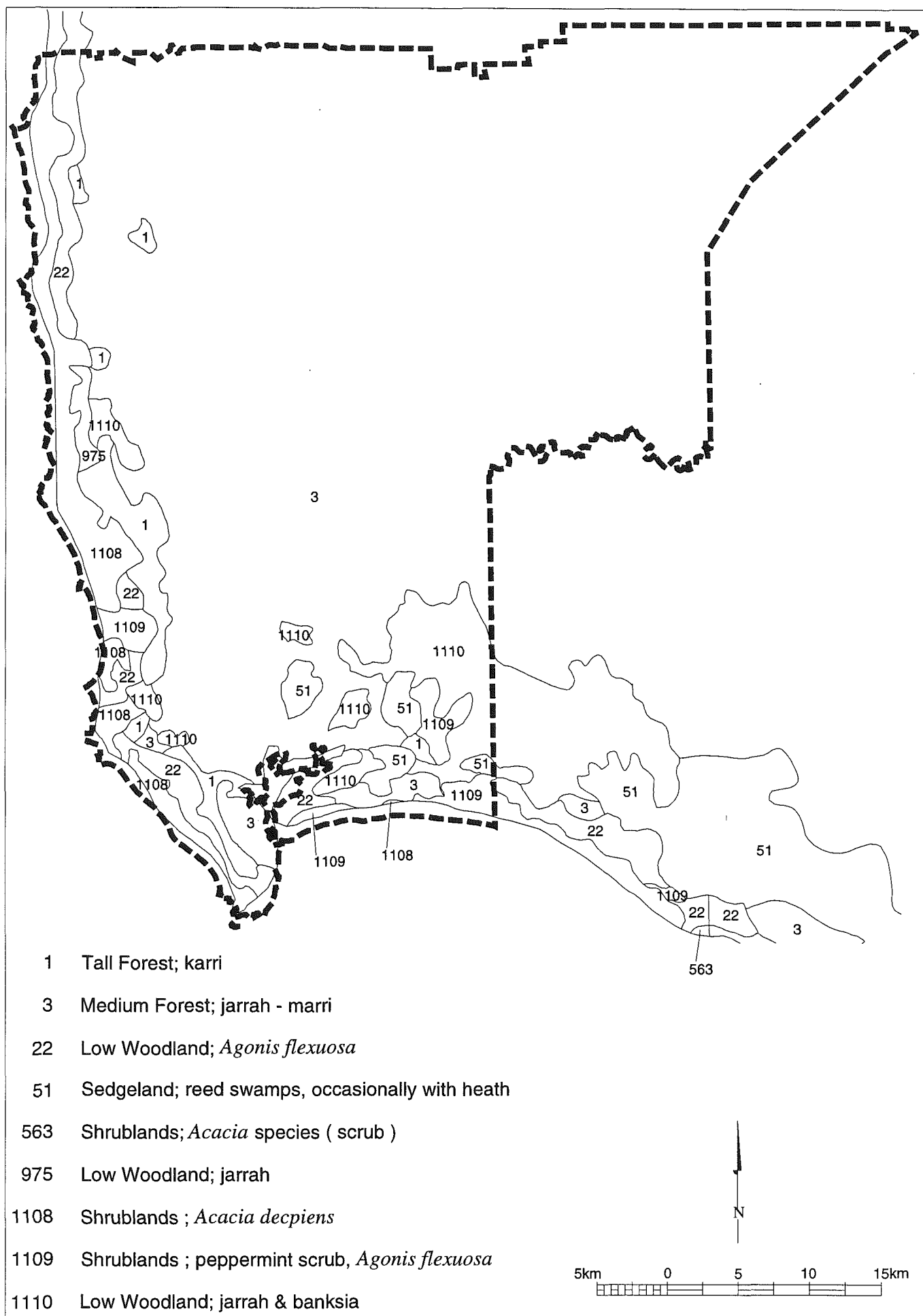


Figure 4: Major Vegetation Types in the Shire of Augusta - Margaret River.

Natural Resources of the Shire of Augusta-Margaret River-Past and Present

Native vegetation has been degraded in a variety of ways as a consequence of extensive clearing and agricultural practices. In the South-West of Western Australia, clearing for agricultural purposes has resulted in the removal of 85-95% of native vegetation. More than 80% of plant species, now extinct, were formerly found on land cleared for agricultural.

Physical factors such as soil and climate combine to produce natural ecological regions, within which the plant life is essentially similar. Western Australia is divided into three Botanical Provinces (ie. natural ecological regions) - the South-Western, the Eremaean, and the Northern (Beard, 1980). The Botanical Provinces are in turn divided into Botanical Districts and then into Vegetation Systems. The Shire of Augusta-Margaret River lies within the South-Western Botanical Province, the Darling Botanical District and the Menzies (Southern Jarrah Forest) and Warren (Karri Forest) Subdistricts. It contains portions of three Vegetation Systems - Chapman, Boranup and Scott River (Beard, 1981) (Figure 4). Each of these Vegetation Systems consists of a series of plant communities occurring in a mosaic pattern and closely linked to topographic and soil features. To complement Beard's broad vegetation descriptions, Smith's Augusta/Busselton mapsheets (Smith, 1973) has also been used in describing vegetation communities in the Shire.

Brief Description of the Vegetation Systems

This section is based on the plant distribution studies of J.S. Beard and further detail can be obtained from the following reference - a) Beard, J.S., (1981). *Vegetation Survey of Western Australia: Swan 1:1,000,000 Vegetation Series with Explanatory Notes*. University of Western Australia Press, Perth.

The type of vegetation is closely related to the soil type on which it grows. In fact, many of the soil types of the Shire are recognised by their associated type of vegetation.

The Chapman Vegetation System represents the vegetation of the laterite-capped, generally undulating landscape of the Blackwood Plateau. The general cover is one of jarrah (*Eucalyptus marginata*)-marri (*Corymbia calophylla*) forest, frequently stunted by poor drainage conditions. *Eucalyptus megacarpa* and blackbutt (*Eucalyptus patens*) may occur locally, while low woodland of moonah (*Melaleuca preissiana*)

and *Banksia* spp. occupy damp areas. In the deep valleys near Margaret River, there are occasional areas of high open forest of karri (*Eucalyptus diversicolor*). Yellowish clay loam carries scrub of stunted jarrah, numerous shrubs and black gin (*Kingia australis*). On the gravel slopes of the Whicher Range, jarrah forms woodland with *Eucalyptus haematoxylon* and *Banksia* spp. The broad valleys of the upper reaches of the Margaret River and the swamps of the higher areas of the plateau support sedgeland. On the grey earths in the broader western valleys of the plateau, marri become the most frequent component of the open forest.

The **Boranup Vegetation System** extends along the coast from Cape Naturaliste to Irwin Inlet, covering the Leeuwin-Naturaliste Ridge and the coastal dunes of the Scott River Plain. On the exposed western slopes of the Ridge, *Pimelea ferruginea* ranges from heath to thicket. With decreasing exposure, peppermint (*Agonis flexuosa*) and/or *Banksia* spp. and jarrah dominate over a range of structural types from low forest to open low woodland. Jarrah may be associated in the low, open forest on leached sands and once off the coastal limestone develops with marri into forest. On deeply weathered older coastal limestone, where red soils have developed, tall karri forest is heavily supported. Where the slope is particularly steep, as to the east of Boranup Hill, the change from open heath to karri high open forest is abrupt, without intervening zones of low woodland or open forest. Forests of pure marri and woodlands of yate (*Eucalyptus cornuta*) and bullich (*Eucalyptus megacarpa*) occur on brown sands.

The **Scott River System** includes extensive stretches of seasonally swampy flats between the forests of the **Chapman** and **Nornalup Vegetation Systems** and the coastal dunes of the **Boranup Vegetation System**, there is mainly jarrah-*Banksia* low woodland with *Melaleuca* spp. and an understorey of small shrubs and sedges. Isolated hummocks of lateritic material support jarrah in structures ranging from forest to low woodland and sandy ridges of *Banksia* low woodland. Along the Scott River there are some occurrences of karri high open forest and jarrah-marri open forest.

Current Extent of Native Vegetation

The total area of vegetation cover in the Shire of Augusta-Margaret River has not been as significantly reduced as many other shires in the middle and upper reaches of the Blackwood. This is largely a result of the significant areas of State Forest and timber reserves that has been previously set aside as timber resources. However,

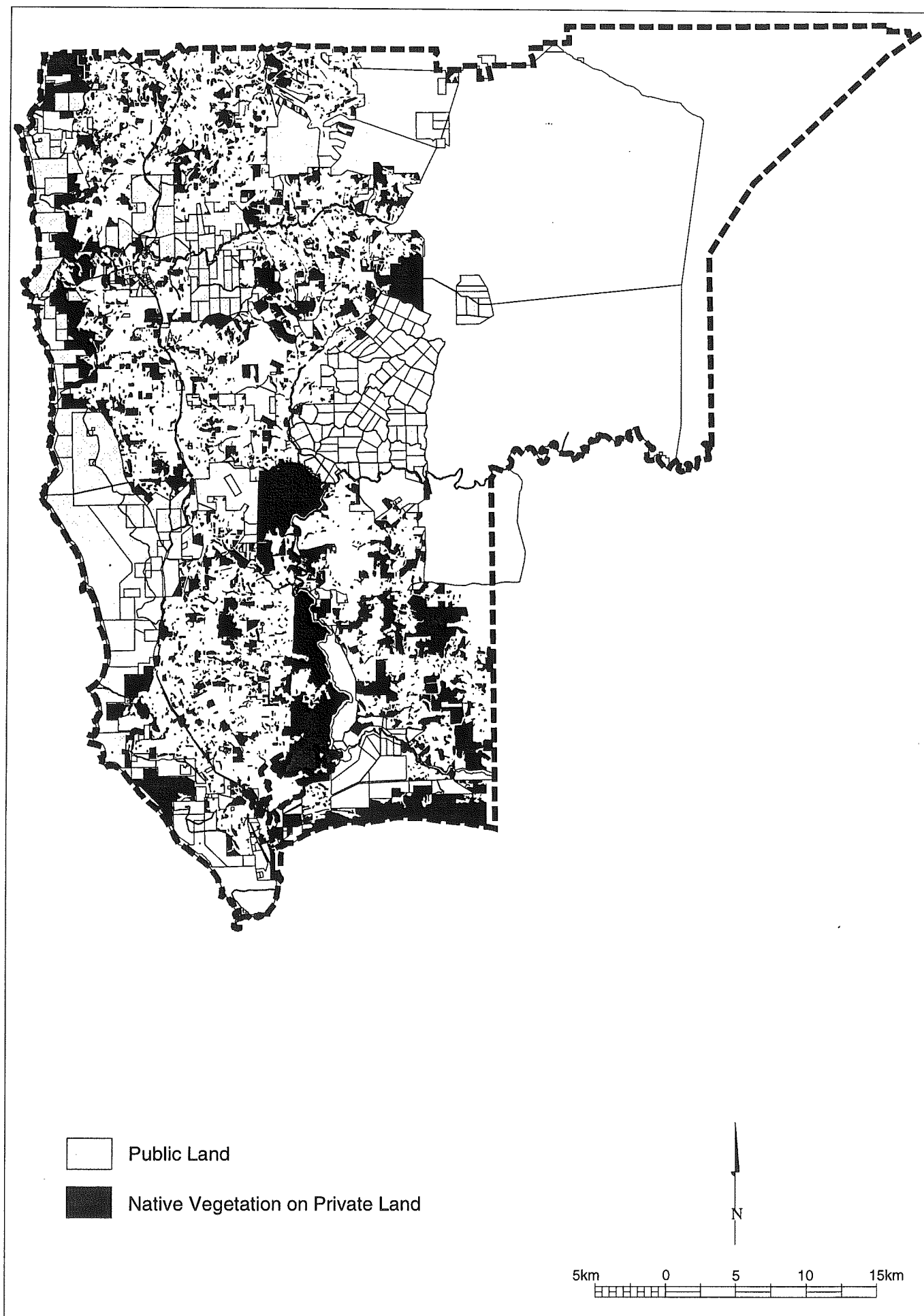


Figure 5: Public Land and Native Vegetation Cover on Private Land in the Shire of Augusta - Margaret River.

much of the native vegetation remaining in public reserves and on private land is being threatened by increased urban and rural development in the Shire.

Approximately 71% of the Shire of Augusta-Margaret River remains covered by original native vegetation, 16% (37,516 hectares) of which is found on private land. The remaining 54% (121,519 hectares) exists as public reserves, water reserves, crown land, gravel pits *ect.*, not all of which has a cover of native vegetation (Figure 5).

In the Shire of Augusta-Margaret River there are 2755 bush remnants on private land, all of which are regarded as being "remnant vegetation". However, only 5% of these are greater than 20 hectares in area (Beeston *et al.*, 1995)

Vegetation classed as "remnant vegetation" has one or more of the following characteristics (Beeston *et al.*, 1994) :

- * Most closely reflects the natural state of vegetation for a given area.
- * Has an intact understorey (if forest or woodland).
- * Has minimal disturbance by agents of human activity.

There are five "A" Class Nature Reserves in the Shire of Augusta-Margaret River under the control of the Museum of Western Australia and the National Parks and Nature Conservation Authority for the conservation of flora and fauna. These range in size from 8275 hectares for Leeuwin-Naturaliste National Park to 16 hectares for Nature Reserve No. 8436. Other reserves include the Scott National Park (3273 hectares). In addition, there are a number of vested reserves under the control of the local government authority, the water authority of W.A. and water resources authority.

In 1994, Ted Griffin undertook a botanical survey of the Shire of Augusta-Margaret River (Griffin, 1995) (NB. Copies of the findings of this survey are available by contacting the Spatial Resource Information Group, Agriculture Western Australia on [08] 9368 3732). A total of 618 bush remnants in the Shire were surveyed by Griffin including four in detail. For the remnants surveyed in detail, each stand was classified according to its structure, major species, landform, soil type, drainage, percentage canopy cover and condition. This information and details of species recorded in each remnant are given in Appendices 4-7.

Wetlands

Wetlands are defined by the Wetlands Advisory Committee as "... areas of seasonally, intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline eg. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and tributaries".

The rise of saline groundwater as a result of the clearing of native vegetation has been well documented throughout the agricultural region. However, as much of the lower Blackwood Catchment is largely forested, wetland salinity is not yet a significant problem in this region.

The principal wetland system in the Shire of Augusta-Margaret River is the lower reaches of the Blackwood River (Sue's Bridge to Molloy Island) and its associated system of tributaries, including Spearwood Creek, Upper Chapman Brook, McLeod Creek, Rushy Creek and Glenarty Creek (Jaensch, 1992).

The Blackwood River originates 300 km to the east. The upper Blackwood catchment is highly disturbed as a result of agricultural practices, while the forested region of the lower catchment is less disturbed. Spearwood Creek and nearby creeks have only slightly disturbed catchments, while other heavily cleared catchments are highly disturbed. The creeks in the area are known to support the only known populations of the frogs, *Geocrinia alba* and *G. vitellina* and also is one of the few areas where the black bittern (*Dupetor flavicollis*) still occurs in the South-west region. Riparian vegetation includes fringing open forest and open/closed-scrub. Surrounding areas support mainly open forest and cleared land.

Fauna

In the Shire of Augusta-Margaret River, animals commonly seen include the western grey kangaroo (*Macropus fuliginosus*) the western brush wallaby (*Macropus irma*) and the echidna (*Tachyglossus aculeatus*) and reptiles including the bobtail (*Tiliqua rugosa*), the Western blue tongue lizard (*Tiliqua occipitalis*), the dugite (*Pseudonaja affinis affinis*), the mulga snake (*Notechis australis*) and a variety of geckos. Other animals which are considered to be under threat of extinction but were sighted during biological surveys in the Shire (McKenzie, 1973; McKenzie and Youngson, 1975) include the tammar wallaby (*Macropus eugenii*), the red-tailed phascogale (*Phascogale culara*), the western mouse (*Pseudomys occidentalis*) and Carnaby's cockatoo (*Calyptrorhynchus funereus latirostris*). Most of these species are under threat because of introduced predators, loss of habitat and of their preferred food.

Since the surveys by McKenzie in 1973 and McKenzie and Youngson in 1975, there have been no specific faunal surveys have been undertaken in the Shire, although general reconnaissance surveys have been regularly been carried out by wildlife officers from the Department of Conservation and Land Management's Katanning District Office.

The clearing of large amounts of natural bushland for agriculture, the introduction of feral animals, alterations to fire regimes and other disturbances have caused the local extinction of 8 of the 43 species (19%) of mammals (excluding bats) recorded from the wheatbelt since European settlement. Only 12 of the 43 species are considered to be moderately common to abundant (Kitchener *et al.*, 1980). Eight species of mammal are known to have disappeared from the wheatbelt region in the past 100 years region: the western barred bandicoot (*Perameles bougainville*), pig-footed bandicoot (*Chaerpus ecaudatus*), the bilby (*Macrotis lagotis*), the burrowing bettong (*Bettongia lesueur*), the rufous hare wallaby (*Lagorchestes hirsutus*), the banded hare wallaby (*Lagostrophus fasciatus*), the crescent-nailed tail wallaby (*Onychogalea lunata*) and the stick nest rat (*Leporillus* sp.). For a complete list of all mammals in the Katanning CALM region, see Appendix 8. For details of the reptile and frog species recorded see Appendix 9.

Most of the original species of birds still occur in the wheatbelt, although several species have been lost from particular nature reserves (Kitchener *et al.*, 1982). Birds such as whistlers (*Pachycephala* spp.) and fairy wrens (*Malurus* spp.) have not coped well with the changes associated with clearing and are generally declining in numbers. They may well become locally extinct. Species such as the Carnaby's cockatoo and Major Mitchell's cockatoo (*Cacatua leadbeateri*) have undergone a significant reduction through loss of habitat (Saunders *et al.*, 1985).

In the southwest of the State, 83% of the land birds (as opposed to ducks) are dependant on native vegetation for all or some of their annual requirements (Smith, 1987). Continued loss of these bird species can therefore be expected due to degradation of remnant vegetation and continued clearing. However, some species including galahs (*Cacatua roseicapilla*), ravens (*Corvus coronoides*), crested pigeons (*Ocyphaps lophotes*), magpies (*Cracticus tibicen*) and wood-ducks (*Chenonetta jubata*) have benefited from increased agricultural development and are increasing in numbers. For a complete list of all avifauna seen in the Shire see Appendix 10.

Rare and Endangered Flora

Eight of 232 species of Western Australian plants declared endangered are found in the Shire of Augusta-Margaret River (Graham, unpub.; Hopper *et al.*, 1990).

The eight Rare and Endangered species of flora found in the Shire of Augusta-Margaret River are:

1. *Caladenia excelsa* (Giant spider orchid) - The tallest growing and largest flowered *Caladenia* found in Western Australia. Height of 90 cm. Flowers up to 30 cm long and 15 cm wide. Distributed along Leeuwin-Naturaliste Ridge in deep sandy soils amongst dense, low shrubs in banksia, jarrah and marri woodland. Flowering period - late September to October.
2. *Caladenia huegelii* (Grand spider orchid) - Closely resembles *C. georgiei* but has larger flowers and a much larger labellum. Flowering period - September to October
3. *Darwinia ferricola* - Domed bush, densely branched to 1m. Flowers are greenish-red in colour and are scented. Found on ironstone peaty sand in the Scott River Flats region. Flowering period - December to January.
4. *Drakaea micrantha* (Dwarf hammer orchid) - Grows to 30cm. Distinguished from *D. Thynniphila* by its diminutive flower, shorter, more-pouched labellum and small, predominantly veined leaf. Occurs in scattered populations in Perth and Albany. Flowering period - September to early October.
5. *Kennedia macrophylla* (Augusta kennedia) - A woody twiner, climbing 4 m or more. It has divided leaves, each leaflet to 7 cm long. Flowers are red with a yellow throat. Restricted to coastal granite areas in the Augusta region. Flowering period - September to November.
6. *Lambertia orbifolia* (Round-leaf honeysuckle) - An erect shrub to 4 m with stems and round opposing leaves to 5 cm in length. Grows in sandy laterite between Busselton and Scott River. Flowering period - January to February, May to July.
7. *Mezella trifida* - A red-leaved prostrate shrub to 20 cm in diameter. It has red flowers and fruit. Occurs on winter wet flats and low open heath with scattered *Melaleuca preissiana* (moonah) on grey, sandy clay over clay east of Augusta. Flowering period - October.

8. *Verticordia plumosa* var. *ananeotes*

There are compelling reasons for focussing conservation efforts on endangered species. From an aesthetic perspective, it is clear that there lies an opportunity to appreciate and study the biological diversity and attractiveness of many of these endangered flora. Equally compelling, is the fact that the extinction of a species constitutes an irreplaceable lost opportunity for plant utilisation by humans. Some of the world's rare species have proven to be of outstanding economic value. Also, as so little is known of the biochemistry of many of these species, there lies the possibility of discovering cures to major human diseases. For example, it has recently been publicised that smokebush (*Conospermum* sp.) may possibly provide a potential cure for AIDS.

Land Resources

Geology

The Shire of Augusta-Margaret River is divided into four physiographic regions (Tille and Lantzke, 1990):

1. *The Blackwood Plateau*; is a gently undulating plateau formed on laterized sedimentary rocks that form the Perth Basin. These have been intensely dissected in some areas to form rolling, low hills and rises. It is located in the centre of the Leeuwin-Naturaliste area, lying to the east of the Margaret River Plateau.
2. *The Margaret River Plateau* is a gently undulating plateau which is dissected by a series of valley systems. It has formed on the laterized granitic and gneissic basement rock of the Leeuwin Block. It is between 5 and 15 km wide and extends from Dunsborough to Augusta.
3. *The Leeuwin-Naturaliste Coast*; is a narrow strip of land, 0.2 to 6 km wide running along the coast between Cape Naturaliste to Cape Leeuwin. It is a discontinuous ridge of Tamala Limestone, with the underlying Leeuwin Block granite being exposed in places.
4. *The South Coast Plain*; is a low lying, poorly drained flat to gently undulating plain formed on Quaternary sediments. It is 15km wide and extends eastwards from the Blackwood River with a strip of high dunes running along the Southern Ocean coast.

Soils

The lower Blackwood, of which the Shire of Augusta-Margaret River is a major part, significantly differs in terms of landform and geology to the rest of the catchment. To the west of the Yilgarn Block there is a fall of approximately 150 m, resulting in a much less deeply incised landscape. The soils information is based on the work of Tille and Lantzke (1990) and Tille (1996), from the Land Resources Series available from Agriculture Western Australia. Augusta-Margaret River is dominated by two landform zones; the *Donnybrook Sunkland Zone* and the *Leeuwin Block Zone* (Tille, 1996). These Zones are subdivided into Land Systems (areas with recurring patterns of landforms, soils and vegetation)

The *Donnybrook Sunkland Zone* extends 60 km westwards from the Darling Scarp near Nannup to the edge of the *Leeuwin Block Zone* near the mouth of the Blackwood River.

The Donnybrook Sunkland Zone varies from flat to undulating terrain formed over Cretaceous and Jurassic Basin sedimentary rocks. It rises gradually from the Southern Ocean coastline to a height of 120 to 180 m above sea level in the north. Here it consists of the gently undulating, lateritic plateau with grey and yellow-brown, sandy gravels and deep, loose sands. The plateau has been dissected by the Blackwood River and its tributaries to form shallow valleys, the floors of which lie between 20 and 80 m above sea level. Similar soils are found on the slopes of these valleys to those on the plateau, with grey-brown sands and loams also becoming common in the west.

In the south, the plateau merges with low-lying coastal plain and is a poorly drained area formed on Quaternary sediments. Soils here are deep, loose white or grey sands, often over coffee rocks. There are some deep, coloured sands and loams on the river flats. On the southern sands and loams on the river flats. On the southern boundary of the coastal plain are coastal dunes of grey calcareous sands.

There is a risk of water erosion on areas where sloping is high. Waterlogging is a problem in low lying areas, particularly on the Scott River Plain, where there is also a risk of nutrient leaching from these soils. Sand dunes on the Scott River Plain and along the south coast are prone to wind erosion.

The Leeuwin Block Zone covers a narrow strip of land , less than 10 km wide, on the western edge of the lower catchment. It extends from Augusta through Karridale to Witchcliffe. The Leeuwin Block Zone was formed on the Leeuwin Block which is made up of Proterozoic granitic rocks overlain by Tertiary laterite and Quaternary limestone. The dominant feature is a lateritic plateau which sits 20 to 80 m above sea level. Soils on the plateau include yellow-brown sandy and gravelly loams and grey-brown sands and loams. Dissection of the eastern margin of the Leeuwin Block has produced slopes and valleys with loamy gravels, loamy duplex soils and loams grading into clay. The western margin of the plateau is overlain by a ridge of limestone and by yellow and red deep loose siliceous sands.

Large areas of the uplands are highly susceptible to waterlogging, while there is some risk of water erosion in the valleys and of wind erosion along the coast.

Soil Landscape Systems for the Shire are described below and are shown in Figure 6.

Blackwood Plateau System (BLP): Lateritic plateau in the Donnybrook Sunkland. Sandy gravel, loamy gravel, loamy gravel and deep sand. The predominant vegetation is jarrah-marri forest.

Blackwood River System (BLR): Alluvial flats, on the lower Blackwood River. The major soils are deep sand (pale and yellow), non-saline wet soils and yellow sandy earth. Heaths, sedgeland and jarrah-marri-paperbark woodland and forest form the major vegetation.

Cowaramup Uplands System (CWU): Lateritic plateau in the Leeuwin Zone. Main soils are sandy gravel, loamy gravel and grey sandy duplex. The predominant vegetation is jarrah-marri forest.

Glenarty System (GLE): Granitic valleys in the southern Leeuwin Zone. Major soil types are gravel, sandy duplex, loamy duplex, deep sand and non-saline wet soil. Main vegetation type is jarrah-marri forest.

Gracetown Ridge System (GTR): Limestone ridge, in the coastal edge of the Leeuwin Zone. Major soils include yellow deep sand and red deep sand. Predominant vegetation types include coastal scrub, peppermint woodland and jarrah-marri-karri forest.

Goodwood Valleys System (GVW): Valleys of the Donnybrook Sunkland. Major soils are sandy gravel, loamy gravel and deep sand. The predominant vegetation is jarrah-marri forest and woodland.

Kilcarnup Dune System (KCD): Coastal dunes overlying limestone and rocky headlands in the Leeuwin Zone. Main soils are calcareous deep sand and calcareous stony soil. Major vegetation type is coastal scrub.

McLeod System (MLO): Rises and low hills of the western Donnybrook Sunkland. Predominant soils are sandy gravel, grey deep sandy duplex and loamy gravel. Main vegetation type is jarrah-marri forest.

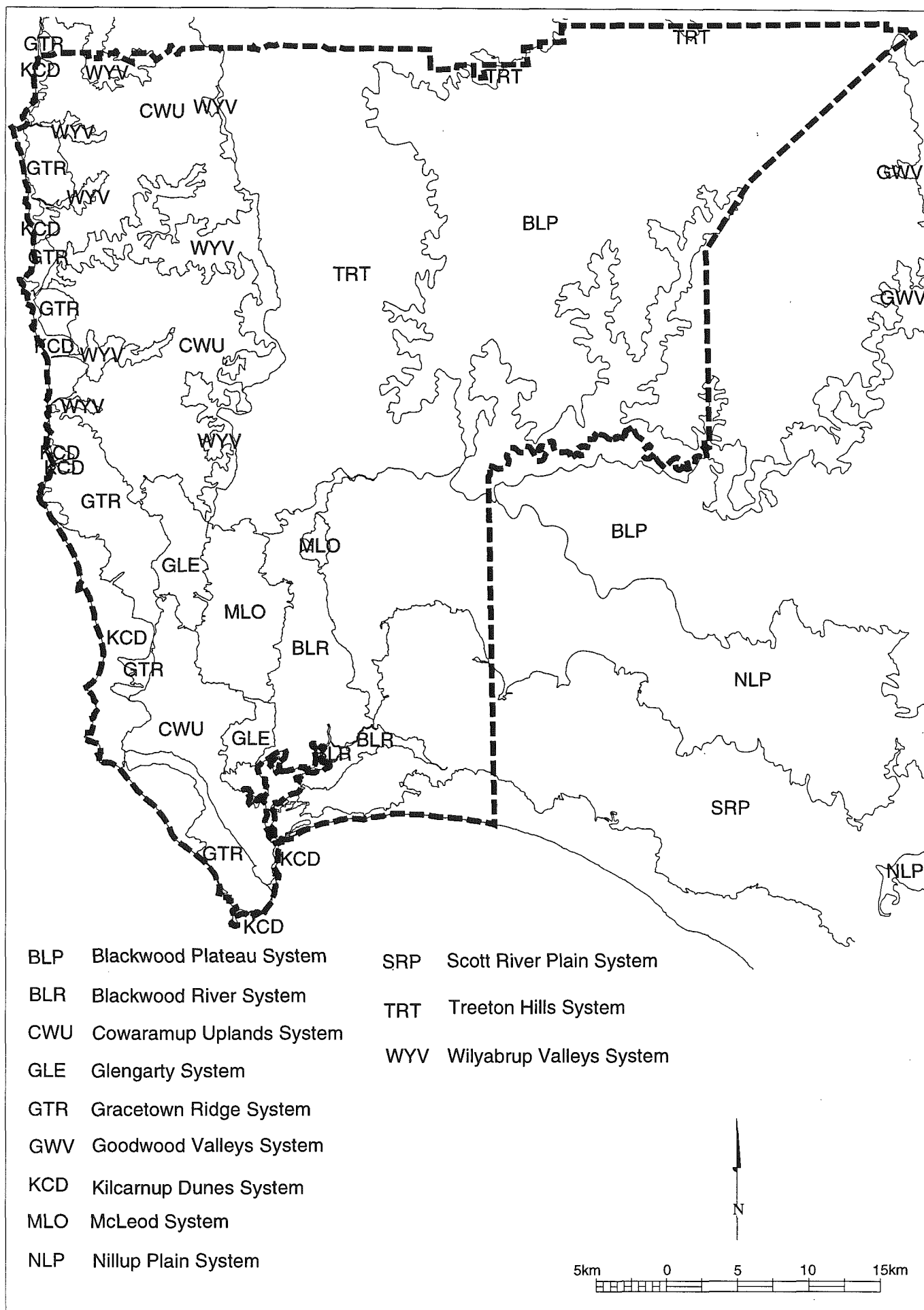


Figure 6: Soil - Landscape Systems for the Shire of Augusta - Margaret River.

Nillup Plain System (NLP): Poorly drained plain in the southern Donnybrook Sunkland. Major soils include sandy gravel, non-saline wet soil, grey deep sandy duplex, loamy gravel and deep pale sands. Jarrah-marri-paperbark woodland is the chief vegetation.

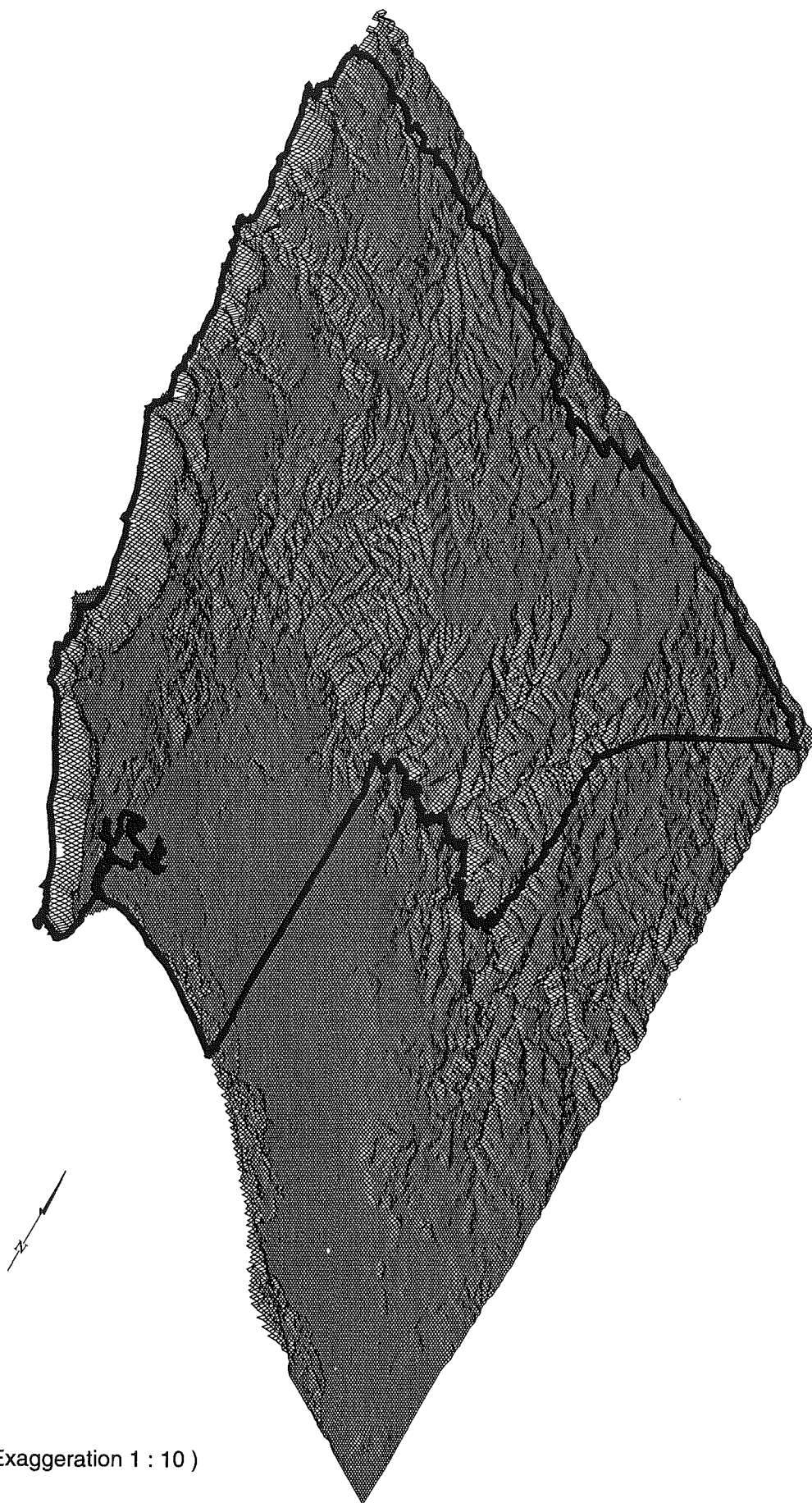
Scott River Plain System (SRP): Poorly drained coastal plain in the southern Donnybrook Sunkland. Non-saline wet soil and deep pale sand are the main soil types. Chief vegetation types include heaths, sedgelands and jarrah-marri-paperbark woodland.

Treeton Hills System (TRT): Rises and low hills of the western Donnybrook Sunkland. Main soil types are sandy gravel, grey deep sandy duplex and loamy gravel. Jarrah-marri forest is the predominant vegetation.

Wilyabrup Valleys System (WYV): Granitic valleys in the Leeuwin Zone. Loamy gravel, sandy gravel and loamy earth. Jarrah-marri-karri forest is the predominant vegetation.

Topography

The topographic feature most notable in the Shire of Augusta-Margaret River is the Hardy Inlet at the mouth of the Blackwood River and St Patrick's Elbow, a short distance upstream. In the western part of the Shire, the topography is more undulating with generally steeper slopes and greater sediment accumulation on slopes. This part of the Shire has been more extensively eroded than the eastern region because of the higher rainfall. Other features of local significance are the numerous soaks, springs and rockholes throughout the Shire. Figure 7 provides a digital elevation model of the Shire of Augusta-Margaret River, showing metres above sea level.



(Vertical Exaggeration 1 : 10)

Figure 7: Topographical Veiw of the Shire of Augusta - Margaret River.

Land Management and Land Degradation Issues of the Shire

Since settlement in the south west of Western Australia and the subsequent clearing and replacement of native vegetation with crops and pastures, problems have arisen for both agricultural production and native vegetation conservation. Some of the most obvious problems are associated with changes in hydrology eg. rising water table with associated salinity and waterlogging. Water erosion and wind erosion are a problem on unprotected soils.

There are several forms of land degradation that occur within the Shire of Augusta-Margaret River including salinity, waterlogging, wind erosion, water erosion, soil acidification and subsoil compaction. An integrated approach to tackling these problems uses farm planning to: reorientate paddock boundaries; revegetate and fence drainage lines; protect and connect existing vegetation and establish windbreaks and replant on both recharge and degraded areas. In addition, altering management practices to minimum and zero tillage will benefit both agricultural production and wildlife conservation.

Most farmers now recognise that replanting the trees and shrubs that existed prior to clearing is one of the most effective means of reversing the current trend towards land degradation. One of the main problems has been a lack of information about how to go about revegetation and what, when and where to plant. The *'Revegetation Guide to the Central Wheatbelt'* (Lefroy *et al.*, 1991) is an excellent resource book which attempts to address these problems by providing lists of local species grouped according to the specific soil types of a particular area.

Clearing

The Shire of Augusta-Margaret River, being a more recently established horticultural area, has been less extensively cleared than many other earlier settled shires. As a consequence, there remains a relatively high proportion of native vegetation on farms or as public reserves.

Current guidelines recommend that for an area receiving less than 500 mm/annum rainfall (eg Shire of Augusta-Margaret River), the minimum proportion of native vegetation considered necessary to be left to use sufficient groundwater to ensure water tables remain stable in that sub-catchment is 20% or 2000 hectares/catchment. (Clark, 1992; Holm, 1994). Currently, the Shire has approximately 30% remnant vegetation cover.

Continued vegetation clearance is obviously not compatible with the desire for native vegetation to persist. Much of the south west was cleared during major agricultural developments following World War II, and little thought was given to nature conservation requirements.

There are several actions being undertaken by the state government and local government authorities to address the clearing of native vegetation. Land clearing on private land is currently under the control of the Soil and Land Conservation Act which requires all landowners to give notice to the Commissioner of Soil Conservation of their intent to clear land. The guidelines for assessing notices of intent (NOI) to clear land are directed at preventing further land degradation problems (Select Committee into Land Conservation, 1992). In addition, many local government authorities have implemented planning schemes which may give them scope to effectively control the clearing of land.

A great deal of native vegetation was set aside by the government, as crown reserves for townsites, water catchments and sites of gravel extraction *etc.* Many of these patches of native vegetation were designated by the government as conservation reserves in the 1960s and 1970s. However, their conservation value varied because most of the patches of vegetation that are now nature or conservation reserves are fragmented and represent only a very small percentage of the region's vegetative cover.

Waterlogging

Waterlogging is the temporary or permanent saturation of the soil by rainfall or runoff and is usually a result of poor drainage. The problem is often exacerbated by excessive or inappropriate clearing of deep-rooted native vegetation and soil compaction by livestock and heavy machinery. The principal cause of waterlogging is a combination of excess rainfall, poor external drainage (runoff), poor internal drainage (water movement in the soil profile) and the inability of the soil to store much water.

Waterlogging is most prevalent in the 400-500 mm rainfall area of the wheatbelt and the problem is usually seasonal. However, areas of soils with low permeability in valleys downslope of areas which shed water will be prone to waterlogging in years of high rainfall. The problem is slowly increasing in the wheatbelt because of the continued clearing in upland areas and the effects of modern agricultural practices in

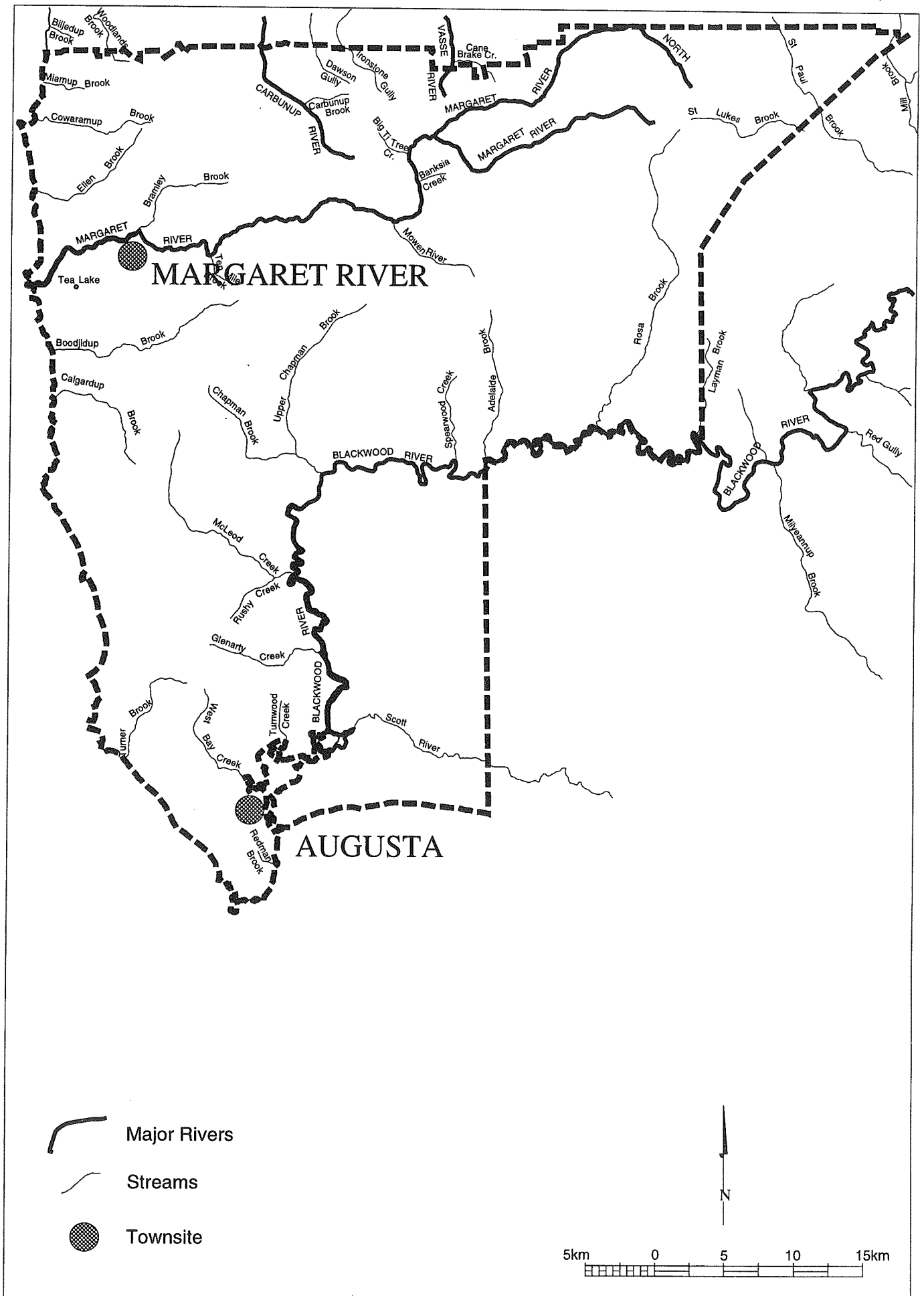


Figure 8: Major Drainage Systems of the Shire of Augusta - Margaret River.

reducing water infiltration. Waterlogged soils in Western Australia are also often salt-affected (Barrett-Lennard *et al.*, 1990). There are a number of indicators of waterlogging:

- * The presence of weeds such as canary grass (*Phalaris* sp.) that tolerate waterlogging.
- * The absence of waterlogging-sensitive species such as clovers.
- * The presence of red, yellow or grey mottles in the soil profile (Cox and McFarlane, 1990).

In the Shire of Augusta-Margaret River, waterlogging is a major problem in the upland areas of the Leeuwin Block and the low lying areas of the Scott River Plain. These problems are probably linked to clearing within the Shire and in particular, the clearing of lateritic landscapes where water use of even the most productive annual pastures and crops is relatively low and hence the groundwater recharge is high. Figure 8 shows the areas of the Shire which are susceptible to waterlogging and inundation. The establishment of vegetation with high water use in strategic locations may help to ameliorate the problem of waterlogging in these catchments.

Rising Water Tables and Salinity

Rising water tables and salinity is not a serious problem in the Shire of Augusta-Margaret River. This is a result of the large percentage of deep-rooted perennial vegetation that remains in the Shire.

Wind Erosion

Wind erosion is the action of the wind removing and redepositing soil. It can result in the loss of vegetation through sand blasting and smothering, and it reduces plant growth because of the loss of soil structure and fertility. The predominantly sandy-surfaced soils of Western Australia are naturally prone to wind erosion when vegetation is insufficient to protect the soil surface and at least 90% of the wheatbelt is vulnerable to wind erosion if soils are mismanaged (Carter *et al.*, 1992). The most susceptible areas are those which are prone to sustained droughts extended over several growing seasons. The extent and severity of wind erosion depends on seasonal conditions.

The Shire of Augusta-Margaret River, being largely comprised of lateritic and pallid zones clayey soils is not as severely affected by wind erosion as some Shires (Select Committee in Land Conservation Discussion Paper 2, 1990). However, in the valleys of the Leeuwin Block, the sand dunes of Scott River Plain, and along the south coast, areas are prone to wind erosion. The establishment of windbreaks and shelterbelts will help in ameliorating the effect of wind erosion. Ideally, windbreaks should be several rows wide and include a mix of trees and shrubs. Shelterbelts can also serve as corridors for wildlife and may link up areas of existing vegetation.

Water Erosion

Water erosion is the loss of topsoil due to runoff from the soil surface. Water erosion occurs in three forms of increasing severity: sheet, rill and gully erosion.

Western Australian soils are particularly susceptible to water erosion because they are inherently infertile and have a sandy, loose texture. Their susceptibility is further increased by cultivation, overgrazing and stock trampling. An estimated 0.7 million hectares of the 6 million hectares of land cropped annually in the wheatbelt is affected by water erosion.

In the Shire of Augusta-Margaret River, water erosion can be expected to occur on sloping areas within the Donnybrook Sunkland Zone. Clayey soils tend to be more prone to water erosion (State of the Environment Report, 1992).

Contour banks can reduce the speed of runoff water flow. They do this by restricting all cultivation to the contour, by diverting any runoff to a well grassed waterway, or by storing excess water in the channel above the bank. Vegetation can also reduce the possibility of water erosion by reducing the impact of raindrops.

Managing Existing Vegetation

Protecting existing vegetation is often easier than replanting. However, the survival of existing vegetation is affected by a number of factors including: grazing by stock of unfenced bush (passive clearing); changes in hydrology; increased exposure to the elements; increased fertiliser regimes; herbicide drift and weed invasion. Native plants are often choked or covered by fast growing introduced plants that become weeds when they escape from pastures. Weeds compete with native plants for water and nutrients and often don't provide the food and shelter that wildlife need.

The long term solution to the problems of land degradation and the loss of local plant and animal species lies in taking a holistic approach to the management of natural resources within the Shire of Augusta-Margaret River.

Specific recommendations on how to manage existing bush are provided in '*Managing your Bushland: A Guide for Western Australian Landowners*' (Hussey and Wallace, 1993).

Bringing it all together

Integrated Management for Land and Nature Conservation in the Shire

The wheatbelt of Western Australia today has severe nature conservation and agricultural problems resulting from the rapid and excessive clearing of native vegetation. The problems associated with land degradation and the maintenance of native vegetation are problems which cannot be halted by onsite management alone. An integrated catchment/land conservation district and farm-based approach needs to ensure long term agricultural production, optimal water use and the maintenance of the diversity of flora and fauna. Retention of remnant vegetation, rehabilitation of degraded areas and strategic revegetation are essential components of this approach. Ownership of the problems and solutions at a local scale is the key to success.

As so much of the conservation resource lies under the control of private landowners and the local government authorities, the responsibility for the coordination of the conservation and management of natural resources must ultimately stem from these locally based groups. The Shire of Augusta-Margaret River has a number of different organisations working towards land and nature conservation in the Shire.

The Lower Blackwood Land Conservation District Committee (LCDC) has been a prime mover in this field.

Projects in the Shire

A combination of measures aimed at protecting remnant vegetation, strategically revegetating areas degraded or void of native vegetation and combating land degradation problems in the Shire of Augusta-Margaret River have proved to be an effective method of achieving positive results.

One major impediment to farmers' motivation to conserve their remnant vegetation is the cost of fencing. This problem has been partially alleviated by the Remnant Vegetation Protection Scheme (RVPS). The Remnant Vegetation Protection Scheme was developed by the State Government in 1988 to enhance soil and nature conservation by protecting native vegetation on farm land. It has not been a scheme which has been used so far, in the Shire of Augusta-Margaret River, as the vast majority of native vegetation in the Shire is protected through the reserve and State Forest system.

There are several examples of projects aiming to strategically revegetate sparsely vegetated areas currently underway in the Shire of Augusta-Margaret River.

The One Billion Trees (OBT) Program was initiated in 1989 by the Federal Government with the aim of catalysing revegetation projects aimed at land and nature conservation. In 1992, the Nyabing-Pingrup LCD received \$2003 towards the Sles Greening and water use project, while in 1994, the South Bryde Catchment Group received \$14,740 towards the cost of revegetation the Lake Bryde Drainage line to link two nature reserves and to control salinity.

Plants for Conservation, a program managed by Greening Western Australia and sponsored by ALCOA provided the Nyabing/Pingrup LCDC with 6000 seedlings to plant in bush corridors in recharge areas to control wind erosion, reduce recharge and to link existing vegetation.

Road verges in the Shire of Augusta-Margaret River were surveyed for their vegetation conservation status with the assistance of the Roadside Conservation Committee (RCC). The surveys were undertaken by community volunteers using a method developed by the RCC. To date 26.7% (431.8 km) of the Shires 1619 km of road network has been surveyed. Further surveys are expected to be carried out in the near future and a relevant map showing the conservation values of roadside vegetation in the Shire should be available when surveys are completed.

The Shire of Augusta-Margaret River has not received any funding from the Save the Bush Program since its inception in 1989.

The Nyabing/Pingrup Land Conservation District Committee, has received support from the National Landcare Program (NLP) through the National Soil Conservation Program (NSCP) for 3 projects. The first, in 1989/90, was the Nyabing/Pingrup LCD Tree Planting Project. The NSCP provided \$9,000 to purchase a Chatfield tree planting machine. In 1990/91, the LCD applied to the NSCP for more than \$300,000 to assist in achieving sustainable agriculture in the region. It was recommended that the LCD combine their project with the Frankland Below Gordon LCD and Gnowangerup LCD project. There have been three State Landcare funded projects in the Shire of Augusta-Margaret River since 1989/90, many of which have involved cooperation with neighbouring Shires. Details of each of these are outlined in detail in Appendix 11.

Reducing the cost of conservation

It is now widely recognised that planting native trees and shrubs can be used to remedy land degradation problems. However, the cost of revegetation is a relatively expensive practice. Protecting remnant vegetation and planting native trees and shrubs are some of the most cost effective ways of combating land degradation. Initial costs are offset by long-term increases in productivity and decreases in land degradation.

To reduce the establishment costs for vegetation projects, a landholder could consider:

- * cheaper fencing - (electric or re-cycled)
- * collecting native plant seed from nearby sources instead of buying it (NB. if the seed collector does not own the land, a licence will be needed. Check with the CALM, Manjimup Regional Office for details).
- * growing their own seedlings instead of buying in.
- * direct seeding instead of planting seedlings
- * include deep-rooted perennial fodder species for multiple use of revegetation areas.

Developing new products and industries from planted trees has the potential to provide farmers with an additional source of income. Some possibilities for the development of tree-farm products include eucalypt and tea tree oils; tannins from acacia and eucalypt species; cut wildflowers and wildflower seeds, provision of firewood, particularly from cleared areas; and value-added wood products such as tool handles, craftwood and laminated wood products for furniture manufacture. Contact CALM Katanning for advice (08) 98211 296.

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Department of Conservation and Land Management Manjimup District Office - Phone: (08) 97717929.

Blackwood Catchment Co-ordinating Group Centre, Co-ordinator - Sue Masterson. P.O. Box 27, Boyup Brook, 6244. Phone: (08) 97651401

Appendix 1.

Dominant Plant species list for the Chapman Vegetation System, Menzies Subdistrict (Beard, 1981)

Botanical Name

Banksia sp.
Eucalyptus cornuta
Eucalyptus haematoxylin
Eucalyptus megacarpa
Eucalyptus patens
Kingia australis
Melaleuca preissiana

Common Name (if known)

Yate
Mountain marri
Bullich
Blackbutt
Grasstree
Moonah

Appendix 2.

Dominant Plant species list for the Boranup Vegetation System, Menzies Subdistrict (Beard, 1981)

<u>Botanical Name</u>	<u>Common Name (if known)</u>
<i>Agonis flexuosa</i>	Peppermint tree
<i>Ammophila arenaria</i>	Marram grass
<i>Banksia</i> sp.	
<i>Eucalyptus diversicolor</i>	Karri
<i>Eucalyptus marginata</i>	Jarrah
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus cornuta</i>	Yate
<i>Eucalyptus megacarpa</i>	Bullich
<i>Pimelia ferruginea</i>	

Appendix 3.

Dominant Plant species list for the Scott River Vegetation System, Menzies Subdistrict (Beard, 1981)

<u>Botanical Name</u>	<u>Common Name (if known)</u>
<i>Eucalyptus marginata</i>	Jarrah
<i>Banksia</i> sp.	
<i>Melaleuca</i> sp.	
<i>Viminaria</i> sp.	

Appendix 4.

Botanical Information and Species list for stands in Remnant AUG02613 (Griffin, 1995)

Augusta - Margaret River Shire, Margaret River, west;

Survey date: 02/11/94

Location: 33° 55' 53" latitude, 115° 5 ' 0" longitude;

Stand: AUG02613 1

Structure (Muir 1977): open woodland/low forest a/heath b/dwarf scrub c/open dwarf scrub

Major spp.: *Eucalyptus diversicolor*, *Agonis flexuosa*, *Corymbia calophylla*

Landform: lower slope, slope - 1°

Soil: brown loamy sand

Drainage: good, winter damp

Percentage canopy cover: 10% bare ground; 80% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 2

Structure (Muir 1977): scattered trees/open dwarf scrub c/low heath d/open herbs;

Major spp.: *Hibbertia hypericoides*, *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*

Landform: bench, slope - 3°

Soil: grey sand/brown sandy loam/granite

Drainage: poor, winter damp

Percentage canopy cover: 10% bare ground; 50% litter cover; 10% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 3

Structure (Muir 1977): woodland/low woodland a/scattered tall shrubs/heath b/low heath d

Major spp.: *Corymbia calophylla*, *Eucalyptus marginata* ssp. *marginata*, *Xanthorrhoea preissii*

Landform: upper slope, slope - 2°

Soil: brown loamy sand

Drainage: good

Percentage canopy cover: 15% bare ground; 80% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 4

Structure (Muir 1977): woodland/low woodland a/open low scrub b/dwarf scrub c/dwarf scrub d

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Banksia attenuata*, *Podocarpus drouynianus*

Landform: plain, slope - 1°

Soil: grey sand

Drainage: good

Percentage canopy cover: 15% bare ground; 45% litter cover; 1% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 5

Structure (Muir 1977): woodland/low woodland b/low scrub b/dwarf scrub d/open low sedges

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Agonis flexuosa*, *Corymbia calophylla*

Landform: plain, slope - 1°

Soil: grey sand

Drainage: good

Percentage canopy cover: 10% bare ground; 90% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 6

Structure (Muir 1977): woodland/low woodland b/dwarf scrub c/low heath d

Major spp.: *Bossiaea disticha*, *Hibbertia furfuracea*, *Corymbia calophylla*

Landform: rise, slope - 1°

Soil: brown sand

Drainage: good

Percentage canopy cover: 10% bare ground; 80% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 7

Structure (Muir 1977): scattered trees/low forest a/low scrub a/dwarf scrub c/dwarf scrub d/open herbs

Major spp.: *Agonis flexuosa*, *Templetonia retusa*, *Eucalyptus marginata* ssp. *marginata*

Landform: rise, slope - 1°

Soil: orange sand/Tamala limestone

Drainage: good. 15% bare ground

Percentage canopy cover: 40% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 8

Structure (Muir 1977): open tree mallee/scrub/low heath c/dwarf scrub d/open herbs;

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Agonis flexuosa*, *Hibbertia furfuracea*

Landform: rise, slope - 2°

Soil: orange sand/Tamala limestone

Drainage: good.

Percentage canopy cover: 10% bare ground; 70% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02613 9

Structure (Muir 1977): low woodland a/scrub/low scrub b/open herbs

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Agonis flexuosa*, *Corymbia calophylla*

Landform: mid slope, slope - 3°

Soil: grey sand

Drainage: good

Percentage canopy cover: 20% bare ground; 90% litter cover; 6% weeds

Condition (M.E. Trudgen in Griffin, 1994): Good; long unburnt.

Stand: AUG02613 10

Structure (Muir 1977): forest/thicket/heath b/dwarf scrub c/open dwarf scrub d/open tall sedges

Major spp.: *Eucalyptus diversicolor*, *Trymalium floribundum* ssp. *trifidum*, *Lepidosperma effusum*

Landform: channel bank, Slope - 1°

Soil: brown sandy loam

Drainage: poor, winter damp
Percentage canopy cover: 0% bare ground; 95% litter cover; 1% weeds
Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Species List

<u>Botanical Name</u>	<u>Common Name (if known)</u>
<i>Acacia cochlearis</i>	Rigid wattle
<i>Acacia divergens</i>	
<i>Acacia pulchella</i> var. <i>pulchella</i>	Prickly Moses
<i>Acacia urophylla</i>	
<i>Agonis flexuosa</i>	Peppermint tree
<i>Aira caryophyllea</i>	Silvery hairgrass
<i>Anagallis arvensis</i>	Pimpernel
<i>Anthoxanthum odoratum</i>	Sweet vernal grass
<i>Astroloma ciliatum</i>	Candle cranberry
<i>Banksia attenuata</i>	Acorn banksia
<i>Banksia grandis</i>	Bull banksia
<i>Bossiaea disticha</i>	
<i>Bossiaea linophylla</i>	
<i>Brachycome iberidifolia</i>	Swan River daisy
<i>Bridelia indet</i>	
<i>Briza maxima</i>	Quaking grass
<i>Briza minor</i>	Shivery grass
<i>Burchardia umbellata</i>	Milkmaids
<i>Caesia micrantha</i>	Pale grass-lily
<i>Caesia parviflora</i>	Grass lily
<i>Caladenia excelsa</i>	
<i>Caladenia flava</i> subsp. <i>sylvestris</i>	
<i>Caladenia flava</i>	Cowslip orchid
<i>Caladenia latifolia</i>	Pink fairy orchid
<i>Caladenia marginata</i>	White fairy orchid
<i>Cassytha racemosa</i>	Dodder laurel
<i>Centrolepis aristata</i>	Pointed centalopis
<i>Centrolepis drummondiana</i>	
<i>Centrolepis polygyna</i>	Wiry centralopis
<i>Chamaescilla corymbosa</i>	Blue quill
<i>Cheilanthes austrotenuifolia</i>	
<i>Chorilaena quercifolia</i>	Chorilaena
<i>Clematis indet</i>	
<i>Clematis pubescens</i>	Common white clematis
<i>Comesperma confertum</i>	
<i>Conospermum capitatum</i>	
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	
<i>Conostylis aculeata</i>	Prickly conostylis
<i>Craspedia indet</i>	
<i>Craspedia variabilis</i>	
<i>Cryptandra mutila</i>	
<i>Cyathochaeta avenacea</i>	
<i>Danthonia caespitosa</i>	Common wallaby grass
<i>Darwinia citriodora</i>	Lemon-scented darwinia
<i>Daucus glochidiatus</i>	Australia carrot
<i>Daviesia horrida</i>	Prickly bitter-pea
<i>Dichondra repens</i>	Kidney weed
<i>Drosera glanduligera</i>	Pimpernel sundew
<i>Drosera pallida</i>	Pale rainbow
<i>Empodisma gracillimum</i>	

<i>Eriostemon spicatus</i>	Pepper and salt
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus diversicolor</i>	Karri
<i>Eucalyptus marginata</i>	Jarra
<i>Eucalyptus megacarpa</i>	Bullich
<i>Eutaxia densifolia</i>	
<i>Freesia indet</i>	
<i>Galium murale</i>	Small goosegrass
<i>Gnaphalium sphaericum</i>	Star cudweed
<i>Hakea amplexicaulis</i>	Prickly hakea
<i>Hakea lissocarpa</i>	Honey bush
<i>Hakea oleifolia</i>	Dungyn
<i>Hakea ruscifolia</i>	Candle hakea
<i>Hardenbergia comptoniana</i>	Native wisteria
<i>Hibbertia amplexicaulis</i>	
<i>Hibbertia cuneiformis</i>	Cutleaf hibbertia
<i>Hibbertia cunninghamii</i>	
<i>Hibbertia furfuracea</i>	
<i>Hibbertia grossulariifolia</i>	
<i>Leucopogon propinquus</i>	Tassel flower
<i>Leucopogon verticillatus</i>	Midget stylewort
<i>Levenhookia pusilla</i>	Common stylewort
<i>Levenhookia stipitata</i>	Winged-seeded lobelia
<i>Lobelia heterophylla</i>	Slender lobelia
<i>Lobelia tenuior</i>	
<i>Lomandra hermaphrodita</i>	
<i>Lomandra micrantha</i>	Small-flower mat-rush
<i>Loxocarya fasciculata</i>	
<i>Luzula meridionalis</i>	Field woodrush
<i>Lyperanthus nigricans</i>	Red beak orchid
<i>Macrozamia riedlei</i>	Zamia
<i>Melaleuca thymoides</i>	
<i>Microlaena stipoides</i> var. <i>stipoides</i>	
<i>Microlaena stipoides</i>	Weeping grass
<i>Millotia myosotidifolia</i>	
<i>Millotia pilosa</i>	
<i>Monadenia bracteata</i>	
<i>Olearia axillaris</i>	Coastal daisybush
<i>Opercularia hispidula</i>	Hispid stinkweed
<i>Opercularia volubilis</i>	Twining stinkweed
<i>Oxalis corniculata</i>	Redwood sorrel
<i>Oxylobium linearifolium</i>	Narrow-leaved oxylobium
<i>Patersonia umbrosa</i>	Yellow flags
<i>Persoonia articulata</i>	
<i>Persoonia longifolia</i>	Snottygobble
<i>Petrorhagia velutina</i>	Velvet pink
<i>Phebalium anceps</i>	Blister bush
<i>Phlebocarya ciliata</i>	
<i>Phyllanthus calycinus</i>	False boronia
<i>Pimelea lanata</i>	
<i>Pimelea rosea</i>	Rose banjine
<i>Plantago varia</i>	Variable plantain
<i>Platysace tenuissima</i>	
<i>Podocarpus drouynianus</i>	
<i>Poranthera microphylla</i>	Small poranthera
<i>Pteridium esculentum</i>	Bracken
<i>Pterostylis nana</i>	Snail orchid
<i>Quinetia urvillei</i>	

<i>Ranunculus colonorum</i>	Common buttercup
<i>Rhodanthe citrina</i>	
<i>Senecio laetus</i>	
<i>Sollya heterophylla</i>	Australian bluebell
<i>Sowerbaea laxiflora</i>	Purple tassels
<i>Stackhousia monogyna</i>	
<i>Stylidium amoenum</i>	Lovely triggerplant
<i>Stylidium brunonianum</i> subsp. <i>brunonianum</i>	
<i>Stylidium brunonianum</i>	Pink fountain triggerplant
<i>Stylidium calcaratum</i>	Book triggerplant
<i>Stylidium crassifolium</i>	Thick-leaved triggerplant
<i>Stylidium schoenoides</i>	Cow kicks
<i>Stylidium spathulatum</i> subsp. <i>spathulatum</i>	
<i>Synaphea gracillima</i>	
<i>Templetonia retusa</i>	Cockies tongues
<i>Tetraria octandra</i>	
<i>Tetrarrhena laevis</i>	Forgest ricegrass
<i>Tetratheca setigera</i>	
<i>Thelymitra crinita</i>	Blue lady orchid
<i>Thelymitra pauciflora</i>	Slender sun orchid
<i>Thomasia foliosa</i>	
<i>Thysanotus arenarius</i>	
<i>Thysanotus patersonii</i>	Twining fringe lily
<i>Thysanotus tenellus</i>	
<i>Trachymene pilosa</i>	Native parsnip
<i>Tremandra stelligera</i>	
<i>Trifolium indet</i>	
<i>Tripterococcus brunonis</i>	Winged stackhousia
<i>Trymalium floribundum</i> subsp. <i>trifidum</i>	
<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	
<i>Wahlenbergia preissii</i>	
<i>Waitzia citrina</i>	
<i>Xanthorrhoea preissii</i>	Grasstree
<i>Xanthosia huegelii</i>	
<i>Zantedeschia aethiopica</i>	Arum lily

Appendix 5.

Botanical Information and Species list for stands in Remnant AUG02822 (Griffin, 1995)

Augusta - Margaret River Shire, Rosa Brook

Survey date: 01/11/94

Location: 33° 58' 82" latitude, 115° 5 ' 9" longitude.

Stand: AUG02822 1

Structure (Muir 1977): open woodland/low woodland b/dwarf scrub d/open low sedges

Major spp.: *Dasypogon hookeri*, *Corymbia calophylla*, *Agonis flexuosa*

Landform: upland plain, slope - 0°

Soil: grey sand/lateritic gravel

Drainage: good

Percentage canopy cover: 20% bare ground, 45% litter cover; 3% weeds

Condition (M.E. Trudgen in Griffin, 1994): Good; long unburnt.

Stand: AUG02822 2

Structure (Muir 1977): woodland/open low woodland a/low woodland b/dwarf scrub c

Major spp.: *Corymbia calophylla*, *Agonis flexuosa*, *Eucalyptus marginata* ssp. *marginata*

Landform: upper slope, slope - 2°

Soil: grey sand/brown sand

Drainage: good.

Percentage canopy cover: 15% bare ground 90% litter cover; 2% weeds

Condition (M.E. Trudgen in Griffin, 1994): Good, long unburnt.

Stand: AUG02822 3

Structure (Muir 1977): woodland/low woodland a/open scrub/low scrub b/low heath d/very open low sedges

Major spp.: *Agonis parviceps*, *Eucalyptus marginata* ssp. *marginata*, *Hibbertia hypericoides*

Landform: upland plain, slope - 0°

Soil: lateritic brown sandy gravel

Drainage: good

Percentage canopy cover: 10% bare ground, 80% litter cover 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02822 4

Structure (Muir 1977): woodland/low forest a/open low scrub b/dwarf scrub c/low heath D

Major spp.: *Corymbia calophylla*, *Hibbertia hypericoides*, *Eucalyptus marginata* ssp. *Marginata*

Landform: upland plain, slope - 1°

Soil: lateritic grey sandy gravel

Drainage: good

Percentage canopy cover: 10% bare ground, 80% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02822 5

Structure (Muir 1977): woodland/low forest a/low scrub b/low heath d/very open low sedges

Major spp.: *Corymbia calophylla*, *Hibbertia hypericoides*, *Eucalyptus marginata* ssp. *marginata*

Landform: mid slope, slope - 4°

Soil: lateritic brown loamy sandy gravel

Drainage: good.

Percentage canopy cover: 10% bare ground, 80% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good; long unburnt.

Stand: AUG02822 6

Structure (Muir 1977): open woodland/low woodland a/low scrub b/open low sedges

Major spp.: *Corymbia calophylla*, *Agonis flexuosa*, *Eucalyptus marginata* ssp. *marginata*

Landform: lower slope, slope - 2°

Soil: grey sand/pale yellow loamy sand

Drainage: good,

Percentage canopy cover: 15% bare ground, 80% litter cover, 2% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, recently burnt.

Stand: AUG02822 7

Structure (Muir 1977): woodland/low forest a/low heath d/very open low sedges

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Hibbertia hypericoides*, *Corymbia calophylla*

Landform: upper slope, slope - 1°

Soil: lateritic brown sandy gravel

Drainage: good,

Percentage canopy cover: 10% bare ground, 80% litter cover, 1% weeds

Condition (M.E. Trudgen in Griffin, 1994): Very good recently burnt.

Stand: AUG02822 8

Structure (Muir 1977): low scrub a/tall sedges

Major spp.: *Agonis linearifolia*, *Sporodanthus rivularis*, *Xyris flexifolia*

Landform: vale (upper drainage line), slope - 1°

Soil: organic dark grey sand

Drainage: poor, winter wet

Percentage canopy cover: 5% bare ground, 20% litter cover 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Species List

<u>Botanical Name</u>	<u>Common Name (if known)</u>
<i>Acacia browniana</i> var. <i>obscura</i>	
<i>Acacia divergens</i>	
<i>Acacia myrtifolia</i>	Narrow-leaved myrtle wattle
<i>Acacia pulchella</i> var. <i>pulchella</i>	Prickly Moses
<i>Adenanthos barbiger</i> subsp. <i>intermedius</i>	
<i>Agonis flexuosa</i>	Peppermint tree
<i>Agonis linearifolia</i>	Swamp peppermint
<i>Agonis parviceps</i>	
<i>Agrostocrinum scabrum</i>	Blue grass lily
<i>Aira caryophyllea</i>	Silvery hairgrass
<i>Amphipogon debilis</i>	
<i>Anigozanthos flavidus</i>	Tall kangaroo paw
<i>Astartea fascicularis</i>	
<i>Banksia grandis</i>	Bull banksia
<i>Baumea preissii</i>	

<i>Billardiera drummondiana</i>	Karri boronia
<i>Boronia gracilipes</i>	
<i>Bossiaea linophylla</i>	Broad leaved brown pea
<i>Bossiaea ornata</i>	Blowfly grass
<i>Briza maxima</i>	Shivery grass
<i>Briza minor</i>	Milkmaids
<i>Burchardia umbellata</i>	Pale grass lily
<i>Caesia parviflora</i>	
<i>Caladenia flava</i> subsp. <i>sylvestris</i>	Cowslip orchid
<i>Caladenia flava</i>	Common white spider orchid
<i>Caladenia longicauda</i>	Tangle dodder laurel
<i>Cassytha glabella</i>	Pointed centrolopis
<i>Centrolepis aristata</i>	
<i>Centrolepis</i> sp aff <i>fascicularis</i>	
<i>Chorizema diversifolium</i>	
<i>Chorizema indet</i>	
<i>Clematis pubescens</i>	Common clematis
<i>Comesperma confertum</i>	
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	
<i>Conostylis aculeata</i>	
<i>Craspedia variabilis</i>	
<i>Cyperaceae</i> genus nova EAG 9992	
<i>Dampiera hederacea</i>	Karri dampiera
<i>Dampiera linearis</i>	Narrow-leaved dampiera
<i>Dasypogon hookeri</i>	Pineapple bush
<i>Daucus glochidiatus</i>	Australian carrot
<i>Dichondra repens</i>	Kidney weed
<i>Diuris longifolia</i>	Common donkey orchid
<i>Drosera pallida</i>	Pale rainbow
<i>Drosera stolonifera</i> subsp. <i>stolonifera</i>	Leafy sundew
<i>Eriostemon spicatus</i>	Pepper and salt
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus marginata</i>	Jarrah
<i>Gymnoschoenus anceps</i>	
<i>Haemodorum laxum</i>	
<i>Hakea amplexicaulis</i>	Prickly hakea
<i>Hakea lissocarpa</i>	Honey bush
<i>Hakea ruscifolia</i>	Candle hakea
<i>Hardenbergia comptoniana</i>	Native wisteria
<i>Hibbertia amplexicaulis</i>	
<i>Hibbertia cuneiformis</i>	
<i>Hibbertia grossulariifolia</i>	
<i>Hibbertia hypericoides</i>	Yellow buttercups
<i>Hovea chorizemifolia</i>	Holly-leaved hovea
<i>Hovea elliptica</i>	Tree hovea
<i>Hypochaeris glabra</i>	Smooth catsear
<i>Hypolaena exsulca</i>	
<i>Isotoma hypocrateriformis</i>	Woodbridge poison
<i>Johnsonia lupulina</i>	Hooded lily
<i>Lagenifera huegelii</i>	Coarse lagenifera
<i>Lepidosperma angustatum</i>	
<i>Lepidosperma leptophyllum</i>	
<i>Lepidosperma tetraquetrum</i>	
<i>Leucopogon capitellatus</i>	
<i>Leucopogon propinquus</i>	
<i>Leucopogon racemulosus</i>	
<i>Leucopogon verticillatus</i>	
<i>Levenhookia pusilla</i>	Tassel flower
	Midget stylewort

<i>Logania indet</i>	
<i>Logania serpyllifolia</i> subsp. <i>serpyllifolia</i>	
<i>Logania vaginalis</i>	White spray
<i>Lomandra hermaphrodita</i>	
<i>Lomandra purpurea</i>	Purple mat rush
<i>Lomandra sericea</i>	Silky mat rush
<i>Loxocarya fasciculata</i>	
<i>Macrozamia riedlei</i>	Zamia
<i>Mesomelaena tetragona</i>	Semaphore sedge
<i>Microlaena stipoides</i>	Weeping grass
<i>Millotia tenuifolia</i>	Soft millotia
<i>Mirbelia dilatata</i>	Holly-leaved mirbelia
<i>Opercularia apiciflora</i>	
<i>Opercularia hispidula</i>	Hispid stinkweed
<i>Oxalis corniculata</i>	Yellow wood sorrel
<i>Oxylobium lineare</i>	Narrow-leaved oxylobium
<i>Patersonia umbrosa</i>	Yellow flags
<i>Pentapeltis peltigera</i>	
<i>Persoonia longifolia</i>	Snottygobble
<i>Petrophile diversifolia</i>	
<i>Phlebocarya ciliata</i>	
<i>Pimelea indet</i>	
<i>Pimelea rosea</i>	Rose banjine
<i>Platysace tenuissima</i>	
<i>Podocarpus drouynianus</i>	Wild plum
<i>Poranthera huegelii</i>	
<i>Prasophyllum indet</i>	
<i>Pteridium esculentum</i>	Bracken
<i>Pterostylis nana</i>	Snail orchid
<i>Pterostylis vittata</i>	Banded greenhood
<i>Pultenaea drummondii</i>	
<i>Ranunculus colonorum</i>	Common buttercup
<i>Scaevola striata</i>	Royal robe
<i>Senecio hispidulus</i>	Hispid fireweed
<i>Sphaerolobium medium</i>	
<i>Sphaerolobium racemosum</i>	
<i>Sporadanthus rivularis</i>	
<i>Stipa indet</i>	
<i>Stylidium amoenum</i>	Lovely triggerplant
<i>Stylidium calcaratum</i>	Book triggerplant
<i>Stylidium scandens</i>	Climbing triggerplant
<i>Tetraria octandra</i>	
<i>Tetrarrhena laevis</i>	Forgest ricegrass
<i>Thelymitra crinita</i>	Blue lady orchid
<i>Thelymitra</i> sp EAG 9588 aff. <i>holmsii</i>	
<i>Thysanotus multiflorus</i>	Many flowered fringe lily
<i>Thysanotus patersonii</i>	Twining fringe lily
<i>Thysanotus tenellus</i>	
<i>Tremandra indet</i>	
<i>Tremandra stelligera</i>	
<i>Trichocline spathulata</i>	Native gerbera
<i>Tricoryne humilis</i>	
<i>Trifolium indet</i>	
<i>Velleia trinervis</i>	
<i>Xanthorrhoea gracilis</i>	Slender grasstree
<i>Xanthorrhoea preissii</i>	Grasstree
<i>Xanthosia candida</i>	
<i>Xanthosia huegelii</i>	

Appendix 6.

Botanical Information and Species list for stands in Remnant AUG02873 (Griffin, 1995)

Augusta - Margaret River Shire, Witchcliffe, West,

Survey date: 31/10/94

Location: 34° 2' 23" latitude, 115° 5' 2" longitude

Stand: AUG02873 1

Structure (Muir 1977): forest/open low woodland b/open low scrub a/dwarf scrub d/open low sedges

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*, *Podocarpus drouynianus*

Landform: upland plain, slope - 1°

Soil: grey sand/lateritic orange loamy gravel

Drainage: good.

Percentage canopy cover: 15% bare ground, 90% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02873 2

Structure (Muir 1977): low woodland a/open low woodland b/low scrub a/dwarf scrub c/tall sedges

Major spp.: *Agonis flexuosa*, *Oxylobium lineare*, *Lepidosperma tetraquetrum*

Landform: vale (upper drainage line), slope - 0°

Soil: grey sand

Drainage: poor, winter wet,

Percentage canopy cover: 5% bare ground, 40% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02873 3

Structure (Muir 1977): forest/low woodland a/low scrub a/dwarf scrub c/low heath d/open low sedges

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*, *Hibbertia hypericoides*

Landform: upper slope, slope - 2°

Soil: brown loamy sand/lateritic orange-brown gravelly sandy loam

Drainage: good.

Percentage canopy cover: 15% bare ground, 70% litter cover; 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02873 4

Structure (Muir 1977): open woodland/open low woodland a/scrub/low scrub a/dwarf scrub c/open tall sedges

Major spp.: *Oxylobium lineare*, *Corymbia calophylla*, *Eucalyptus diversicolor*

Landform: vale (upper drainage line), slope - 0°

Soil: dark brown sandy loam/clay

Drainage: poor, winter damp.

Percentage canopy cover: 15% bare ground, 65% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02873 5

Structure (Muir 1977): forest/open low woodland a/open scrub/low scrub a/dwarf scrub d

Major spp.: *Eucalyptus diversicolor*, *Bossiaea linophylla*, *Hibbertia hypericoides*

Landform: lower slope, slope - 2°

Soil: brown gravelly sandy loam/loamy gravel/granite

Drainage: good

Percentage canopy cover: 15% bare ground, 90% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Stand: AUG02873 6

Structure (Muir 1977): forest/low woodland a/low scrub b/low heath d

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*, *Hibbertia hypericoides*

Landform: plain, slope - 1°

Soil: dark brown loamy sand/lateritic brown gravelly loamy sand

Drainage: good

Percentage canopy cover: 10% bare ground, 90% litter cover, 2% weeds

Condition (M.E. Trudgen in Griffin, 1994): very good, long unburnt.

Species List

Botanical Name

Common Name (if known)

Acacia divergens
Acacia myrtifolia
Acacia pulchella var. *pulchella*
Acacia tayloriana
Agonis flexuosa
Agonis linearifolia
Agonis parviceps
Agrostocrinum scabrum
Amperea ericoides
Amphipogon debilis
Anigozanthos indet
Anthoxanthum odoratum
Asplenium trichomanes
Astartea fascicularis
Banksia grandis
Baumea preissii
Boronia crenulata
Bossiaea linophylla
Briza maxima
Briza minor
Caesia micrantha
Caesia parviflora
Caladenia flava subsp. *sylvestris*
Caladenia flava
Caladenia infundibularis
Cassytha glabella
Chorilaena quercifolia
Chorizandra cymbaria
Chorizema diversifolium
Chorizema ilicifolium
Chorizema nanum
Clematis pubescens
Comesperma ciliatum
Conostylis aculeata subsp. *aculeata*
Craspedia indet

Narrow-leaved myrtle wattle
Prickly Moses

Peppermint tree
Swamp peppermint

Blue grass lily

Sweet vernal grass
Maidenhair spleenwort

Bull banksia

Blowfly grass
Shivery grass
Pale grass-lily
Pale grass lily

Cowslip orchid

Tangled dodder laurel
Chorilaena
Heron bristle rush

Holly flame pea

Common clematis

<i>Dampiera hederacea</i>	Karri dampiera
<i>Danthonia caespitosa</i>	Common wallaby grass
<i>Elythranchia brunonis</i>	Purple enamel orchid
<i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>	White bunny orchid
<i>Corymbia calophylla</i>	Marri
<i>Eucalyptus diversicolor</i>	Karri
<i>Eucalyptus marginata</i>	Jarra
<i>Hakea amplexicaulis</i>	Prickly hakea
<i>Hakea lissocarpa</i>	Honey bush
<i>Hardenbergia comptoniana</i>	Native wisteria
<i>Hibbertia amplexicaulis</i>	
<i>Hibbertia commutata</i>	Cutleaf hibbertia
<i>Hibbertia cuneiformis</i>	Yellow buttercups
<i>Hibbertia hypericoides</i>	Holly-leaved hovea
<i>Hovea chorizemifolia</i>	Tree hovea
<i>Hovea elliptica</i>	
<i>Hovea indet</i>	
<i>Hypochaeris glabra</i>	Smooth catsear
<i>Isopogon cuneatus</i>	Coneflower
<i>Lagenifera huegelii</i>	Coarse lagenifera
<i>Lepidosperma angustatum</i>	
<i>Lepidosperma indet</i>	
<i>Lepidosperma leptophyllum</i>	
<i>Lepidosperma tetraquetrum</i>	
<i>Leucopogon capitellatus</i>	
<i>Leucopogon propinquus</i>	
<i>Leucopogon verticillatus</i>	
<i>Logania serpyllifolia</i> subsp. <i>serpyllifolia</i>	Tassel flower
<i>Macrozamia riedlei</i>	Zamia
<i>Microlaena stipoides</i>	Weeping grass
<i>Mirbelia dilatata</i>	Holly-leaved mirbelia
<i>Opercularia apiciflora</i>	
<i>Opercularia hispidula</i>	Hispid stinkweed
<i>Oxylobium lineare</i>	Narrow-leaved oxylobium
<i>Patersonia occidentalis</i>	Purple flag
<i>Patersonia umbrosa</i>	Yellow flags
<i>Persoonia longifolia</i>	Snottygobble
<i>Pimelea rosea</i>	Rose banjine
<i>Platysace tenuissima</i>	
<i>Poaceae indet</i>	
<i>Podocarpus drouynianus</i>	Wild plum
<i>Pteridium esculentum</i>	Bracken
<i>Pterostylis turfosa</i>	Bird orchid
<i>Ricinocarpos glaucus</i> var. <i>glaucus</i>	Wedding bush
<i>Scaevola striata</i>	Royal robe
<i>Sollya heterophylla</i>	Australian bluebell
<i>Stackhousia monogyna</i>	
<i>Stylidium adnatum</i> var. <i>propinquum</i>	Common beaked triggerplant
<i>Stylidium amoenum</i>	Lovely triggerplant
<i>Stylidium calcaratum</i>	Book triggerplant
<i>Stylidium junceum</i>	Reed triggerplant
<i>Stylidium leptophyllum</i>	Needle-leaved triggerplant
<i>Tetraria octandra</i>	
<i>Tetrarrhena laevis</i>	Hair sedge
<i>Thelymitra crinita</i>	Blue lady orchid
<i>Thomasia triloba</i>	
<i>Thysanotus indet</i>	
<i>Thysanotus tenellus</i>	

<i>Trachymene pilosa</i>	Native parsnip
<i>Tremandra indet</i>	
<i>Tremandra stelligera</i>	
<i>Tripterococcus brunonis</i>	Winged stackhousia
<i>Trymalium floribundum</i> subsp. <i>trifidum</i>	
<i>Velleia trinervis</i>	
<i>Waitzia citrina</i>	
<i>Xanthorrhoea preissii</i>	Grasstree
<i>Xanthosia candida</i>	
<i>Xanthosia huegelii</i>	

Appendix 7.

Botanical Information and Species list for stands in Remnant AUG03125(Griffin, 1995)

Margaret River Shire, Alexander Bridge, south-east

Survey date: 31/10/94

Stand: AUG03125 1

Structure (Muir 1977): forest/low woodland a/low heath

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*, *Hibbertia hypericoides*

Landform: upland plain, slope - 1°

Soil: lateritic grey sandy gravel

Drainage: good.

Percentage canopy cover: 15% bare ground, 85% litter cover 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): good.

Stand: AUG03125 2

Structure (Muir 1977): woodland/low forest a/low heath

Major spp.: *Eucalyptus marginata* ssp. *marginata*, *Corymbia calophylla*, *Hibbertia hypericoides*

Landform: rise, slope - 1°

Soil: grey sand

Drainage: good

Percentage canopy cover: 10% bare ground, 70% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): good, long unburnt.

Stand: AUG03125 3

Structure (Muir 1977): low scrub a/low heath d/dense tall sedges

Major spp.: *Agonis linearifolia*, *Gahnia* sp. *indet.*, *Schoenus cruentus*

Landform: open depression, slope - 0°

Soil: organic dark grey sand

Drainage: poor, winter wet

Percentage canopy cover: 5% bare ground, 10% litter cover, 0% weeds

Condition (M.E. Trudgen in Griffin, 1994): good, long unburnt.

Species List

Botanical Name

Common Name (if known)

Acacia divergens

Acacia pulchella var.

Acacia semitrullata

Adenanthos meisneri

Agonis flexuosa

Agonis linearifolia

Agonis parviceps

Agrostocrinum scabrum

Aira caryophylla

Allocasuarina fraseriana

Anarthria prolifera

Andersonia caerulea

Asplenium trichomanes

Astartea fascicularis

Banksia grandis

Wongan wattle

Peppermint tree

Swamp peppermint

Blue grass lily

Silvery hairgrass

Common sheoak

Foxtails

Maidenhair spleenwort

Bull banksia

Baumea vaginalis
Boronia fastigiata
Bossiaea linophylla
Caladenia flava subsp. *sylvestris*
Caladenia indet
Caladenia longicauda
Cassytha glabella
Cassytha racemosa forma *pilosa*
Chamaescilla corymbosa
Comesperma virgatum
Conostylis aculeata subsp. *aculeata*
Conostylis setigera subsp. *setigera*
Cyathochaeta avenacea
Dampiera linearis
Dasypogon bromeliifolius
Diaspasis filifolia
Drosera pallida
Elythranthera brunonis
Empodisma gracillimum
Eriostemon spicatus
Corymbia calophylla
Eucalyptus marginata
Eutaxia virgata
Gompholobium polymorphum
Gompholobium preissii
Hakea lissocarpa
Hakea ruscifolia
Hibbertia amplexicaulis
Hibbertia hypericoides
Hibbertia stellaris
Hovea elliptica
Hovea trisperma
Hypolaena exsulca
Johnsonia lupulina
Lepidosperma leptophyllum
Leucopogon capitellatus
Leucopogon propinquus
Leucopogon racemulosus
Lomandra purpurea
Loxocarya cinerea
Loxocarya fasciculata
Macrozamia riedlei
Mesomelaena tetragona
Nuytsia floribunda
Opercularia apiciflora
Opercularia echinocephala
Oxylobium lineare
Patersonia indet
Patersonia occidentalis
Pericalymma spongiocaule
Persoonia longifolia
Platysace tenuissima
Podocarpus drouynianus
Scaevola striata
Schoenus cruentus
Sphenotoma gracile
Stylidium amoenum
Stylidium calcaratum

Sheath twigrush
 Bushy boronia

Common white spider orchid
 Tangled dodder laurel

Blue quill
 Milkwort
 Prickly conostylis
 Bristly cottonhead

Common dampiera
 Pineapple bush
 Thread-leaved diaspasis
 Pale rainbow
 Purple enamel orchid

Pepper and salt
 Marri
 Jarrah

Honey bush
 Candle hakea

Yellow buttercups
 Orange stars
 Tree hovea
 Common hovea

Hooded lily

Purple mat rush

Zamia

Christmas tree

Bristly headed stink weed
 Narrow-leaved oxylobium

Purple flags

Snottygobble

Wild plum
 Royal robe

Swamp paper-heath
 Lovely triggerplant
 Book triggerplant

Tetraria octandra
Thelymitra crinita
Thelymitra pauciflora
Tricoryne humilis
Tripterococcus brunonis
Villarsia lasiosperma
Xanthorrhoea preissii
Xanthosia candida
Xanthosia huegelii
Xylomelum occidentale
Xyris indet

Blue lady orchid
Slender sun orchid

Winged stackhousia

Grasstree

Woody pear

Appendix 8.

Native Mammals of the Katanning CALM District (Sanders and Harold, 1991)

Taxa	Common Name	Conservation Status
<i>Tachyglossus aculeatus</i>	Echidna	
<i>Dasyurus geoffroii</i>	Chudditch	G1, AR
<i>Phascogale calura</i>	Red-tailed Phascogale	G1,AR, RP
<i>Phascogale tapoatafa</i>		
<i>Anthechinus flaviceps</i>	Mardo	NR
<i>Sminthopsis gilberti</i>	Common Dunnart	
<i>Sminthopsis griseoventer</i>	Common Dunnart	PO, NR
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	
<i>Sminthopsis granulipes</i>	White-tailed Dunnart	
<i>Antichinomys laniger</i>	Kultarr	NR
<i>Myrmecobius fasciatus</i>	Numbat	G1, AR,
<i>Isoodon obseculus fusciventer</i>	Brown Bandicoot	G1, AR
<i>Perameles bougainville</i>	Barred Bandicoot	ER, G1
<i>Macrotis lagotis</i>	Bilby	ER, G1
<i>Pseudocheirus peregrinus occidentalis</i>	Common Ringtail	G1, AR,NR
<i>Trichosurus vulpecula</i>	Brush-tailed Possum	
<i>Cercartetus concinnus</i>	South-west Pygmy Possum	
<i>Tarsipes rostratus</i>	Honey Possum	
<i>Bettongia penicillata</i>	Woylie	G1, AR
<i>Bettongia lesueur</i>	Burrowing Rat-kangaroo	ER, G1
<i>Onychogalea lunata</i>	Crescent nail-tailed wallaby	ER, G1
<i>Macropus eugenii</i>	Tammar Wallaby	G1, AR
<i>Macropus irma</i>	Western Brush Wallaby	
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	
<i>Tadarida australis</i>	White-striped Bat	
<i>Mormopterus planiceps</i>	Little Mastiff-Bat	NR
<i>Nyctophilus major</i>	Greater Long-eared Bat	
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	NR
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	
<i>Chalinologus morio</i>	Chocolate Bat	
<i>Scotorepens balstoni</i>	Western Broad-nosed Bat	NR
<i>Falsistrellus mackenziei</i>		
<i>Eptesicus finlaysoni</i>		
<i>Hydromys chrysogaster</i>	Water Rat	
<i>Pseudomys shortridgei</i>	Blunt-faced Mouse	G1, AR
<i>Pseudomys albocinereus</i>	Ash-grey Mouse	
<i>Pseudomys occidentalis</i>	Western Mouse	G1, AR, RP
<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse	
<i>Notomys alexis</i>	Brown Hopping-Mouse	
<i>Canis familiaris</i>	Dingo	

Status Key

AR - At risk within the region

ER - Extinct within the region

G1 - Gazetted as Schedule 1 under Wildlife Conservation Act 1950

NR - Not recorded in the region since 1980

PO - Possibly occurring in the region but not yet recorded

RP - Have population mainly within the region

Appendix 9.

Reptiles and Amphibians of the Katanning CALM District (Sanders and Harold, 1991)

Taxa	Conservation Status	Common Name
Amphibians		
Leptodactylidae (Frogs)		
<i>Crinia georgiana</i>	NK;AR	
<i>Crinia pseudinsignifera</i>	NK;AR	
<i>Heleioporus albopunctatus</i>	AR	
<i>Heleioporus eyrei</i>	AR	Moaning frog
<i>Heleioporus inornatus</i>	AR	
<i>Heleioporus psammophilus</i>	NR;AR	
<i>Limnodynastes dorsalis</i>	AR	Western banjo frog
<i>Myobatrachus gouldii</i>	AR	Turtle frog
<i>Neobatrachus albipes</i>	RP;AR	
<i>Neobatrachus kunapalari</i>	AR	
<i>Neobatrachus pelobatoides</i>	AR	Humming frog
<i>Neobatrachus sutor</i>	NR;AR	Shoemaker frog
<i>Pseudophryne guentheri</i>	AR	Guenther's toadlet
<i>Pseudophryne occidentalis</i>	NK;AR	Orange-crowned toadlet
Hylidae (Tree Frogs)		
<i>Litoria adelaidensis</i>	AR	Slender tree frog
<i>Litoria cyclorhynchus</i>	AR	Spotted thighed frog
<i>Litoria moorei</i>	AR	Western green frog
Reptiles		
Chelidae (Turtles)		
<i>Chelodina oblonga</i>		Oblong turtle
Gekkonidae (Geckos)		
<i>Crenadactylus ocellatus ocellatus</i>		Clawless gecko
<i>Diplodactylus granariensis</i>		
<i>Diplodactylus polyophthalmus</i>		
<i>Diplodactylus pulcher</i>		
<i>Diplodactylus spinigerus inornatus</i>		Western spiny-tailed gecko
<i>Gehyra variegata</i>		Tree dtella
<i>Oedura reticulata</i>		Reticulated velvet gecko
<i>Phyllodactylus marmoratus marmoratus</i>		Marbled gecko
<i>Underwoodisaurus milii</i>		Thick-tailed gecko
Pygopodidae (Snake Lizards)		
<i>Aprasia pulchella</i>		
<i>Aprasia repens</i>		
<i>Delma australis</i>		
<i>Delma fraseri</i>		
<i>Delma greyii</i>	NR	
<i>Lialis burtonis</i>		Burton's snake lizard
<i>Pygopus lepidopodus lepidopodus</i>	NK	Common scaly-foot
Agamidae (Lizards)		
<i>Ctenophorus cristatus</i>		
<i>Ctenophorus maculatus griseus</i>		
<i>Ctenophorus ornatus</i>		
<i>Ctenophorus salinarum</i>		
<i>Moloch horridus</i>		Thorny devil
<i>Pogona minor minor</i>		

<i>Tymanocryptis adelaidensis</i>	NR	
Scincidae (Skinks)		
<i>Bassiana trilineata</i>		
<i>Cryptoblepharus plagiocephalus</i>		
<i>Ctenotus catenifer</i>	NK	
<i>Ctenotus gemmula</i>	NR	
<i>Ctenotus impar</i>		
<i>Ctenotus labillardieri</i>	NR	
<i>Ctenotus schomburgkii</i>		
<i>Egernia kingii</i>	NR	King skink
<i>Egernia multiscutata bos</i>		
<i>Egernia napoleonis</i>		
<i>Egernia richardi</i>		
<i>Hemiergis peronii</i>		
<i>Lerista microtis</i>		
<i>Menetia greyii</i>		
<i>Morethia butleri</i>	NR	
<i>Morethia lineoocellata</i>	NR	
<i>Morethia obscura</i>		
<i>Tiliqua occipitalis</i>		Western blue-tongued lizard
<i>Tiliqua rugosa rugosa</i>		Bobtail
Varanidae (Goannas)		
<i>Varanus gouldii</i>		Gould's goanna
<i>Varanus tristis tristis</i>	NK	
<i>Varanus rosenburgi</i>		
Typhlopidae		
<i>Ramphotyphlops australis</i>		
<i>Ramphotyphlops pinguis</i>	NK	
<i>Ramphotyphlops waitii</i>		
Boidae (Pythons)		
<i>Morelia spilota imbricata</i>	G2;AR	Carpet python
<i>Morelia stimsoni stimsoni</i>	PO(K);NK	
Elapidae (Viper Snakes)		
<i>Acanthophis antarcticus</i>	PO(K);NK	Common death adder
<i>Notechis coronatus</i>	PO(K);NK	
<i>Notechis curtus</i>		
<i>Notechis scutatus occidentalis</i>	NR	Mainland tiger snake
<i>Pseudonaja australis</i>	NR	
<i>Pseudonaja affinis affinis</i>		Dugite
<i>Pseudonaja modesta</i>	NK	Ringed brown snake
<i>Pseudonaja nuchalis</i>		Western brown snake
<i>Rhinoplocephalus bicolor</i>	NK	
<i>Rhinoplocephalus gouldii</i>		
<i>Rhinoplocephalus nigriceps</i>		
<i>Vermicella bertholdi</i>		
<i>Vermicella bimaculata</i>	PO(K);NK	
<i>Vermicella semifasciata semifasciata</i>		

Status Key

AR - At risk within the region

G2 - Gazetted as Schedule 2 under Wildlife Conservation Act 1950

NR - Not recorded in the region since 1980

PO - Possibly occurring in the region but not yet recorded (district shown in brackets)

NK - Date of last record not known

RP - Have population mainly within region

Appendix 10.

Bird Species Seen in the Shire of Augusta-Margaret River (Barratt *et al.*, 1994; Saunders and Ingram, 1994; Garstone, 1970)

Common Name	Scientific Name
Emu	<i>Dromaius novaehollandiae</i>
Great crested grebe	<i>Podiceps cristatus</i>
Australasian grebe	<i>Podiceps novaehollandiae</i>
Hoary-headed grebe	<i>Podiceps poliocephalus</i>
Little pied cormorant	<i>Phalacrocorax melanoleucos</i>
Pelican	<i>Pelecanus conspicillatus</i>
Little black cormorant	<i>Phalacrocorax sulcirostris</i>
Black cormorant	<i>Phalacrocorax carbo</i>
White-faced heron	<i>Ardea noveahollandiae</i>
Straw-necked ibis	<i>Threskiornis spinicollis</i>
Yellow-billed spoonbill	<i>Platalea flaviceps</i>
Black swan	<i>Cygnus atratus</i>
Freckled duck	<i>Stictonetta naevosa</i>
Black duck	<i>Anas superciliosa</i>
Grey teal	<i>Anas gibberifrons</i>
Chestnut teal	<i>Anas castanea</i>
Pink-eared duck	<i>Malacorhynchus membranaceus</i>
Wood duck	<i>Chenonetta jubata</i>
Blue-billed duck	<i>Oxyura australis</i>
Musk duck	<i>Biziura lobata</i>
Mountain duck	<i>Tadorna tadornoides</i>
Hardhead	<i>Aythya australis</i>
Coot	<i>Fulica atra</i>
Shoveler	<i>Anas rhynchotis</i>
Black-shouldered kite	<i>Elanus caeruleus</i>
Brown goshawk	<i>Accipiter fasciatus</i>
Collared sparrowhawk	<i>Accipiter cirrocephalus</i>
Wedge-tailed eagle	<i>Aquila audax</i>
Spotted harrier	<i>Circus assimilis</i>
Swamp harrier	<i>Circus aeruginosus</i>
Brown falcon	<i>Falco berigora</i>
Nankeen kestrel	<i>Falco cenchroides</i>
Cattle egret	<i>Egretta ibis</i>
Large egret	<i>Egretta alba</i>
Little egret	<i>Aquila morphnoides</i>
Little falcon	<i>Falco longipennis</i>
Malleefowl	<i>Leipoa ocellata</i>
Stubble quail	<i>Coturnix novaezelandiae</i>
Brown quail	<i>Coturnix ypsilophora</i>
Painted button-quail	<i>Turnix varia</i>
Little button-quail	<i>Turnix velox</i>
Black-tailed native-hen	<i>Gallinula ventralis</i>
Spotted crane	<i>Porzana fluminea</i>
Banded plover	<i>Vanellus tricolor</i>
Australian dotterell	<i>Peltohyas australis</i>
Red-capped dotterell	<i>Charadrius ruficapillus</i>
Black-fronted dotterell	<i>Charadrius melanops</i>
Hooded dotterell	<i>Charadrius cucullatus</i>
Banded stilt	<i>Cladorhynchus leucocephalus</i>
Pied stilt	<i>Himantopus himantopus</i>
Red-necked avocet	<i>Recurvirostra novaehollandiae</i>

Common sandpiper
 Greenshank
 Marsh sandpiper
 Wood sandpiper
 Sharp-tailed sandpiper
 Curlew sandpiper
 Silver gull
 Whiskered tern
 Common bronzewing
 Brush bronzewing
 Crested pigeon
 Carnaby's cockatoo
 Baudin's black cockatoo
 Galah
 Purple-crowned lorikeet
 Regent parrot
 Budgerigar
 Red-capped parrot
 Elegant parrot
 Western rosella
 Port Lincoln parrot
 Mulga parrot
 Pallid cuckoo
 Fan-tailed cuckoo
 Fork-tailed swift
 Horsefield's bronze cuckoo
 Shining bronze-cuckoo
 Tawny frogmouth
 Owlet-nightjar
 Spotted nightjar
 Laughing kookaburra
 Sacred kingfisher
 Rainbow bee-eater
 Restless flycatcher
 Western flyeater
 Welcome swallow
 Tree-martin
 Fairy martin
 Richard's pippit
 Black-faced cuckoo shrike
 White-winged triller
 Southern scrub-robin
 Scarlet robin
 Red-capped robin
 Hooded robin
 Western yellow robin
 Jacky winter
 Golden whistler
 Rufous whistler
 Grey shrike-thrush
 Crested bellbird
 Grey fantail
 Willy wagtail
 White-browed babbler
 Clamorous reed-warbler
 Little grassbird
 Brown song lark
 Rufous song lark

Tringa hypoleucos
Tringa nebularia
Tringa stagnatilis
Tringa glareola
Calidris acuminata
Calidris ferruginea
Larus novaehollandiae
Sterna hydrida
Phaps chalcoptera
Phaps elegans
Ocyphaps lophotes
Calyptorhynchus latirohynchus
Calyptorhynchus baudinii
Cacatua roseicapilla
Glossopsitta porphyrocephala
Polytelis anthopeplus
Melopsittacus undulatus
Platycercus spurius
Neophema elegans
Platycercus icterotis
Barnardius zonarius
Psephotus varius
Cuculus pallidus
Cuculus flabelliformis
Apus pacificus
Chrysococcyx basalis
Chrysococcyx lucidus
Podargus strigoides
Aegotheles cristatus
Eurostopodus guttatus
Dacelo gigas
Halycon sancta
Merops ornatus
Myiagra inquieta
Gerygone fusca
Hirundo neoxena
Hirundo nigricans
Hirundo ariel
Anthus novaeseelandiae
Corocina novaehollandiae
Lalage leucomela
Drymodes brunneopygius
Petroica multicolor
Petroica goodenovii
Petroica cucullata
Eopsaltria georgiana
Microeca leucophaea
Pachycephala pectoralis
Pachycephala rufiventris
Colluricincla harmonica
Oreoica gutturalis
Rhipidura fuliginosa
Rhipidura leucophrys
Pomatostomus superciliosus
Acrocephalus stentoreus
Megalurus gramineus
Cincloramphus cruralis
Cincloramphus mathewsi

Blue-breasted fairy wren
 White-browed scrubwren
 Shy hylacola
 Weebill
 Yellow-tailed thornbill
 Varied sittella
 Red wattlebird
 Spiny-cheeked honeyeater
 Purple-gaped honeyeater
 Brown-headed honeyeater
 White-plumed honeyeater
 Brown honeyeater
 Tawny-crowned honeyeater
 White-cheeked honeyeater
 White-eared honeyeater
 Singing honeyeater
 Yellow-throated miner
 White-fronted chat
 Mistletoebird
 Yellow-rumped pardalote
 Striated pardalote
 White ibis
 Western silvereye
 Australian magpie lark
 Black-faced woodswallow
 Dusky woodswallow
 Grey butcherbird
 Australian magpie
 Grey currawong
 Australian raven

Malurus pulcherrimus
Sericornis frontalis
Sericornis cautus
Smicrornis brevirostris
Acanthiza chrysorrhoa
Daphoenositta chrysoptera
Anthochaera carunculata
Acanthagenys rufogularis
Meliphaga cratitia
Helithreptus brevirostris
Helithreptus lunatus
Lichmera indistincta
Philidonyris melanops
Philidonyris nigra
Meliphaga leucotis
Meliphaga virescens
Manrina flavigula
Ephthiamura albifrons
Dicaeum hirundinaceum
Pardalotus xanthopygus
Pardalotus striatus
Threskiornis aethiopicus
Zosterops gouldi
Grallina cyanoleuca
Artamus cinereus
Artamus cyanopterus
Cracticus torquatus
Gymnorhina tibicen
Strepera versicolor
Corvus coronoides

Appendix 11.

Programs of Funding Aimed at Land and Nature Conservation

Remnant Vegetation Protection Scheme

The Remnant Vegetation Protection Scheme (RVPS) was developed by the State Government in 1988 to enhance soil and nature conservation by protecting native vegetation on farm land. The scheme (which is jointly administered by CALM and Agriculture Western Australia (AgWA), with AgWA as the lead agency) provides a fifty percent subsidy towards the cost of protective fencing of native vegetation on farms, with landowners giving an undertaking that the fenced vegetation will be managed for nature conservation for a period of at least thirty years, convenient on title.

To be granted a subsidy, the area of vegetation to be fenced must be five hectares or more, and must be in good condition or able to be rehabilitated to good condition. Regular botanical surveys of RVPS fenced areas are undertaken to monitor the condition of the vegetation. This not only provides an excellent, objective measure of the longer term success of the scheme, but also an opportunity for landowners to improve their management practices by providing them with a measure of the impact of their management actions.

National Vegetation Initiative

The National Vegetation Initiative (NVI) is one of five components of the National Heritage Trust. The primary objective of the NVI is to protect and enhance native vegetation cover across Australia. The NVI incorporates aspects of the National Landcare Program, One Billion Trees and Save the Bush (see below). The NVI is planned to begin in 1997 and details are available from Ag WA and Greening Western Australia.

National Landcare Program/National Soil Conservation Program

The National Soil Conservation Program (NSCP) was established by the Federal Government in 1983 with the aim of developing and implementing a national strategy for the rehabilitation and sustainable use of the nation's soil and land resources. The program has provided funds to government, education and research institutions and landcare and other community groups for soil conservation projects, with particular emphasis given to fostering co-operation and co-ordination amongst government agencies and those in the local community working on land degradation problems.

In 1992/93, the NSCP, the One Billion Trees Program (OBT), the Save the Bush Program (STB) and the Federal Water Resources Assistances Program were incorporated into a One-Stop-Shop for Community Grants under the National Landcare Program (NLP). The NLP aim is to encourage community groups to responsibly manage and conserve land, water, biological diversity and cultural heritage in their area.

One Billion Trees

The One Billion Trees (OBT) program was initiated in 1989 by the Federal Government with the aim of catalysing revegetation projects aimed at land and nature conservation. It is administered in Western Australia by Greening Western Australia. The program provides grants for revegetation projects through the one-stop-shop for community groups under the National Landcare Program.

Save the Bush

The Save the Bush Program (STB) was established by the Federal Government in 1989 to assist with the preservation of biological diversity by the protection and management of remnant vegetation. It is administered by the Australian Nature Conservation Agency (ANCA) and by CALM in Western Australia. Grants from this scheme encourage, facilitate and support programs action and activities associated with the protection, management and investigation of remnant bush.

Ribbons of Green

Ribbons of Green is a community based Greening Australia project which started in 1989 with the aim of replanting and regenerating cleared strips of land with native plants and trees. The "ribbons" are corridors along roads or rail reserves, along waterways or linking patches of bush. These "ribbons" may only contribute slightly to overall land conservation, but they are important for the conservation of wildlife by providing bush corridors. The details of what to plant, where and when to plant, are developed by the local community in consultation with Greening Western Australia, government departments (AgWA, CALM), local government authorities, consultants and community groups.

Plants for Conservation

The aim of Plants for Conservation Program (PFC) is to support groups and individuals actively undertaking projects aimed at land and nature conservation. The program provides seedlings for revegetation projects aimed at land and nature

conservation. It is managed by Greening Western Australia and sponsored by ALCOA of Australia and Hamel Nursery.

Gordon Reid Foundation for Conservation

The Gordon Reid Foundation for Conservation aims to provide funds or other support for the purposes of enhancing community involvement in conservation within Western Australia.

Funds are provided for:

- * the conservation of the Western Australian environment with emphasis on native flora and fauna;
- * the identification and conservation of critical habitats and ecosystems;
- * the conservation of rare, threatened and endangered species in WA;
- * public education and awareness of environmental issues within WA;
- * and research or other studies into other matters related to any of the above.

State Landcare Program

The State Government introduced the State Landcare Program in the 1987 to support Land Conservation District Committees and catchment groups in combating land degradation problems in rural areas. Financial support is provided to LCDCs to undertake projects in catchment planning, demonstrate conservation practices and for communications and training.

Appendix 12.

Projects in the Shire of Augusta-Margaret River to have received support through the State Landcare Program include:

1. (1990/91)	Project Title: Saltland Agronomy Trials Project Location: Nyabing/Pingrup LCD Objectives: To assess viable plant species that can be utilized on soils affected by salinity and flooding. State Assistance Provided: \$1,315
2. (1990/91)	Project Title: Purchase of a mobile drilling rig for drilling piezometers and observation wells. Project Location: Nyabing/Pingrup, Pingaring and Lakes LCDs. Objectives: By installing piezometers, farmer education and awareness of salinity processes will be enhanced. State Assistance Required: \$3,500
3. (1990/91)	Project Title: Purchase of surveying equipment Project Location: Mynelup Catchment Group Objectives: It is proposed to purchase a set of surveying equipment for use by the LCD and the catchment group. State Assistance Provided: \$1,104