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Native Vegetation Handbook for the Shire of Mingenew

Shaun B. Grein

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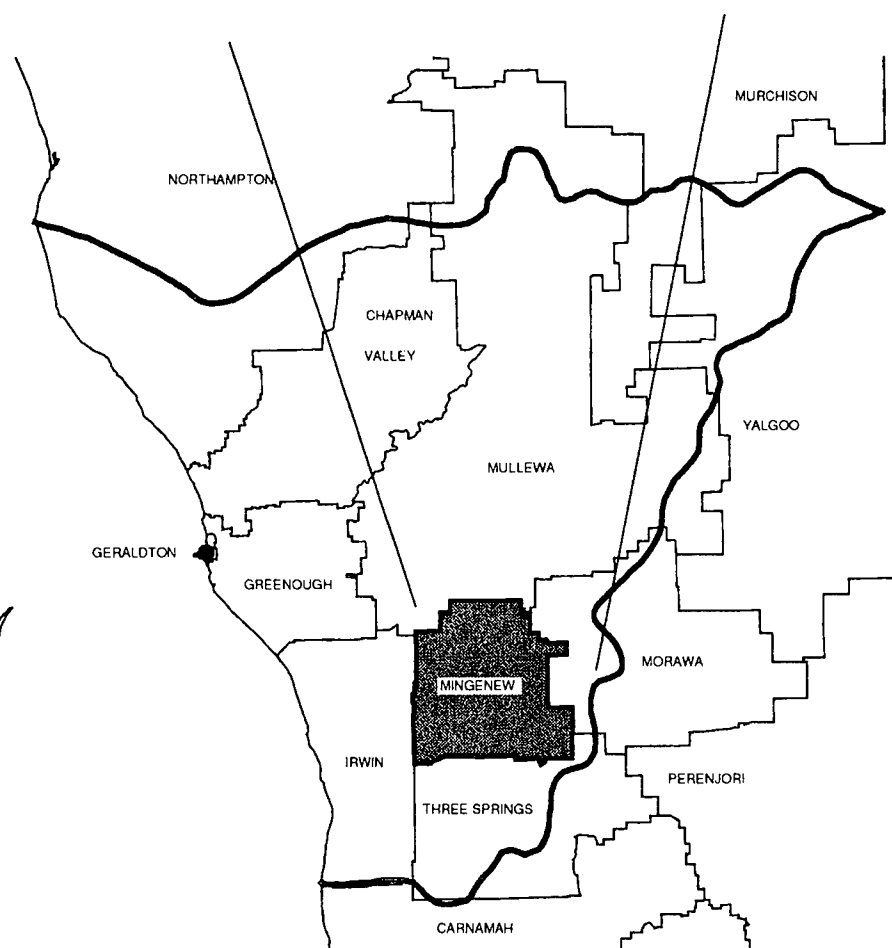
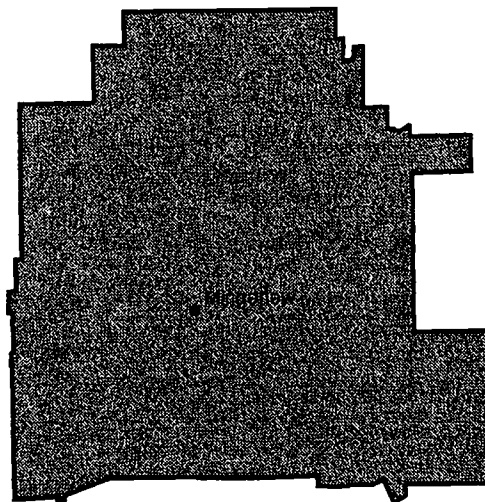
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Native Vegetation Handbook for the Shire of Mingenew



Copies of the Native Vegetation Handbook for the Shire of Mingenew are available by contacting :

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Cover: The Shire of Mingenew in relation to the Greenough River Catchment (as indicated by bold line)

NATIVE VEGETATION HANDBOOK FOR THE SHIRE OF MINGENEW

Shaun B. Grein

Spatial Resource Information Group

Land Management Branch

Division of Regional Operations

Western Australian Department of Agriculture

Produced by the Western Australian Department of Agriculture, the Environmental Protection Authority and Greening Western Australia with the assistance from the Commonwealth Government through the Australian Nature Conservation Agency's Save the Bush Program.

May, 1994

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The Vegetation Handbook for the Shire of Mingenew is one of a series covering the Agricultural region of Western Australia. Other handbooks in the series that have been completed are:

The Shire of Katanning
The Shire of Dumbleyung
The Shire of Wagin
The Shire of Wickepin
The Shire of Narrogin
The Shire of Corrigin

The Shire of Mingenew

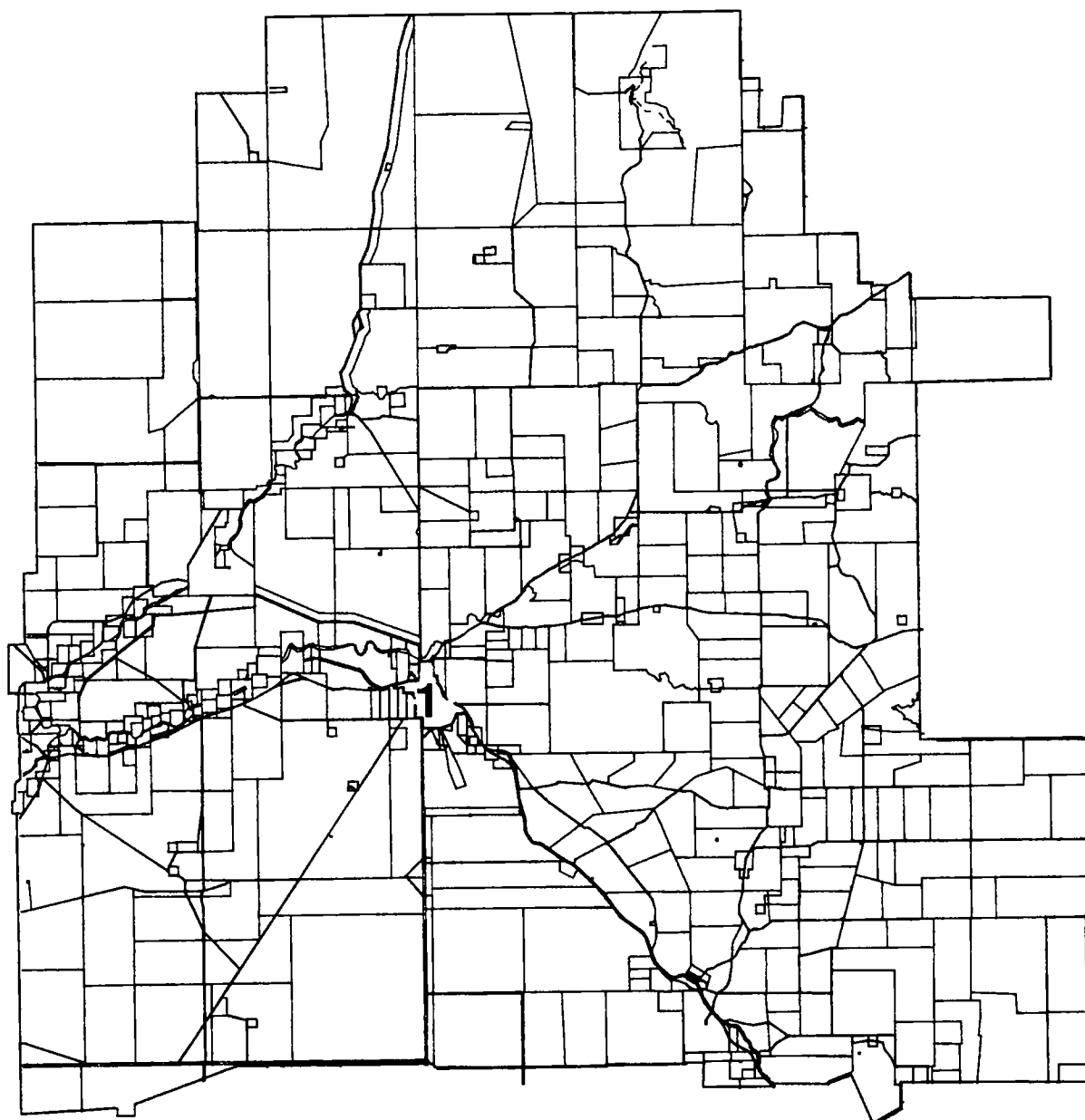
Introduction

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 systems, whether on a regional, catchment or local basis.

The management of native vegetation and agricultural land is closely related. It is vital that both native vegetation and agricultural land issues are considered within the context of their ecological area of influence. Both have a wide range of effects on each other and as a consequence should be managed together. For example native vegetation impacts on the hydrology of agricultural land, and nutrients can be transferred from agricultural land to remnants of native vegetation.

This booklet is one of a series covering the agricultural region of Western Australia and provides agricultural land managers with information relating to the natural resources of the Shire of Mingenew including the existing vegetation, drainage systems and soils. Some of the problems relating to the management of natural vegetation resources in the Shire of Mingenew and where 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 agricultural landscape and the conservation of native vegetation within the Shire.



Townsites

1 Mingenew

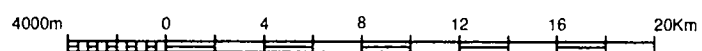


Figure 1 Cadastral Boundaries and townsite in the Shire of Mingenew.

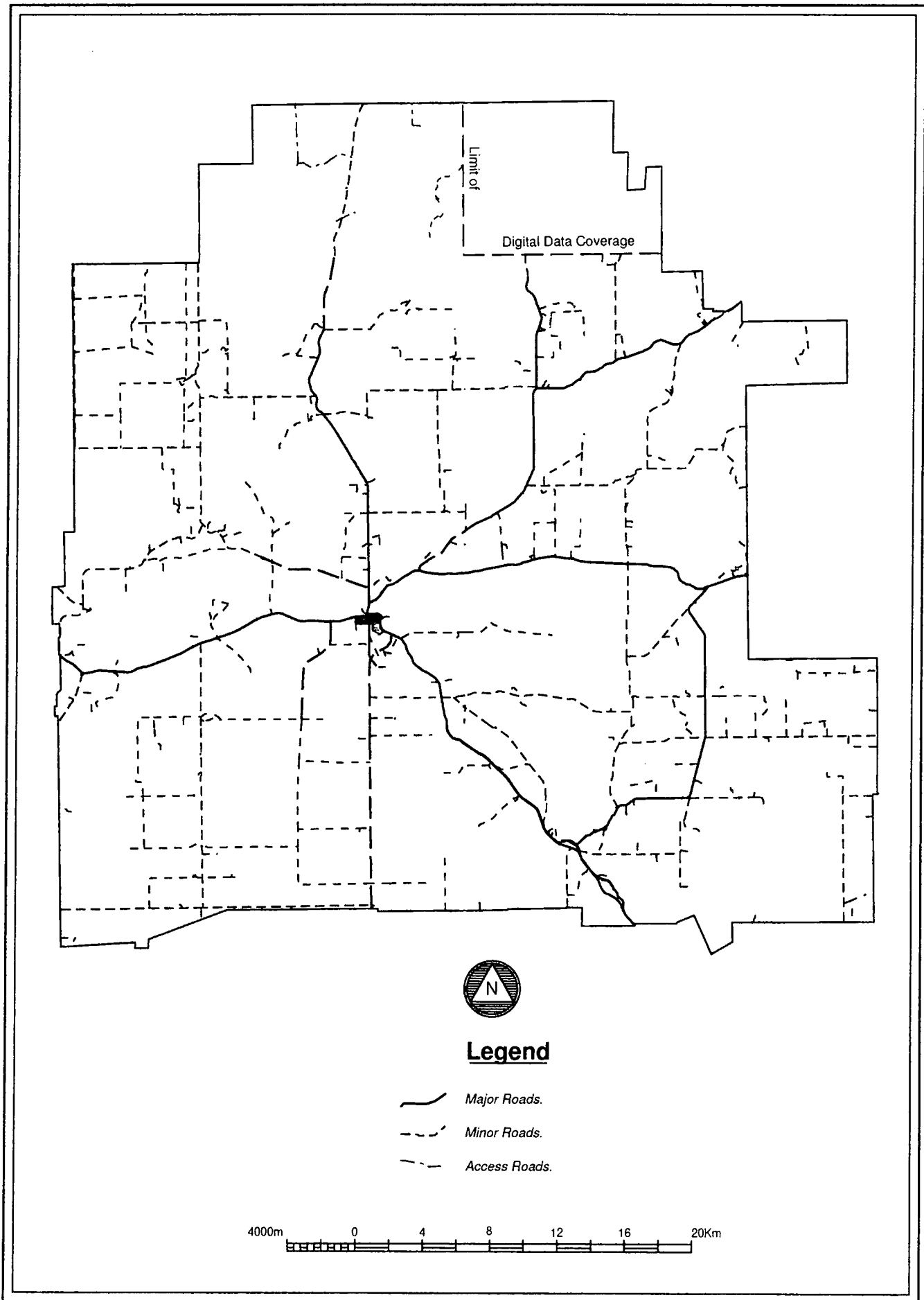


Figure 2 All major, minor and access road in the Shire of Mingenew.

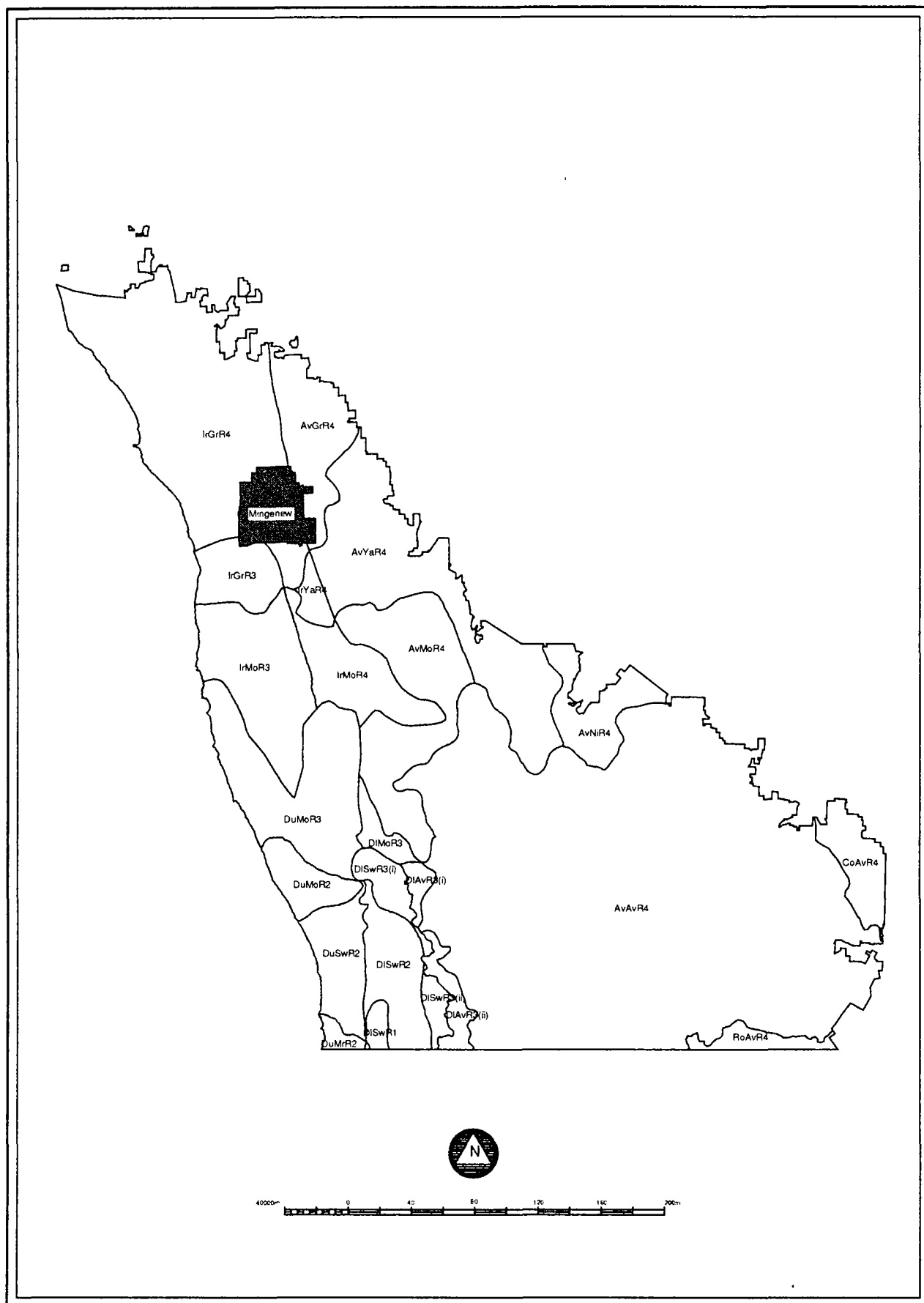


Figure 3. The Shire of Mingenew in relation to the Natural Resource Zones of the South-West Land Division of Western Australia (Allison, *et.al* 1993).

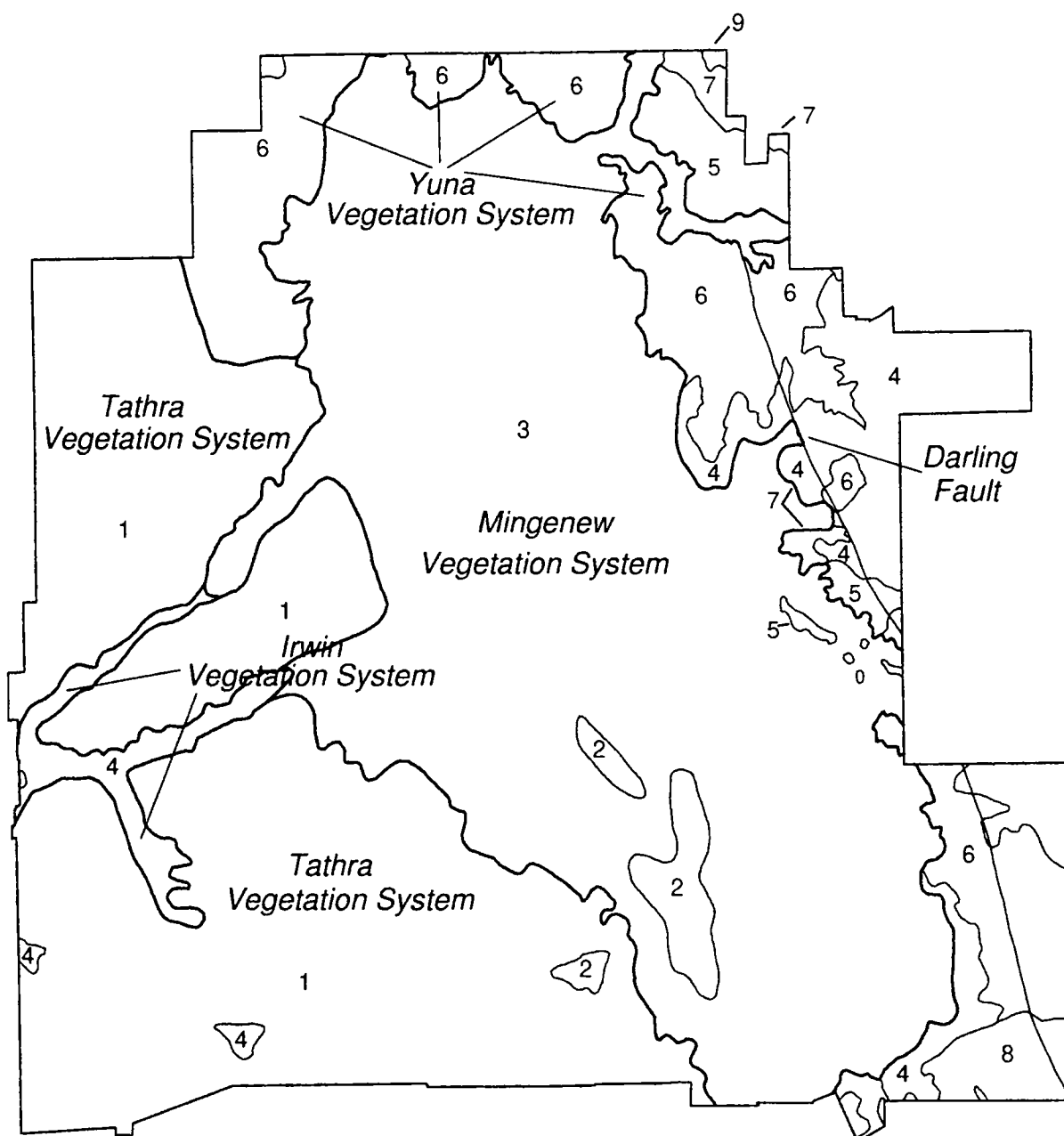
The Shire of Mingenew

The Shire of Mingenew covers an area of 194452 hectares. All of the Shire is located in the Greenough River Catchment (see cover map) and is drained by the upper reaches of the Irwin River. The only major townsite in the Shire is Mingenew (Figure 1).

The Shire's climate is regarded as Mediterranean, with cool winters and hot dry summers. It receives on average, 420 mm rainfall per annum. The average maximum temperature ranges from 36°C in February to 19°C in August, while the corresponding average minimum temperature ranges from 19°C in January to 7°C in July. The population of the Shire was 690 in 1988 (Pink, 1991). Agricultural land use in the Shire is predominantly wheat and sheep:- in 1991/92 a total of 37609 hectares of the Shire was sown with wheat, 60679 hectares with sown pasture, 42644 hectares of native pastures, 170 hectares with hay and 7850 hectares left fallow (ABS, 1992). The cadastral boundaries in the Shire are shown in Figure 1 and all 660 kilometres of road network in the Shire is shown in Figure 2.

The South-west of Western Australia 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 Mingenew contains parts of three Natural Resource Zones (No.55, No.56 and No.66) (Figure 3) making it a mosaic of two vegetation types and one catchment within an area receiving between 500-750 mm and less than 500 mm rainfall per annum.

The Mingenew Land Conservation District (LCD) is based on the Shire's boundaries.



Vegetation Type

- | | |
|--|--|
| 1 Scrub Heath on lateritic sandplain | 5 Scrub Heath |
| 2 <i>Acacia acuminata</i> Scrub (Jam) | 6 Scrub Heath on sandplain |
| 3 Jam with scattered York Gum | 7 Mainly <i>Casuarina</i> - <i>Melaleuca</i> Thicket with mallee |
| 4 York Gum woodland | 8 York & Salmon Gum woodland |
| 9 <i>Acacia</i> - <i>Casuarina</i> - <i>Melaleuca</i> thicket on sandplain with patches of mallee and york gum | |

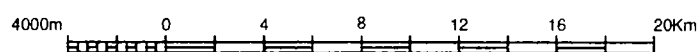


Figure 4 Vegetation systems (*italics, bold line*) and major vegetation types in the Shire of Mingenew (According to Beard, 1976).

Vegetation of the Shire of Mingenew- Past and Present

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

Physical factors such as soil and climate combine to produce natural ecological regions within which the plant communities have features in common. Western Australia is divided into three Botanical Provinces - the South-Western, the Eremaean, and the Northern (Beard, 1980). The Botanical Provinces are divided into Botanical Districts and then into Vegetation Systems. The Shire of Wickepin lies within the Avon Botanical District of the South-West Botanical Province and contains portions of four Vegetation Systems - the Irwin System, the Mingenew System, the Tathra System and the Yuna System (Beard, 1976) (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.

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 references - Beard, J.S., (1976). *The Vegetation of the Dongara Area: Vegetation Map and Explanatory Memoir (1:250,000 series)*. Vegmap Publications, Perth.

The type of vegetation is closely related to the soil type on which it grows. Many of the soil types of the Shire of Mingenew are recognised by their associated type of vegetation.

The central region of the Shire of Mingenew, starting from the headwaters of the Irwin River, is occupied by the **Mingenew Vegetation System** (Figure 4). Its eastern boundary corresponds with the Darling Fault and its western with the Urella Fault. Most of the System has been cleared for agriculture and much of the original vegetation can only be reconstructed from a few remaining relics of vegetation. Much of the Mingenew System is comprised of jam (*Acacia acuminata*) scrub with scattered patches and individuals of York gum (*Eucalyptus loxophleba*) and occasional river gum (*Eucalyptus camaldulensis*) and northern sheoak (*Casuarina dielsiana*). Associated species include summer-scented wattle (*Acacia rostellifera*), manna wattle (*Acacia microbotrya*), kurara (*Acacia tetragonophylla*), *Dodonaea inaequifolia*,

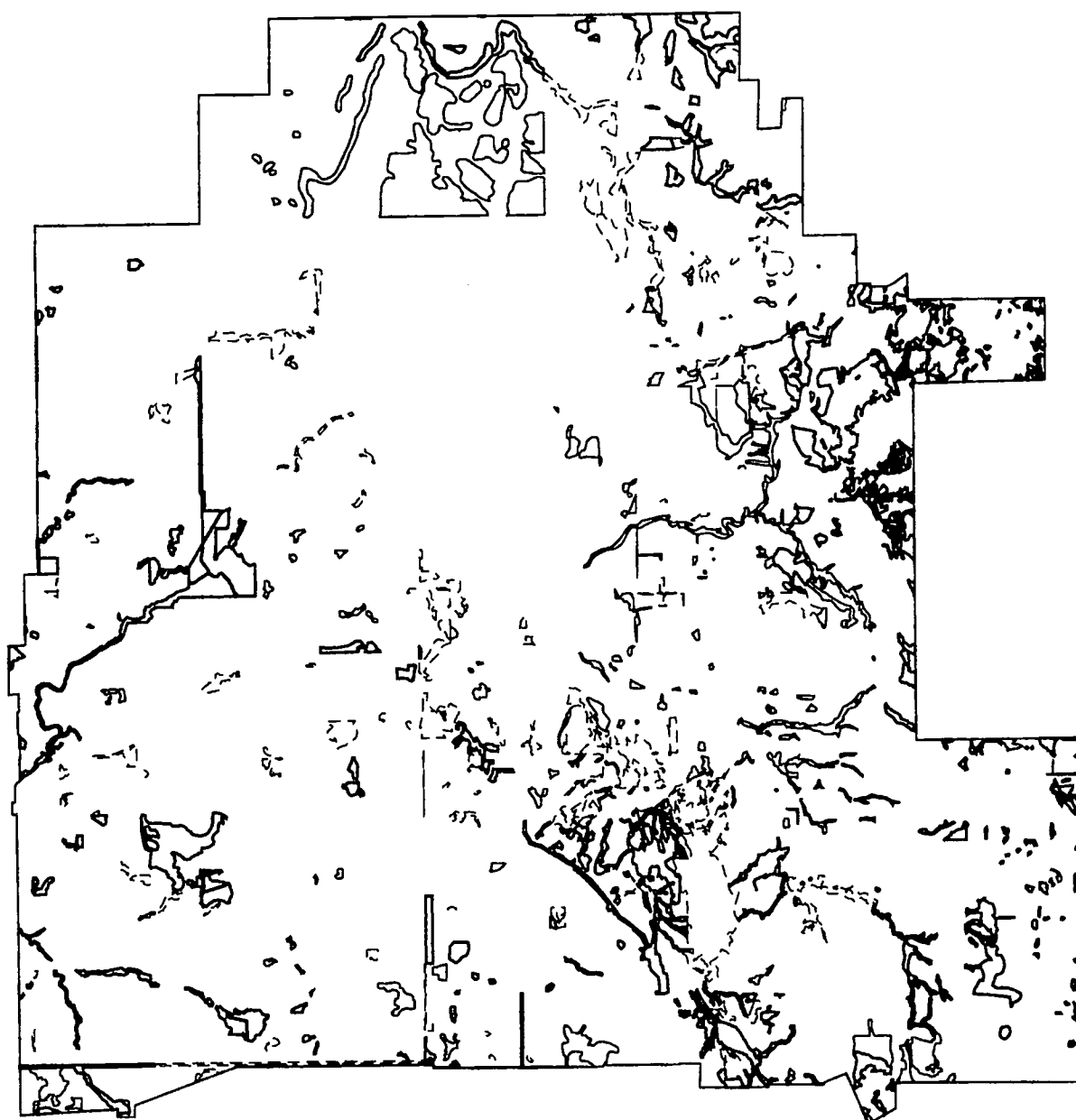
needle tree (*Hakea preissii*), candle hakea (*Hakea recurva*) and weeping pittosporum (*Pittosporum phylliraeoides*). Owing to the extensive clearing of the surrounding countryside, it is not possible to list all of the minor species which originally occurred in the System. Some of the areas on the lower portions of the System are salty, with death of the trees and shrubs and the appearance of *Atriplex*, *Maireana pyramidata* and samphires. It is quite likely that these species are recent colonisers of salt encroached areas.

The **Irwin Vegetation System** is situated in the valley of the Irwin River and its branches from a point 5km west of Mingenew down to its mouth, and occupies a narrow floodplain about 1 kilometre wide. Virtually all of this area has been cleared for agriculture so it is difficult to give accurate details of its past floristic composition. The river channels were lined with river gum and rock sheoak (*Casuarina huegeliana*).

The floodplains were formerly occupied by York gum woodland with scattered river gum and swamp sheoak (*Casuarina obesa*), of which a few trees remain. The principle understorey were likely to have been jam and summer-scented wattle.

The **Tathra Vegetation System** occupies the south-western and north-western corners of the Shire of Mingenew and has been named after the Tathra National Park which lies in the centre of the System to the west of the Shire. The south-western corner is dominated by York gum woodland with scrub heath on a lateritic sandplain, while scrub heath on sandplain and numerous patches of heath on laterite dominate the north-western corner of the Shire. The low lateritic patches of heath consist of sclerophyllous species such as *Hakea auriculata*, *Dryandra fraseri*, scrub sheoak (*Casuarina humilis*), *Petrophile* sp. and the graceful honeymyrtle (*Melaleuca radula*). Mottlecah (*Eucalyptus macropcarpa*) is occasionally seen at the top or at the foot of breakaways. *Casuarina* thicket may often replace this where laterite is less severe. The scrub heath in the System has a rich diversity of flora, with diversity becoming richer accompanying the gradual increased rainfall towards the south. In general the scrub heath consisted of scattered shrubs between 1 and 2 metres tall, with occasional small trees of the Christmas Tree (*Nuytsia floribunda*) and rock sheoak. Coastal blackbutt (*Eucalyptus todtiana*) as a small tree or a mallee is usually confined to valleys in deeper sand, with the taller slender banksia (*Banksia attenuata*), firewood banksia (*Banksia menziesii*) and acorn banksia (*Banksia prionotes*).

The **Yuna Vegetation System** occupies a small part of the northern region of the Shire. It represents only on a few small remnants on the plateau surface adjoining the



LEGEND

- Remnant Vegetation
- - - Modified Vegetation
- Scattered Vegetation

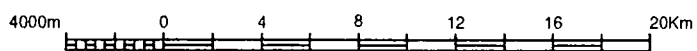


Figure 5 Mingenew Shire was mapped by the Dept. of Agriculture in 1990 and 1992 from aerial photography. Just over ten per cent of the Shire remains under native vegetation, with most on private land.

Mingenew System, some of which straddle the Darling Fault. The surface of the plateau is underlain by deep yellow sand and linear sand ridges. In the Shire of Mingeneu, the Yuna System consists of primarily of scrub heath of which the sandplain cypress (*Actinostrobus arenarius*), the sceptre banksia (*Banksia sceptrum*) and the sandplain woody pear (*Xylomelum angustifolium*) are conspicuous on dunes with common smokebush (*Conospermum stoechadis*) and coppercups (*Pileanthus peduncularis*) distinct on the sandplain.

Current Extent of Native Vegetation

The total area of native vegetation in the Shire of Mingeneu has been significantly diminished through rapid and excessive clearing for agricultural purposes. Despite this much of the native vegetation remaining in public reserves and on private land differs little in composition to that which existed in the past, although the extent of cover has been significantly reduced.

Approximately 11% of the Shire of Mingeneu remains covered by original native vegetation, ten percent (23272 ha) of which is found on private land and 1.2% (2467 ha) which occurs as public reserves or reserves (Figure 5).

In the Shire of Mingeneu, there are 703 bush remnants, of which 41% or 295 (total of 9451 ha) are regarded as being "remnant vegetation", 28% or 200 remnants (6754 ha) regarded as being "scattered trees" and 29% or 208 remnants (7167 ha) as being of "modified vegetation" (Beeston, *et al.*, 1993) (Figure 5)

Vegetation classed as "remnant vegetation" has one or more of the following characteristics (Beeston *et al.*, 1993) :

- * 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.

Vegetation classed as "modified vegetation" has one or more of the following characteristics:

- * Degraded understorey (i.e. reduction in the number of native species, includes weeds).
- * Obvious human disturbance- clearing, mining, grazing, weeds.
- * Affected by salt.

* Narrow corridors of vegetation (usually along roads and railway lines or windbreaks), which are more likely to be affected by edge effects.

Vegetation classed as "scattered vegetation" have:

- * No understorey.
- * Parkland cleared i.e. are scattered single trees
- * No significant signs or chance of regeneration.

In contrast to many other Wheatbelt districts, woodlands account for only 2% of the Shire of Mingenew's native vegetation while shrublands account 96%. The principal shrubland vegetation in the Shire is scrub-heath which covers 56% of the Shire.

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, e.g. 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. The wetlands of the wheatbelt have suffered enormous changes as a result of these salinisation processes.

The Shire of Mingenew does not have any "wetlands" as defined, rather a series of ephemeral ponds and sandplain seepages. The Geraldton Regional Office of the Department of Agriculture vegetation surveys of these "wet-patches" revealed the occurrence of number of species including broom bush (*Melaleuca uncinata*), swamp sheoak, river gum, York gum and orange wattle (*Acacia saligna*).

Environmental changes in the wetlands and "wet-patches" began with the rise of the saline water table that followed the "opening up" of the Wheatbelt in the early 1900's. The salinity changes in the Greenough River Catchment began in the 1960's, which was later than many other Wheatbelt catchments as the region was settled and cleared more recently. These changes were quickly followed by the deaths of fringing, emergent and aquatic vegetation. A further cause of tree deaths around some lakes and wetlands in the Irwin River catchment was waterlogging, which was thought to be responsible for the deaths of the many sheoaks and paperbarks. Thousands of sheoaks were known to occur around the wetlands surrounding the Irwin River. The waterlogging process may occur naturally and it has not been established whether the

death of vegetation owing to waterlogging was a result of natural intermittent inundation or increased runoff due to clearing.

Many of animals (including water-rats (*Hydromys chrysogaster*), water birds and reptiles) that were once common to wetlands and the surrounding areas have now disappeared. This could be because increased wetland salinity has resulted in the decline of their prey or may be related to predation by introduced animals, habitat destruction or other factors.

The amount of salinised land in agricultural areas is still increasing (Schofield *et al.*, 1988), which means that wetlands will continue to become saline and that there will be resultant changes in wetland vegetation. Although it may be too late to rehabilitate most of the degraded wetlands in the Shire of Mingenew, a greater understanding of how and why they have changed may assist in the management of undisturbed wetlands in the Shire.

Fauna

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 17 of the 43 species (40%) of mammals recorded from the Wheatbelt since European settlement. Of these only 12 are considered to be moderately common to abundant (Kitchener *et al.*, 1980). 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* sp.) and fairy wrens (*Malurus* sp.) have not coped well with changes to the land such as clearing and are generally declining in numbers and may well become locally extinct. Species such as the short-billed white-tailed black cockatoo (*Calyptorhynchus funereus latirostris*) and Major Mitchells cockatoo (*Cacatua leadbeateri*) have undergone a significant reduction through loss of habitat (Saunders *et al.*, 1985).

In the south west of the state, 83% of the land birds 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 such as the galah (*Cacatua roseicapilla*) and the Australian Raven (*Corvus coronoides*) have benefited from an increase in agricultural development and are increasing in numbers.

In the Shire of Mingenew animals commonly seen include the western grey kangaroo (*Macropus fuliginosus*), the western brush wallaby (*Macropus irma*), the echidna (*Tachyglossus aculeatus*), and reptiles including the bobtail goanna (*Tiliqua ragosa*), the blue tongued lizard (*Tiliqua occipitalis*), the dugite (*Pseudonaja affinis*), and the tiger snake. Animals which are considered to be under threat of extinction and are being monitored include the tammar wallaby (*Macropus eugenii*).

Rare and Endangered Flora

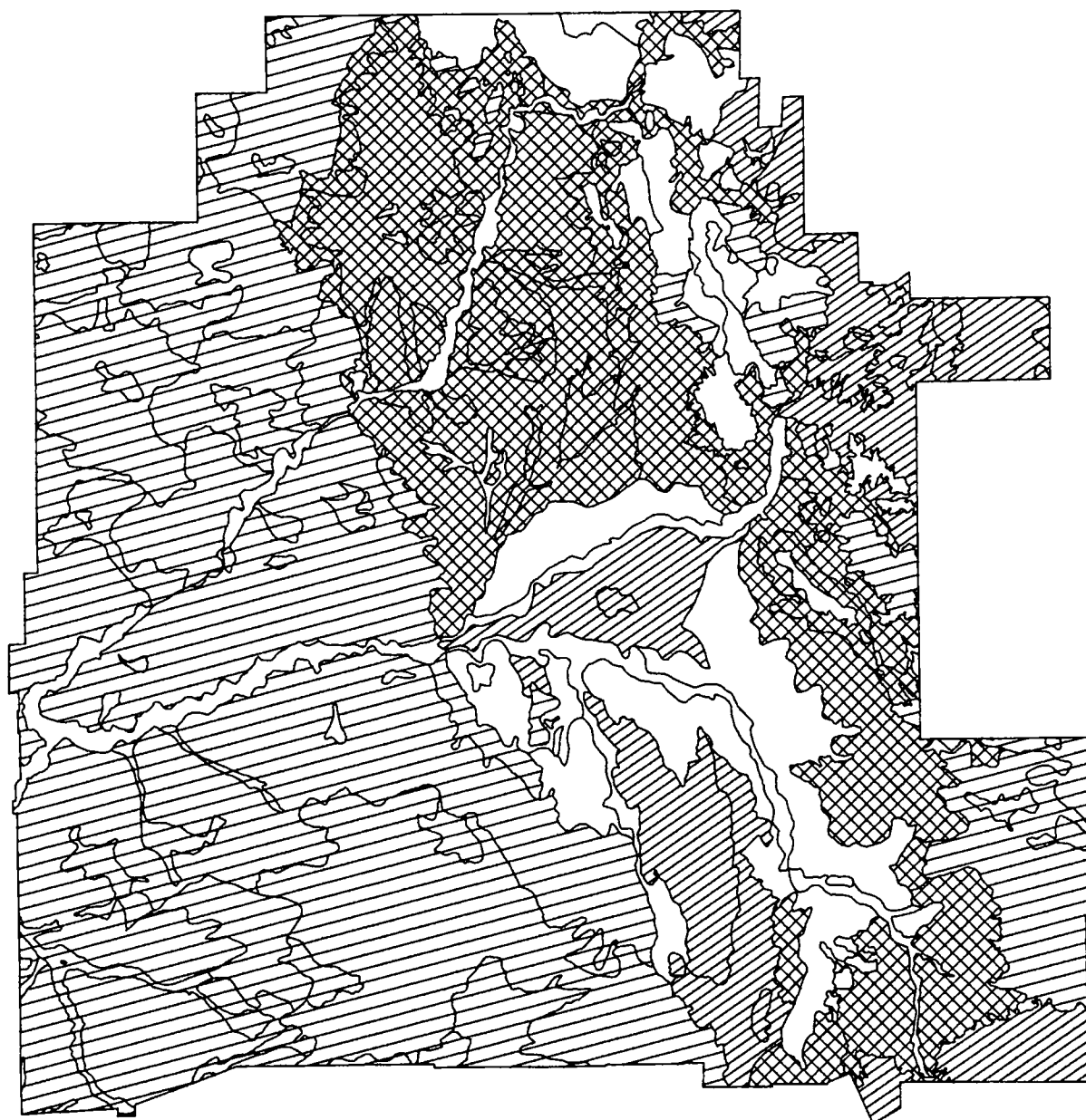
There are approximately 238 plant taxa declared endangered (Hopper *et. al*, 1990) in Western Australia. Many of these can be found within remnants of native vegetation on private land in the Wheatbelt region. Three of these species are found in the Shire of Mingenew.

1. *Wurmbea tubulosa* (Long-flowered Nancy) A small cormous plant to 3cm high with three leaves, the lower two spreading and usually over 5 cm long. Plants are dioecious with male flowers held on an erect spike, while the female flowers are concealed between the lower leaf bases. Confined to heavy soils near rivers between Geraldton and Mingenew.

2. *Daviesia speciosa* (Beautiful Daviesia) A glaucous blue leafless shrub to 90 cm high (although it has been observed to grow to over 2 metres near Mingenew) with stiff erect prickly stems and large long keeled red pea-shaped flowers. Confined to lateritic hilltops in disturbed areas between Eneabba and Carnamah.

3. *Grevillea phanerophlebia*. Found between Mullewa and Mingenew.

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 and medicinal value. For example it has recently been publicized that smokebush (*Conospermum* sp.) may be a potential cure for AIDS.



Soil Systems

- ☐ Undulating sandplain systems of soil type Bi, Ca, Al, Er, MH, Mj, Dg
- ☐ Granitic rock systems of soil type In, Mg, Th, Pe
- ☒ Sloping terrain systems on sedimentary rocks. Soil types Cs, MB, MS, Mo, Nt
- ☐ Alluvial valley systems. Soil types Da, Ir, S, Yn

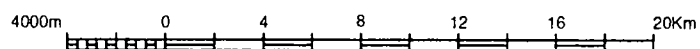


Figure 6 The four main soil systems of the Shire of Mingenew, each of which is a mosaic of different soil types.

Land Resources

Geology

The Shire of Mingenew is bounded to the east by the Darling Fault. East of the fault lies the Yilgarn Block, a very ancient rigid area composed mainly of aged granite. West of the fault, ancient rocks have been overlaid with younger rocks into a basin known as the Perth Basin which then became filled with younger sediments. The basin was submerged and accumulated sediments throughout the Paleozoic and Mesozoic eras with sedimentation ceasing at the end of the Cretaceous period, after which the area seemed to have continually been above the sea and subject to weathering and denudation. Much of the Shire is gently undulating country and almost all the Tertiary plateau surfaces has been removed between the Urella and Darling Faults as far as 8km south of Yandanooka. North of Yandanooka there are low hills underlain by Proterozoic rocks of the Mullingar Inlier, otherwise the country consists of a gently undulating plain with loam soils and numerous creeks.

There are large numbers of basic, intermediate and dolerite dykes in the Shire of Mingenew. They show two prominent trends: a major group with an east-west trend and a minor group with a north-north west trend. There are no major clastic dykes in the Shire.

Soils

The Shire of Mingenew is made up of a mosaic of soil landscapes. Each of the units within the soil system differ mainly in their position within the topographic profile. Below is a key to understanding the composition of each of the soil landscape units in the soil survey classification map for the Geraldton Advisory District (Rogers, in prep.). There are 20 different soil landscapes for the Shire of Mingenew (Figure 6).

1) **Bi (Binu)** - Level to undulating sandplain with neutral to slightly acidic siliceous sands. Bi1-Bi4.

2) **Da (Dartmoor)** - Level to slightly inclined alluvial and colluvial surfaces. Da1-Da6.

3) **Cs (Coalseam)**

4) **Ca (Casuarina)** - Level to gently undulating sandplain. Soils grey sands over gravel and lateritic duricrust and deep yellow sands.

- 5) **Al (Alanooka)** - Level to very gently inclined open drainage depressions at low positions in the landscape. Soils shallow to deep grey and white duplex soils and some deep white sands.
- 6) **Er (Eradu)** - Level to slightly undulating sandplain of deep yellow siliceous sands, neutral to weakly acid.
- 7) **Ir (Irwin)** - Level to gently inclined alluvial flats and terraces of the Irwin and Lockier rivers.
- 8) **In (Indar)** - Gently inclined to undulating slopes commonly found on upland surfaces with low breakaway edges common.
- 9) **MB (Mount Budd)** - Isolated mesas and scarp faces with flat tops, steep side slopes, and moderate to very gently inclined footslopes.
- 10) **MH (Mount Harrier)** - Long gentle slopes and subdivided open depressions with gravel ridges and lateritic breakaways. Soils deep pale yellow and white sands, gravelly sands and sandy duplex soils.
- 11) **Mg (Mullingara)** - Range of undulating to steep low hills with numerous rocky ridges and hill crests.
- 12) **Mj (Munja)** - Gently inclined long slopes, low gravel ridges and spillaway sands below laterite breakaways. Soils leached sands over sandy clay, gravelly sands and minor areas of deep pale yellow sands.
- 13) **MS (Mount Scratch)** - Line of low rolling hills with an integrated drainage network.
- 14) **Nt (Nangetty)**
- 15) **Mo (Moresby)** - Flat topped ranges and isolated mesas.
- 16) **Dg (Dolgooka)** - Gently undulating terrain with numerous low rocky rises and low narrow limestone ridges intersecting gentle slopes and flat areas. Shallow rocky soils on ridges with sand over gravel and gradational sandy loams.

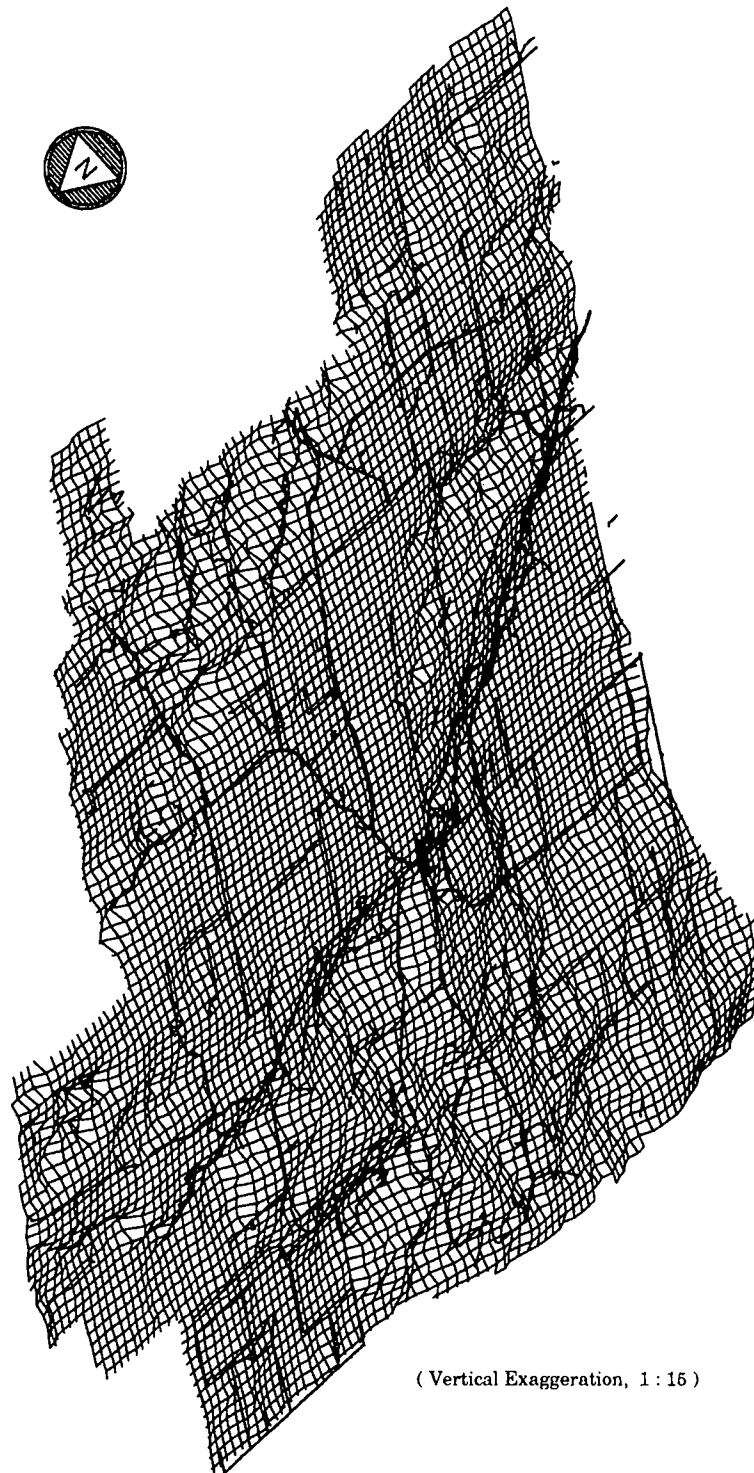
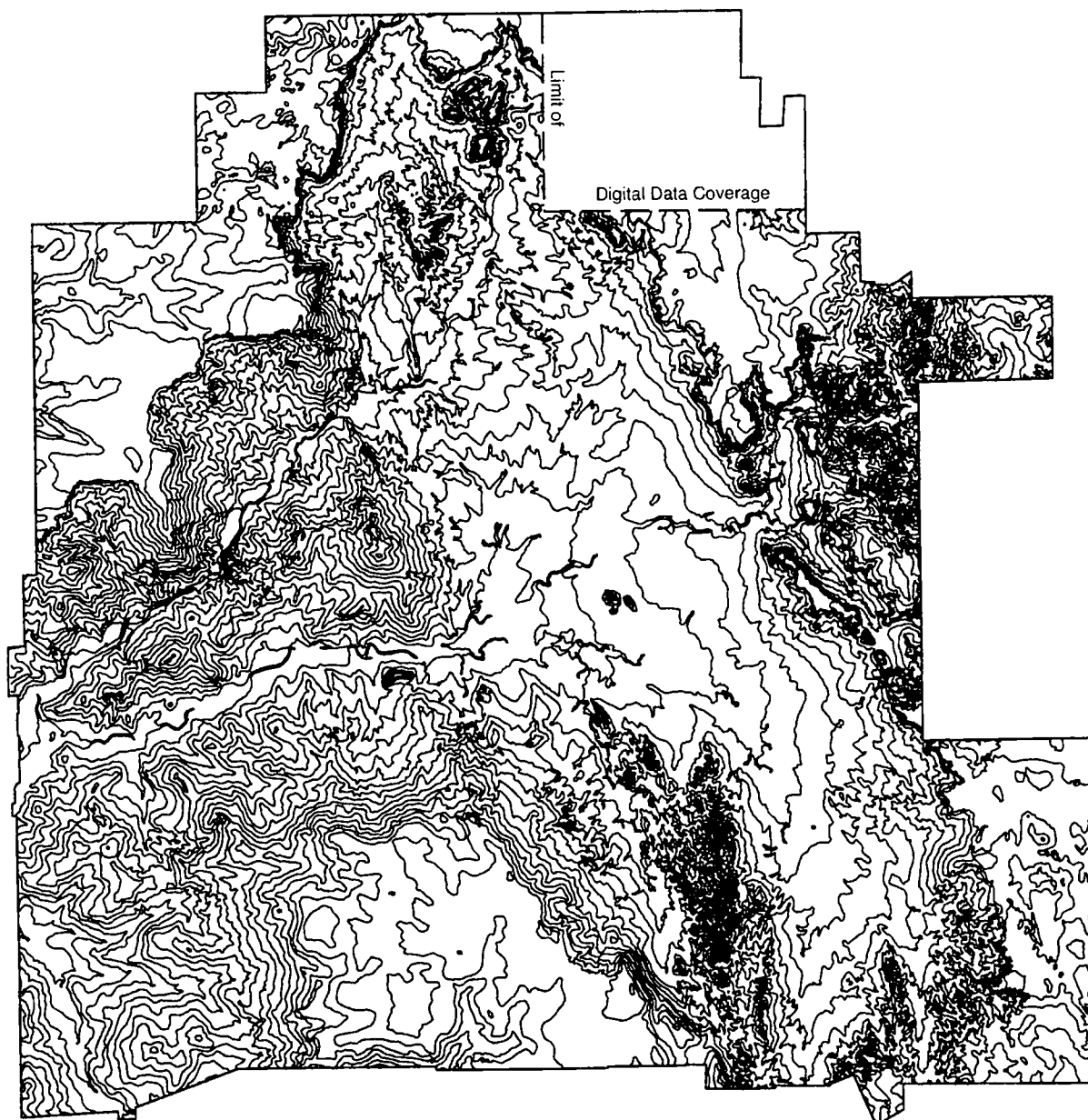


Figure 7 Topographical view of the Shire of Mingenew.



Contour Interval 10m

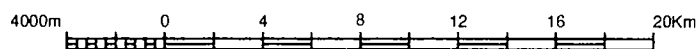


Figure 8 Contour lines in the Shire of Mingenew at intervals of 10 metres.

17) S (Saline Drainage)

18) Yn (Yandanooka) - Level to gently inclined alluvial plain with meandering drainage network, low sandy rises and alluvial terraces associated with major streams.

19) Th (Thindindawah) - Gently undulating terrain with stony rises and gentle slopes. Calcareous rocky soils, gradual red sandy loams and calcareous red and brown clays with gilgai microrelief.

20) Pe (Peterwongy) - Dissected undulating landscape of small narrow valleys divided by stony ridges. Granite outcrops common.

Topography

The Shire of Mingenew can be described as being a terraced or flat to broad flat alluvial plain. The most significant feature in the Shire is the Irwin River which has cut itself a gap in the coastal limestone to reach the sea. Aerial photography showed that the Arrowsmith River at one time flowed north to join the Irwin. The Darling Fault to the east of the Shire is one of the most significant structural features of Western Australia. Figure 7 shows a topographic view of the Shire, showing vertical exaggeration, while Figure 8 shows the map of the Shire, with contours at 10 metre intervals.

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 e.g 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 Wickepin: salinity, waterlogging, wind and 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 how to go about revegetation and what, when and where to plant. "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 Mingenew, being a more recently established farming area, has been less extensively cleared than many other older shires such as Corrigin and Narrogin. As a consequence, there remains a greater amount of native vegetation on farms and public reserves. However overclearing varies significantly between catchments within the Shire.

Current clearing guidelines recommend that for an area receiving less than 500 mm/annum rainfall (e.g. Shire of Mingenew), 20% of the catchment should remain vegetated to prevent land degradation (Clark, 1992). Currently the Shire has approximately 11% remnant native vegetation cover.

There are several actions being undertaken by the State Government and Local Government authorities to address the clearing of native vegetation. Clearing of native vegetation 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 (Select Committee into Land Conservation, 1992) for assessing notices of intent to clear land are geared towards preventing further land degradation problems. In addition many local government authorities have implemented planning schemes which may give them scope to effectively control the clearing of land.

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 2, and little thought was given to nature conservation requirements.

A great deal of the native vegetation that was set aside by the government as crown reserves for townsites, water catchments and sites of gravel extraction etc. Many of these small patches of native vegetation were designated by the government as

conservation reserves in the 1960's and 1970's. However their conservation value varies because most of the patches that are now nature or conservation reserves represent only a very small percentage of the region's vegetative cover.

Rising Water Tables and Salinity

The principle cause for increased soil surface salinisation in much of the Wheatbelt has been the removal of native vegetation. Native vegetation uses more water than pasture species as native plants transpire all year, whereas crops and pastures transpire for only 6 months of the year. The replacement of native vegetation with crops and pastures has resulted in changes to the water balance of the soil, bringing rising water tables and soluble salts to the surface.

There are two main effects of vegetation clearance in salt-prone areas: firstly, deep-rooted trees no longer draw groundwater for transpiration so water accumulates instead of being discharged in the atmosphere; and secondly, there is an increase in the infiltration of rain because there is no vegetation to intercept and as a consequence the water table rises and dissolves the accumulated salts. Quite often the effects of salinity are not seen for 15-20 years following native vegetation removal.

Trees affected by salt display a reduction in growth and stunting compared to those that survive. Further salination among intolerant species results in the death of the lower leaves and branches proceeding from the base upwards followed by wilting, death of growing tip and eventual tree death.

The Shire of Mingenew had 3,055 ha (1.86% of arable land) affected by severe salinity in 1989 (George, 1990). This compares favourably with between the 4.5 to 6.0% of all cleared land in the nearby Shire of Morowa and nearly 6% in the Shire of Perenjori affected by salinity. However the situation in the Shire of Mingenew is worsening with farmers reporting a 2.3% increase in severe salinity since the 1979 saltland survey. Groundwater recharge can occur on cleared land anywhere in the Shire, which is approximately 89% cleared. However cleared areas of low productivity and/or areas which have sandy soils tend to have higher rates of recharge.

Biological solutions to salinity problems can emulate more expensive engineering methods because perennial vegetation can be used to pump out more water from aquifers that have become saline or are in danger of doing so. Obviously salt tolerant species are required for salt affected sites, not only to control the salt levels but also as a measure to prevent and manage erosion. Some of the more commonly planted salt

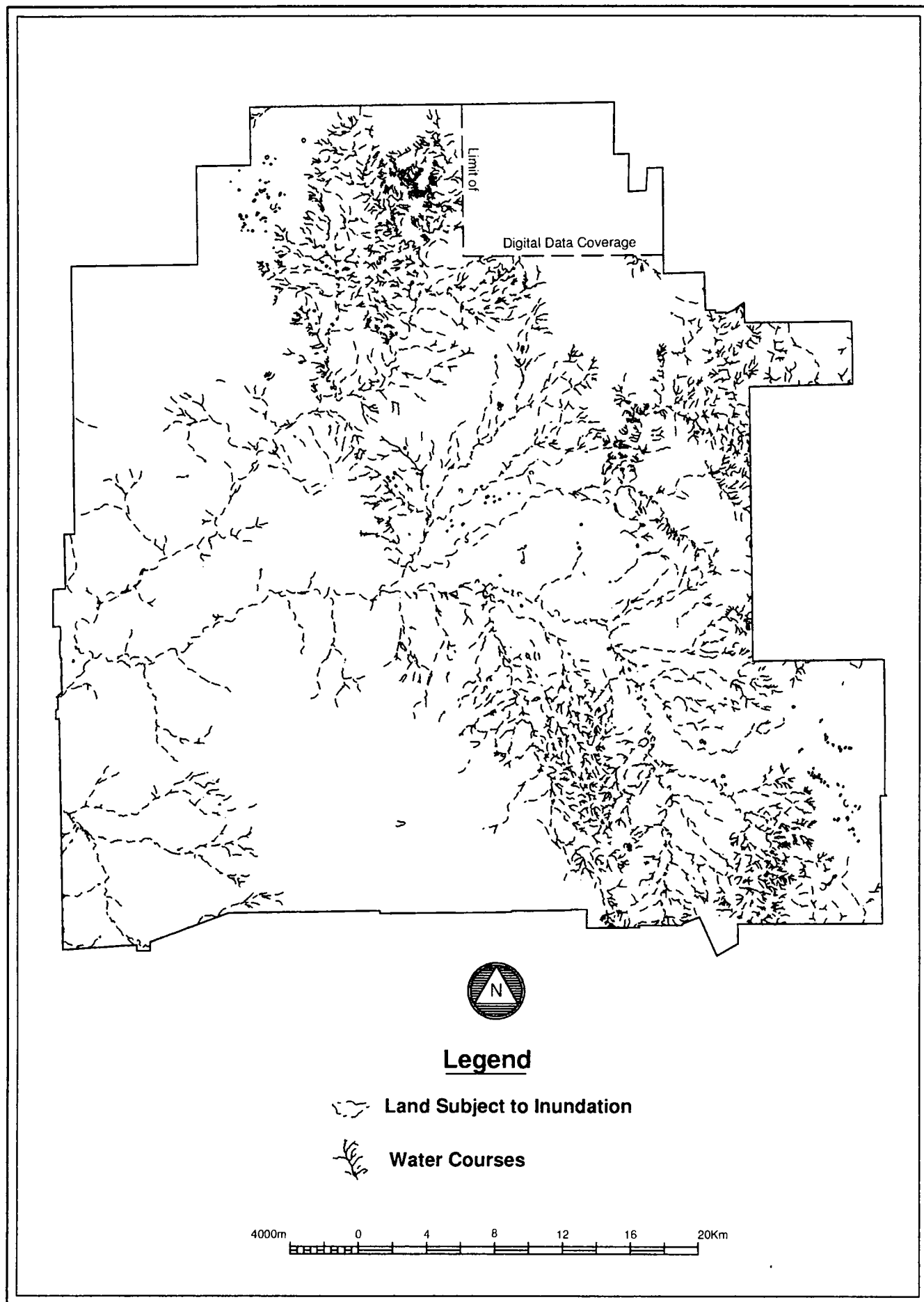


Figure 9 Major Drainage systems of the Shire of Mingenew showing areas subject to inundation and major water courses.

tolerant species include saltbush (*Atriplex* spp.), wandoo and various samphire species. It has been suggested (Lefroy *et al.*, 1991) that for the soils indigenous to the Shire of Mingenew, York gum, jam rock sheoak and *Acacia microbotrya* could be planted. On the soils following drainage lines and around the fringes of salt lake, it is suggested that planting salt river gum (*Eucalyptus sargentii*) and swamp sheoak will help to reverse both salinity and waterlogging problems.

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. 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 Mingenew, being largely comprised of leached and weathered soils is considered to be highly susceptible to wind erosion (Select Committee in Land Conservation Discussion Paper 2, 1990). Wind erosion will occur on both sandy and lateritic soils if vegetation is removed. Overgrazing is the main cause of this. No till methods of cropping, direct seeding of crops into stubble and the establishment of windbreaks for shelter will help in ameliorating the effect of wind erosion. Ideally windbreaks should be several rows wide and should include a mix of trees and shrubs.

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 Mingenew water erosion can be expected to occur on all soil types and on slopes to 1%. Clayey soils tend to be more prone to water erosion (State of the Environment Report, 1992). Figure 9 shows areas in the Shire which may be affected by water erosion.

Acidity

The acidification of topsoils and subsoils can inhibit the growth of plant roots of both native and pasture species. Although some soils are predisposed to acidic conditions, agricultural practices are a major cause for the acceleration of the acidification process. This happens through using ammonium based fertilisers and growing clover pastures. Acidic soils tend to be more susceptible to degradation by wind and water erosion (State of the Environment Report, 1992) as soil particles do not bind together effectively under conditions of low pH.

In the Shire of Mingenew, most of the soils are regarded as being of moderate to high risk of developing subsurface soil acidification at depths of greater than one metre (State of the Environment Report, 1992). Solutions to ameliorating soil acidity include the rotation of legume-based pastures with non-legume-based pastures, reduction in the use of chemical fertilisers and increased liming and gypsum applications.

Soil Compaction

Soil compaction by stock and heavy farm machinery is a major degradation problem experienced by many Wheatbelt Shires including Mingenew. Stock and heavy machinery compact the soil and prevent infiltration of both water and air. This inevitably results in wind and water erosion. The problem can be rectified by using lighter farm machinery and restricting machinery traffic on the land, and by using minimum or zero tillage to establish crops. Fencing remnant vegetation will prevent stock causing soil compaction within the bushland.

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; pests, 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.

Specific recommendations on how to manage existing bush are provided in "Managing your Bushland: A Guide for Western Australian Landowners" (Hussey and Wallace, 1993). The long term solution to the problems of land degradation and the loss of local plant and animal species lies in taking a catchment approach to the management of natural resources within the Shire of Mingenew.

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 Mingenew has a number of different organisations working towards land and nature conservation in the Shire.

The Mingenew Land Conservation District (LCD) has been a prime mover in this field. Within it are three catchment groups; the Green Brook, the Nangetty and the Gurrana Catchment Groups. The Green Brook Catchment Group, a composite of 15 local farmers, has been most active in tending to eleven major revegetation and protection projects since 1991.

Projects in the Shire

A combination of measures and solutions aimed at protecting remnant vegetation, strategically revegetating areas degraded or void of native vegetation, and combating land degradation problems in the Shire of Mingenew have proven to be effective methods in achieving positive results.

In protecting remnants of native vegetation against further degradation and decline, 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. It has been an effective scheme in the Shire of Mingenew. Since 1988/89, the Shire has received 6 RVPS grants to assist in the fencing of 559 hectares of native vegetation on farm land (Figure 10). Many of the fenced remnants which were previously in poor to average condition, are showing obvious signs of regeneration. However, about half of all remnants on private land in the Shire are

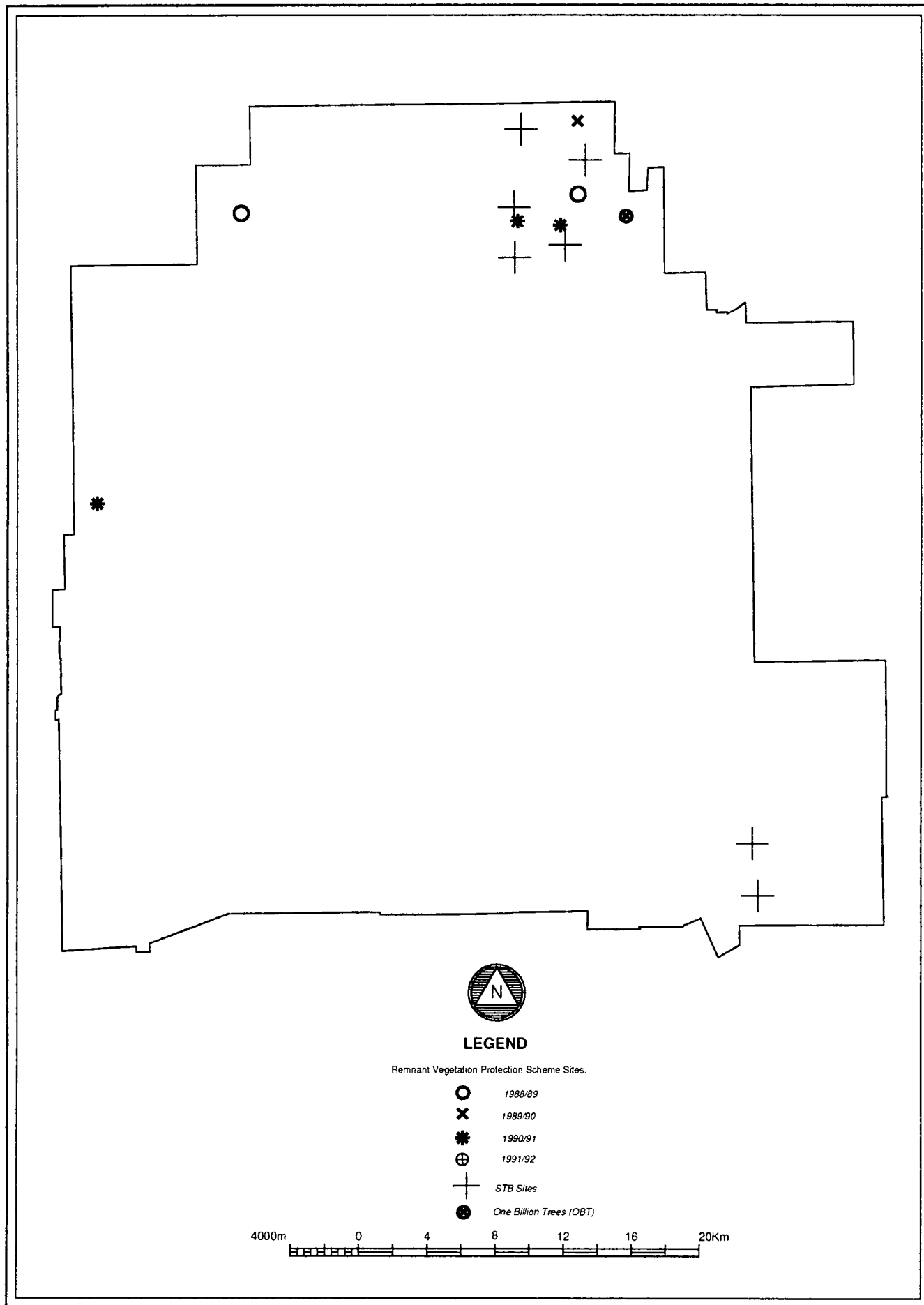


Figure 10 Save The Bush, One Billion Trees and Remnant Vegetation Protection Scheme sites in the Shire of Mingenew.

either unfenced, inadequately fenced or in many cases fences are present but are falling into disrepair (Mollemans, unpub.).

There are several examples of projects with the aim of strategically revegetating sparsely vegetated areas currently underway in the Shire of Mingenew. In 1992/93 the Mingenew LCD received a grant of \$9000 through the One Billion Trees Program (OBT) (Figure 10) and \$16500 from the Save the Bush Program (STB) towards the cost of revegetating and protecting existing remnant vegetation of eleven sites within the Greenbrook Catchment.

Details of the particulars of the objectives intended to be achieved at each of these site are outlined in detail in Appendix 4. In 1991/92 local farmer Doug Parker received \$1600 in assistance from the OBT Program towards to cost of fencing creeklines and planting trees on his property.

E.M. Mattiske and Associates were commissioned by the Save the Bush program in 1990 to undertake a review of the conservation values of remnants along the rail corridor of Westrail's Muchea to Mingenew line. A total of 312 km of rail corridor vegetation between the two towns was surveyed.

Plants for Conservation, a program managed by Greening Western Australia and sponsored by ALCOA provided the Mingenew LCD with 15000 seedlings in 1991/92.

Other community-based conservation and rehabilitation projects included the establishment of a tree nursery at Mingenew Primary School in 1988 and \$3000 in assistance from Gordon Reid Foundation for Conservation towards the cost of purchasing a laser leveler.

Road verges in the Shire of Mingenew were surveyed for their vegetation conservation status with the assistance of the Roadside Conservation Committee (RCC). The surveys were undertaken by community volunteers using the method developed by the RCC.

Road reserves classified as high conservation value generally have little weed invasion or disturbance and retain a high quality representative sample of the original vegetation with multiple layers of the vegetation being present. Medium conservation road reserves usually have been disturbed with the lower layer of vegetation being lost or badly depleted. Weed species in this category of roadside vegetation are well

established and have the potential to eventually dominate the native vegetation. Weeds usually dominate the low conservation category, with few native species from the original vegetation being present. Under the normal regime of roadside management, natural regeneration is highly unlikely. Rehabilitation by planting or direct seeding methods require an ongoing commitment of resources.

The Roadside Conservation Committee (RCC) was established by the State Government in 1985 to co-ordinate and promote the conservation and effective management of roadside vegetation for the benefit of the environment and the people of Western Australia.

The RCC co-ordinates these surveys and the data from them is stored in a computer database. To date 9.7% (63.7 km) of the Shire's roadside vegetation has been surveyed and a map showing the conservation values of roadside vegetation in the Shire should be available in the near future.

The APB has undertaken control of rabbits in roadside verges in the Shire using "1080" poison.

The Mingenew Conservation District Committee, has endeavoured to reverse land degradation problems with assistance from several programs. The National Landcare Program (NLP) had two major projects operating in the Shire of Mingenew in 1991/92. The first was the Greenough River Catchment preliminary mapping study involving satellite imagery, which received funding totalling \$15000 and was completed in December 1991 while the second, a follow-up inventory and management study of the catchment, received \$18000 and is expected to be completed by December 1993. There have also been several State Landcare funded projects in the Shire of Mingenew since 1989/90, many of which have involved co-operation with neighbouring shires. These projects are outlined in greater detail in Appendix 4.

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 (N.B. if the seed collector does not own the land, a licence will be needed. Check with CALM for details.)
- * growing your 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; and value-added wood products such as tool handles, craftwood and laminated wood products for furniture manufacture. Contact CALM Geraldton for further advice.

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Western Australia Department of Agriculture (Three Springs)-Phone: (099) 541 004

Western Australian Department of Agriculture Geraldton, Commissioner Nominee- Ms Caroline Peek- Phone (099) 210509

Mingenew Herbarium-Anne Carr-Phone: (099) 726062

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Appendix 1.

Plant List-Dominant Species (Mingenew System)(Beard, 1976)

Botanical Name	Common Name (if known)
<i>Eucalyptus loxophleba</i>	York gum
<i>Eucalyptus camaldulensis</i>	River gum
<i>Acacia acuminata</i>	Jam
<i>Acacia rostellifera</i>	Summer-scented wattle
<i>Acacia microbotrya</i>	Manna wattle
<i>Acacia tetragonophylla</i>	Kurara
<i>Dodonaea inaequifolia</i>	
<i>Hakea preisii</i>	Needle tree
<i>Hakea recurva</i>	Djarnokmurd
<i>Pittosporum phylliraeoides</i>	Weeping Pittosporum
<i>Atriplex</i> sp.	
<i>Maireana pyramidata</i>	Sago bush
<i>Samphire</i> sp.	

Appendix 2.

Plant List-Dominant Species (Beard, 1976)

Reference List for the Yuna Vegetation System

Botanical Name	Common Name (if known)
<i>Actinostrobus arenarius</i>	Sandplain cypress
<i>Banksia sceptrum</i>	Sceptre Banksia
<i>Xylomelum angustifolium</i>	Sandplain woody pear
<i>Conospermum stoechadis</i>	Common smokebush
<i>Pileanthus peduncularis</i>	Coppercups

Appendix 3.

Plant List- Full species List (Beard, 1976)

Reference List for the Tathra Vegetation System

Botanical Name	Common Name (if known)
<i>Acacia blakelyi</i>	
<i>Acacia lasiocarpa</i>	Panjang
<i>Acacia rostellifera</i>	Summer-scented wattle
<i>Acacia spathulata</i>	
<i>Acacia auronitens</i>	
<i>Adenanthos cygnorum</i>	Woollybush
<i>Anigozanthus humilis</i>	Catpaw
<i>Anigozanthus pulcherrima</i>	Kangaroo Paw
<i>Banksia attentuata</i>	Slender Banksia
<i>Banksia candolleana</i>	Propeller Banksia
<i>Banksia menziesii</i>	Firewood Banksia
<i>Banksia prionotes</i>	Acorn Banksia
<i>Banksia sphaerocarpa</i>	Round fruit Banksia
<i>Beaufortia elegans</i>	
<i>Beaufortia eriocephala</i>	Woolly bottlebrush
<i>Brachysema aphyllum</i>	Ribbon pea
<i>Calothamnus chrysanthrus</i>	Claw flower
<i>Calothamnus sp.</i>	
<i>Calothamnus longissimus</i>	
<i>Calothamnus torulosus</i>	
<i>Calytrix aurea</i>	
<i>Calytrix strigosa</i>	
<i>Allocasuarina campestris</i>	Tamma
<i>Allocasuarina huegeliana</i>	Rock sheoak
<i>Casuarina humilis</i>	Scrub sheoak
<i>Casuarina. 7323</i>	
<i>Casuarina. 7276</i>	
<i>Conospermum stoechadis</i>	Common smokebush
<i>Conospermum nervosum</i>	
<i>Conospermum triplinervium</i>	Tree smokebush
<i>Dampiera sp.</i>	
<i>Darwinia speciosa</i>	
<i>Darwinia neildian</i>	Fringed bell
<i>Daviesia divaricata</i>	
<i>Daviesia daphnoides</i>	
<i>Daviesia quadrilatera</i>	
<i>Diplolaena sp.</i>	
<i>Dryandra carduacea</i>	Pingle
<i>Dryandra fraseri</i>	
<i>Dryandra nana</i>	Dwarf Dryandra
<i>Dryandra pulchella</i>	Wongon Dryandra
<i>Dryandra sessilis</i>	Parrot bush
<i>Dryandra shuttleworthiana</i>	Bearded Dryandra
<i>Dryandra speciosa</i>	Shaggy Dryandra
<i>Dryandra vestita</i>	Summer Dryandra
<i>Dryandra sp.</i>	
<i>Eremaea pauciflora</i>	
<i>Eremaea violacea</i>	Violet Eremaea
<i>Eremaea sp.</i>	
<i>Eucalyptus eudesmioides</i>	Malallie
<i>Eucalyptus tetragona</i>	Tallerack

<i>Eucalyptus tottiana</i>	Coastal Blackbutt
<i>Euphorbiaceae</i> sp.	
<i>Gastrolobium spinosum</i>	Prickly poison
<i>Geleznovia verrucosa</i>	
<i>Grevillea biformis</i>	
<i>Grevillea erinacea</i>	Flame Grevillea
<i>Grevillea eriostachya</i>	Entire-leaved Grevillea
<i>Grevillea interifolia</i>	White plume Grevillea
<i>Grevillea leucopteris</i>	
<i>Grevillea polybotrya</i>	
<i>Hakea adnata</i>	
<i>Hakea auriculata</i>	
<i>Hakea conchifolia</i>	Shell-leaved Hakea
<i>Hakea gilbertii</i>	
<i>Hakea trifurcata</i>	Two-leaved Hakea
<i>Hakea platysperma</i>	Cricket ball Hakea
<i>Hakea</i> 7324	
<i>Hakea</i> sp.	
<i>Hemiandra</i> 7265	
<i>Hibbertia crassifolia</i>	
<i>Isopogon strictus</i>	
<i>Isopogon tridens</i>	Barrel coneflower
<i>Jacksonia florabunda</i>	Holly pea
<i>Jacksonia</i> sp.	
<i>Lachnostachys eriobotrya</i>	Lambswool
<i>Lamarckia hakeifolia</i>	
<i>Lambertia inermis</i>	Chittick
<i>Lasiopetalum</i> sp.	
<i>Leptospermum erubescens</i>	Roadside teatree
<i>Leptospermum spinescens</i>	
<i>Lechenaultia biloba</i>	
<i>Lechenaultia floribunda</i>	
<i>Lechenaultia hirsuta</i>	
<i>Lechenaultia longiloba</i>	Irwin Lechenaultia
<i>Lechenaultia stenosepala</i>	Narrow-sepaled Lechenaultia
<i>Leucopogon striatus</i>	
<i>Lomandra hastilis</i>	
<i>Loudonia aurea</i>	Common popflower
<i>Macropidia fuliginosa</i>	Black Kangaroo paw
<i>Macrozamia riedlei</i>	Zamia
<i>Melaleuca acerosa</i>	Coastal honeymyrtle
<i>Melaleuca cardiophylla</i>	Umbrella bush
<i>Melaleuca cordata</i>	
<i>Melaleuca megecephala</i>	
<i>Melaleuca radula</i>	Graceful honeymyrtle
<i>Melaleuca scabra</i>	Rough honetmyrtle
<i>Melaleuca uncinata</i>	Broom bush
<i>Melaleuca</i> 7264	
<i>Nuytsia floribunda</i>	Christmas tree
<i>Persoonia rudis</i>	
<i>Petrophile ericifolia</i>	
<i>Petrophile linearis</i>	Pixie mops
<i>Petrophile macrostegia</i>	
<i>Petrophile media</i>	
<i>Petrophile</i> 7253	
<i>Physopsis spicata</i>	Hill River lambstail
<i>Pileanthus filifolius</i>	Summer coppercops
<i>Pityrodia bartlingii</i>	Woolly dragon

Pityrodia verbascina
Ricinocarpus sp.
Scholtzia laxiflora
Stirlingia latifolia
Synaphae sp.
Verreauxia reinwardtii
Verticordia chrysantha
Verticordia grandis
Verticordia grandifolia
Verticordia huegelii
Verticordia monadelphae
Verticordia ovalifolia
Verticordia pennigera

Golden bush

Blueboy

Common Verreauxia

Scarlet featherflower

Claw featherflower

Veriegated featherflower

Pink woolly featherflower

Appendix 4.

Plant List - Dominant Species (Beard, 1976)

Reference List for the Irwin Vegetation System

Botanical Name	Common Name (if known)
<i>Eucalyptus camaldulensis</i>	River gum
<i>Allocasuarina huegeliana</i>	Rock sheoak
<i>Eucalyptus loxophleba</i>	York gum
<i>Acacia acuminata</i>	Jam
<i>Acacia rostellifera</i>	Summer-scented wattle

Appendix 5.

Bird Species seen in the Shire of Mingenew (From RAOU Database).

Common Name	Scientific Name
Maned Duck	<i>Chenonetta jubata</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Australian Hobby	<i>Falco longipennis</i>
Australian Kestrel	<i>Falco cenchroides</i>
Crested Falcon	
Red-tailed Black Cockatoo	<i>Calyptorhynchus magnificus</i>
Galah	<i>Cacatua roseicapilla</i>
Little Corella	<i>Cacatua tenuirostris</i>
Port Lincoln Ringneck	<i>Platycercus zonarius</i>
Pallid Cuckoo	<i>Cuculus pallidus</i>
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>
Tree Martin	<i>Hirundo ariel</i>
Richard's Pipit	<i>Anthus novaeseelandiae</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
White-winged Triller	<i>Lalage leucomela</i>
Red-capped Robin	<i>Petroica goodenovii</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Crested Bellbird	<i>Oreoica gutturalis</i>
Grey Fantail	<i>Rhipidura fuliginosa</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Rufous Songlark	<i>Cincloramphus mathewsi</i>
Brown Songlark	<i>Cincloramphus cruralis</i>
Blue-breasted Fairy wren	<i>Malurus pulcherrimus</i>
Weebill	<i>Smicrornis brevirostris</i>
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
Striated Pardalote	<i>Pardalotus striatus</i>
Australian Magpie	<i>Cracticus tibicen</i>
Black-faced Woodswallow	<i>Artamus cinereus</i>
Little Woodswallow	<i>Artamus minor</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Australian Magpie-Lark	<i>Grallina cyanoleuca</i>
Australian Raven	<i>Corvus coronoides</i>

Appendix 6.

Sources of funding for projects 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 Western Australian Department of Agriculture (WADA), with WADA as the lead agency) provides a fifty percent subsidy towards to cost of protective fencing of native vegetation on farms, with landowners giving an undertaking that the fenced vegetation will be managed for a period of at least thirty years.

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.

National Landcare 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 Community grants section National Soil Conservation Program (NSCP), the One Billion Trees Program (OBT), the Save the Bush Program (STB) and the Federal Water Resources Assistance Program were integrated into a one-stop-shop for community grants under the National Landcare Program. The aim of the NLP is to encourage community groups to responsibly manage and conserve land, water and biological diversity 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 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 National Conservation Agency (ANCA) and by CALM in Western Australia. Grants from this scheme encourage, facilitate and support programmes action and activities associated with the protection, management and investigation of remnant vegetation.

Eleven sites within the Green Brook Catchment are being targeted for revegetation and protection with the assistance of the Save the Bush and One Billion Trees Programs. The objectives of the work to be carried out is outlined as follows.

1. Back Yangewah - this project intends to fence off a section of remnant vegetation. The remnant is of high quality and the owners will conduct a direct seeding programme to revegetate the whole area. The length of fence required is 6 km and runs along the main creekline. Plots of *Melaleuca* species will be established on the banks of the creek to naturally regenerate the creek over time.

2. Tree Cemetery Site - this project aims to fence off a major drainage line with areas of remnant vegetation as well as re-establishing vegetation in an area that has been severely degraded. The degraded area will be re-established by direct seeding with seed collected locally.

3. Mt. Scratch Site - this site is associated with an area of breakaway country and will be fenced to protect the remnant and protect the soils downslope from water erosion. The site requires 4.1 km of fencing to exclude stock from the area.

4. Salt Patch - this site intends to duplicate a Department of Agriculture experiment at Boundain near Narrogin. At this site trees were planted at various densities and over a period of 5-7 years the watertable was lowered to a point where useful production could be gained off a degraded saline area.

5 Christmas Tree Corner - the project plans to fence off a block of remnant vegetation that is in very good condition. The length of fencing required to protect this site is 1.9 km.

6. Chivers Saltland - this project plans to demonstrate another possible treatment of land that has become saline following clearing of the catchment. The project is a joint

site involving two landowners. The site will require 2 km of fencing and plans to establish a stand of *Atriplex amnicola* and *A. canescens* as a feed reserve.

7. Cambells Corner - this site aims to revegetate a creek line to stabilize the banks prior to re-shaping to alter the acute angle of the banks which are being undermined. One side of the system has already been fenced and the length of fence required is 1.5 km. The tree species that will be planted are: river gum, York gum and salt gum.

8. Bellendine Brook - this project aims to complete a stream revegetation and stabilisation program started a few years ago by the landowner. The plan is to flank a stream with six rows of trees and fence the stream off from stock.

9. Carr's House Block - this site is 13 ha in size and the project proposes to erect an electric fence to exclude stock from the bush. The site may be used as a seed orchard once the site has regenerated satisfactorily and will become doubly valuable to the district.

10. The Rocks - this site is located around Enokerra Hill and encompasses the soils below the rock. The area is 18 ha and requires 2 km of electric fencing to protect the site from grazing pressures.

11 District Herbarium - the purpose of establishing a district herbarium is to initially identify the plants occurring in the area and to provide a local reference for any interested person to access. The second reason for the herbarium is to log species that are threatened by present farming techniques and locate where small plant communities exist. The herbarium will become a valuable resource for the whole community and will raise awareness of the need to preserve remnants on farms.

Ribbons of Green

Ribbons of Green is a community based Greening Western 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 (WADA, CALM and MRD), local government authorities, consultants and community groups.

Plants for Conservation

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

The Plants for Conservation program provides more than 300,000 seedlings each year for revegetation projects aimed at land and nature conservation. It is managed by Greening Western Australia and sponsored by Alcoa of Australia and by the Hamel Nursery. With the sponsors support, Greening Western Australia provides the seedlings. Participating groups and individuals contribute additional seedlings, materials and labour towards the projects.

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 1980's to support Land Conservation District Committee's (LCDC'S) and catchment groups in combating land degradation problems in rural areas. Financial support is provided to LCDC'S to undertake projects in catchment planning, to demonstrate conservation practices and for communications and training in. Projects in the Shire of Mingenew to have received support through the State Landcare Program include:

Appendix 7

Projects in the Shire of Mingenew which have been successful in receiving financial support through the State Landcare Program include:

1).(1989/90) **Project Title:** Native Vegetation Regeneration Demonstration Plot

Project Location: Mingenew

Project Description: as this is a small isolated area adjacent to the Mingenew-Morowa Shire council and surrounded by a vast area used for broadacre farming, the Shire of Mingenew council has vested the land with the Mingenew LCDC to provide a demonstration plot on means of maintaining remnant vegetation and regenerating natural vegetation in areas damaged by time and farming pursuits.

State Assistance Provided: \$2000.

Contact Person: Mr P. Ward

2) (1989/90) **Project Description:** Irwin River Catchment management project - the initiation of a computerised, land resources inventory approach to catchment mangement, based on local community participation.

Project Location: Mingenew

Project Objectives: The specific objectives of the project are to initiate a community-based, catchment management programme that would seek to ultimately establish a computerised land resources inventory for the Irwin River Catchment.

State Assistance Provided- \$10000

Contact Person: Mr F. Michael

P.O. Box 11

Mingenew WA 6522

Phone: (099) 72 8032

3). (1989/90) **Project Title:** Acquisition of tree planting machine.

Project Location: Mingenew

Objectives: The purchase of a Nufab tree planter to encourage intensive revegetation and tree planting programmes through the Shire of Mingenew. Use of the planter be available to landholders, the local shire, the local lions club and other interested bodies.

State Assistance Provided: \$1855

Contact Person: Mr P. Ward

Secretary

Mingenew S.C.D.

P.O. BOX 6522

Mingenew 6522

Telephone - (099) 72 6056

4) 1990/91

Project Title: Establishment of a tree nursery

Location: Mingenew townsite

Project Description: Propagation of local flora species for establishment in the Mingenew area. Nursery to assist and encourage intensive revegetation and tree planting programmes in the Shire.

State Assistance Provided: \$4623

Contact Person: Mr F. Michael and Mr P. Ward

Mingenew S.C.D.

P.O. Box 34

Mingenew 6522

Telephone- (099) 72 6056