Threatened Species & Ecological Communities Regional Strategic Management Plan

South Coast Region, Western Australia

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Western Australian Department of Environment and Conservation

for
Australian Department of Environment, Water, Heritage and the Arts
and South Coast Natural Resource Management Inc.

This South Coast Threatened Species and Ecological Communities Strategic Management Plan has been prepared by Sandra Gilfillan, Polly Mitchell, Janet Newell, Alan Danks and Sarah Comer, of the Western Australian Department of Environment and Conservation, South Coast Region.

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South Coast Threatened Species and Ecological Communities Strategic Management Plan
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FOREWORD

This Strategic Management Plan is the result of a pilot project in regional threatened species recovery planning, initiated in 2004 by the Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA). The aim of this project was to investigate the feasibility of an integrated regional approach to threatened species recovery and threat abatement planning.

The development of this Plan was managed by the Western Australian Department of Environment and Conservation (DEC) in partnership with DEWHA and the South Coast Natural Resource Management Inc. (South Coast NRM). This Plan is intended to guide threatened species recovery and threat abatement in the South Coast Region. It is intended to complement and not duplicate regional NRM planning and current threatened species Recovery Plans.

This Plan has tested the feasibility of preparing a regional Recovery Plan under the guidelines for a Recovery Plan under the Commonwealths *Biodiversity Conservation Act 1999* (EPBC Act). The structure of this regional Plan meets most but not all of the requirements for a Recovery Plan under the EPBC Act.

This Strategic Management Plan will operate from 2009, following endorsement by DEC and DEWHA. It will remain in force until such time as it is withdrawn or replaced. A review of the plan will be completed after 5 years.

ACKNOWLEDGEMENTS

Development of this Regional Strategic Management Plan began in 2004 with a project team of:

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As well as the project team the development of this Plan was guided by the Steering Committee:

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This Plan has been written by Sandra Gilfillan, Polly Mitchell and Janet Newell (Recovery Planners, South Coast Region, DEC), under the guidance of Alan Danks and Sarah Comer.

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SUMMARY

This Threatened Species and Ecological Communities Strategic Management Plan provides a strategic regional approach to integrating threatened species and threatened ecological community recovery and threat abatement for the South Coast Region of Western Australia. The overarching goal of this Plan is to improve the conservation status of threatened species and ecological communities occurring in the South Coast Region. This approach will facilitate improved conservation outcomes for threatened species within the Region by improving the effectiveness, efficiency and integration of threatened species recovery and threat abatement.

The South Coast Region covers approximately 9.7 million hectares of the central southern coastal area of Western Australia extending from Walpole in the west to Israelite Bay in the east (corresponding to the area covered by South Coast NRM Inc.). The Region is part of the southwest Australia biodiversity hotspot internationally recognised due to its high species diversity, number of endemic species and level of risk from loss of habitat.

There are 57 threatened fauna species, 126 threatened flora species, and 6 threatened ecological communities in the Region. The South Coast Region has a long and active history of threatened species recovery. Since the early 1990's threatened species recovery planning has been based on the Recovery Plan and Recovery Team approach. However 43% of the threatened species and ecological communities in the Region are not covered by Recovery Plans. Furthermore it has long been recognised that there are a number of limitations to the capacity this approach. In particular the operation of single species recovery in isolation can result in inadequate and inefficient integration of recovery actions into broader landscape management.

This Regional Plan has identified a number of limitations in the current recovery approaches on a regional scale that could be addressed with regional strategic planning. This Plan recommends two areas that are seen as keys to increasing the effectiveness and efficiency of threatened species recovery and threat abatement across the South Coast Region. These are:

- Increasing regional capacity for threatened species recovery to increase the ability for adaptive management and coordination of current and future recovery and threat abatement projects; and
- Prioritisation of threatened species/communities and the identification of significant areas for threatened species for more efficient allocation of resources.

This Regional Plan also discusses the incorporation of climate change considerations into regional recovery and threat abatement planning. Identifying and quantifying the impacts of climate change on threatened species is challenging, given the intrinsic uncertainty of climate change projections in combination with the lack of knowledge on the capacity for adaptation and biological responses of species to change. The best management options were determined to be to continue to build the resilience of threatened species by improving landscape connectivity, maximising population viability, and reducing the impact of other threatening processes.

This Plan represents the first attempt in Western Australia to assess and prioritise threatened species across a region and provide a strategic framework for implementing coordinated recovery planning and management at a landscape scale. Utilising this approach will facilitate improved conservation outcomes for threatened species within the Region by improving the effectiveness, efficiency and integration of threatened species recovery and threat abatement.

1 INTRODUCTION

1.1 South Coast Region

The South Coast Region, as defined in this Plan, encompasses the central southern coastal area of Western Australia extending from Walpole in the west to Israelite Bay in the east (Figure 1.1). The total area of the Region is approximately 9.7 million hectares, stretching 160 km inland to Gnowangerup in the west and to 40 km north of Salmon Gums in the east. The Region includes over 1000 kms of coastline and approximately 1.3 million hectares of state controlled marine waters (to the 3 nautical mile limit). A large number of small islands occur within close proximity to the coast, particularly in the eastern portion, in the Recherche Archipelago.

This Region, hereafter referred to in this document as the South Coast Region or the Region, corresponds to the area covered by the South Coast Natural Resource Management Inc. (South Coast NRM) NRM group (Figure 1.1). This Region is different to the Western Australian Department of Environment and Conservation (DEC) regions, consisting of a large part of the South Coast DEC region, and smaller parts of the Warren and Wheatbelt DEC regions.

As the boundary of the South Coast Region is essentially an administrative one, it does not take into consideration biological linkages that occur with adjoining regions. To better appreciate the possibility of inter-regional linkages, a 30 km buffer was added to the boundary when carrying out data collation and information processing for this Plan (Figure 1.1).

The South Coast Region is part of the southwest Australia biodiversity hotspot internationally recognised due to its high species diversity, number of endemic species and level of risk from loss of habitat (Myers *et al.* 2000). The Region forms the southern part of this biodiversity hotspot and contributes significantly to its biodiversity values.

The Region has a Mediterranean climate with cool to cold wet winters and warm to hot dry summers. Rainfall generally decreases northward and eastward across the Region, averaging from 1400 mm to 300 mm annually (Figure 1.2). The geology broadly consists of the Yilgarn Plateau which forms the upland plain and the marine plain comprising lowland areas (CALM 1992b).

The Region contains a diverse range of vegetation associations with forested areas to the west, several low mountain ranges (the highest being the Stirling Range with the highest point at Bluff Knoll (1073 m)), woodlands to the north east and sandplain heath and mallee communities closer to the coast. Around 120 vegetation associations, as described and mapped by John Beard (Hopkins *et al.* 2001), are represented in the Region. In addition there is great diversity in aquatic ecosystems with perennial and intermittent rivers systems, a number of large inlets, wetlands and coastal dunes.

The marine environment of the Region is part of the temperate Southern Australian Biogeographic Region with many species occurring here also widely distributed across the southern coast from Bass Strait to the Leeuwin-Naturaliste coast and some as far eastward as New South Wales. Some northern species originating in the tropics have distributions extending along the south coast, with larval stages thought to be transported southward by the Leeuwin Current (Wilson & Allen 1987).

Within the Region past land clearing, mainly for agricultural purposes, has resulted in approximately 48% (4.6 million ha) of the pre-European vegetation in the Region being removed

(Figure 1.2). However, large areas of remnant vegetation still remain in the Region, most notably the Fitzgerald River National Park (320,000 ha), and the large continuous tracts of remnant vegetation in the north-west of the Region, comprising of Unallocated Crown Land and large reserve areas such as Cape Arid National Park, and Nuytsland and Dundas Nature Reserves.

The Region also contains some important connectivity between remnants, most notably the "Coastal Corridor" spanning approximately 500 km from Walpole in the west to Cape Arid National Park in the east, and the "Forest to Fitzgerald Corridor" which is approximately 145 km in length and currently exists as a series of "stepping stones" (Watson & Wilkins 1999).

The flora of the southwest of Western Australia is characterised by high levels of species diversity and a high proportion of endemic species. The South Coast Region contains over 4,500 flora species, around 400 of which are endemic to the Region (Danks 2004). High levels of floral endemism occur in three main areas within the region: the Stirling Range National Park, Ravensthorpe Range/Fitzgerald River National Park area (Beard *et al.* 2000; Hopper & Gioia 2004) and Mount Lindesay (Greg Keighery pers. comm.). Areas of high floral species richness in the Region include Walpole, Frankland, Stirling Range, Manypeaks, and Bremer Bay to Ravensthorpe areas (Hopper & Gioia 2005). The high level of endemism and richness among the flora has been attributed to the Region's long geological history (unglaciated since the Permian), and stable and highly weathered landscapes with nutrient deficient soils (Hopper & Gioia 2004).

The fauna species native to the South Coast Region includes 42 mammals, 270 birds, 22 frogs and 70 reptiles (Danks 2004). Like other Mediterranean areas in Australia, faunal endemism in the South Coast Region is generally low, with only 11 vertebrate fauna species endemic to the Region.

Despite their undoubted ecological significance, knowledge of the invertebrate fauna of the South Coast is far less comprehensive than for vertebrates. This situation is slowly being addressed as more biological surveys include invertebrates in their range of target groups. However, difficulties are encountered due to the large number of undescribed invertebrate species and the fact that experts on particular groups often reside outside the state or overseas. Many of the invertebrates common to southern temperate Australia occur in South Coast communities and representatives of most Australian orders are present. There are endemic species among most groups, and current understanding of these from the South Coast is that there is a high level of short-range endemism in many groups, in particular spiders, millipedes, scorpions, pseudoscorpions, land snails and velvet worms (Framenau *et al.* 2008).

The South Coast Region contains many short range endemic species (SRE) that are found in a very restricted area, generally less than 10,000 km^2 (Harvey 2002), in particular in the flora, invertebrates and amphibian groups (Cowling *et al.* 1994; Wardell-Johnson & Horwitz 1996; Hopper & Gioia 2004). Many of the invertebrates are Gondwanan refugial species (e.g. *Moggridgea*, *Bothriembryon*) which are highly restricted to continually moist habitats which mimic the climatic conditions present in the late Cretaceous period. SREs generally have low fecundity, are long-lived and are poor dispersers.

Although South Coast marine biodiversity has not been well studied, the high level of terrestrial endemism in the Region is likely to be repeated here due its long geological isolation and the influence of various changes in currents and water temperatures over millions of years (Green 2003).

1.2 Rationale for this Regional Plan

Recovery plans are important management documents that enable threatened species and ecological community recovery activities to be approached within a planned and logical framework. There are three types of recovery plans, single species or communities, multi-species and regional. Regional plans are a recent style of recovery planning that aim to provide a strategic framework for incorporating recovery and threat abatement priorities for all threatened species and communities within a region. Regional recovery plans do not aim to replace the need for single and multi-species recovery plans.

The single species approach to recovery planning has seen many successful programs implemented for threatened species, and may be the most appropriate method for some species recovery (e.g. small discrete populations, Critically Endangered species). However, it has long been recognised that there are a number of limitations to the capacity this approach. These include that such programs are often very resource intensive, are carried out in isolation from other species and generally include inadequate integration of recovery actions into broader natural resource management issues.

The multi-species approach to recovery planning has been used across Western Australia for many years, in particular for threatened flora. Although a multi-species recovery plan provides integration of the recovery of the species covered by the plan, it still has many of the same limitations as single species plans.

Threat abatement activities relating to threatened species are planned for in specific threat abatement plans as well as in recovery plans. Current limitations include that threat abatement of a particular threatening process is generally carried out in isolation from other threats and without regard for potential interactions between threats, and that these threat abatement activities are often different between land tenures. This Regional Plan aims to provide a framework for more effective management through an integrated approach across land tenures.

There is currently a general lack of understanding within the community about threatened species, their management and the realities of the potential of species extinction in the South Coast Region. There is also limited understanding of statutory roles and responsibilities for threatened species and threatening process abatement. This Regional Plan aims to provide a framework for the dissemination of information on threatened species and recovery planning.

1.2.1 Trialing of a Regional Approach

This South Coast Regional Threatened Species and Ecological Communities Strategic Management Plan is the result of an Australian Government funded pilot project to test the feasibility of an integrated regional approach to threatened species recovery and threat abatement planning. Other similar plans are currently been developed elsewhere in Australia, including the Adelaide and Mount Lofty Ranges (SA), Border Ranges region (QLD/NSW), King Island (TAS) and Lord Howe Island (NSW).

This Plan represents the first attempt in Western Australia to assess and prioritise threatened species across a region and provide a strategic framework for their recovery planning and management. It is hoped that this approach will provide a greater understanding of threatened species within the Region and improve the effectiveness, efficiency and integration of threatened species recovery and threat abatement.

This Plan has been developed by the Western Australian Department of Environment and Conservation (DEC) (formally Department of Conservation and Land Management), in partnership with the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) (formally the Department of the Environment and Heritage) and the South Coast Natural Resource Management Inc. (South Cost NRM) (formally the South Coast Regional Initiative Planning Team).

1.3 Scope of this Plan

This Regional Strategic Management Plan covers all threatened flora, fauna (terrestrial and marine) and ecological communities listed as threatened under either or both State and Commonwealth legislation that occur in the South Coast Region (Section 2). There are 57 fauna and 126 flora threatened species, and 6 threatened ecological communities in the Region and therefore covered by this Plan (Section 3, Appendix 1).

In this document the term 'threatened species' refers to all species, sub-species or distinct populations that are listed under either State legislation as 'rare or likely to become extinct' (fauna) or 'rare (extant)' (flora), or Commonwealth legislation as 'critically endangered', 'endangered' or 'vulnerable'.

This Plan also discusses species and ecological communities that are scheduled as 'other specially protected' (fauna) under State legislation and those that DEC identify as priority species or ecological communities (Section 2). This includes 837 priority species/ecological communities and 4 specially protected fauna (Section 3). However, due to time constraints and often lack of information, these species and ecological communities are not included in the data analysis conducted for this Plan (Section 7). However, they are highlighted as species or communities that require further survey and monitoring to determine their conservation status.

The data analysis conducted for this Plan also does not include marine species as only one species, the Southern Right Whale, breeds in the Region. Also, there is a severe lack of information on distribution or the importance of the South Coast marine habitat to threatened marine fauna and it is not known if threatening processes impacting on these species on a national or global level are also impacting on these species within the Region.

This Plan also identifies species that occur in the 30km buffer around the Region and beyond, but not in the Region itself. These species are highlighted for further survey as this may reveal sub-populations within the Region, and the threats impacting on these species are flagged as threats which will require integrated management across regions. However, these species are not included in the regional data analysis.

1.4 Objectives

This Regional Threatened Species and Ecological Communities Strategic Management Plan aims to provide a strategic regional approach to integrating threatened species and ecological community recovery and threat abatement for the South Coast Region of Western Australia. The goal of this Plan is to improve the conservation status of threatened species and ecological communities occurring in the South Coast Region.

The specific aim of this Plan is to improve the quality, efficiency and effectiveness of the management of threatened species and ecological communities across the region through:

- The identification of the roles, processes and regional capacity required to provide optimal management of threatened species and ecological communities in the region;
- The identification of recovery, threat abatement and research priorities through an analysis of the regional distribution of threatened species and threatening processes;
- Trialing the incorporation of climate change considerations into regional recovery and threat abatement planning; and
- The development of strategic actions needed for a regional approach to threatened species recovery.

Due to the size of the region (9.7 million ha) and the large number of threatened and priority species and ecological communities it is beyond the scope of this Plan to provide detailed recovery actions for each species or group of species. Rather the Plan provides a regional strategic approach to improve the integration of threatened species recovery and threat abatement at a regional scale. Specific detailed recovery actions will continue to be outlined in single species, ecological communities or multi-species recovery plans.

1.5 Regional Plan Evaluation

This Regional Plan covers a period of five years following adoption, subject to review at the end of that time. Over this 5 year period this Plan retains the flexibility to be updated as new information becomes available.

1.6 Relationship to Existing Regional Recovery and Threat Abatement Documents

This Regional Plan is intended to operate in conjunction with the Regions key planning documents that relate to the recovery of threatened species and threat abatement including:

- South Coast Region Regional Management Plan 1992-2002 (CALM 1992b)
- Southern Prospects 2004-2009: South Coast Regional Strategy for NRM (SCRIPT 2005),
- A 100-year Biodiversity Conservation Strategy for Western Australia: Blueprint to the Bicentenary in 2029 (Draft) (DEC 2006a).

Other key documents that relate to threatened species recovery and threat abatement in the Region are listed in Appendix 2, including Commonwealth Threat Abatement Plans, Area Management Plans for National Parks and Nature Reserves, Recovery Plans, Interim Recovery Plans and Action Plans. The Gondwana Link's Functional Landscape Plan for the Fitzgerald to Stirling Operation Area (Deegan 2008) provides guidelines for off-reserve management of threats and biodiversity conservation. The Macro Corridor Project (Watson & Wilkins 1999) details a bioregional approach to aspects of conservation planning in the South Coast Region.

This Regional Plan has been developed to provide guidance to relevant stakeholders on recovery planning and threat abatement, help to raise awareness of threatened species management, and identify actions that can feed directly into regional NRM plans and investment strategies.

1.7 Document Structure

The project and document logic of this Regional Plan is detailed in Figure 3. Background to the threatened species and threatening processes that occur in the region, current recovery and threat abatement programs and why a regional recovery and threat abatement plan is needed is detailed in Sections 1 to 5. Section 7 then details the development of the GIS tool and how it has been used to identify management and research priorities. Climate change and how it will be integrated into this Plan is discussed in Section 8. Section 9 details the strategic management actions needed for a regional approach to threatened species recovery.

1.8 Assessment of the Regional Approach

As the development of this Regional Plan was a pilot project initiated by the Australian Government a separate issues paper has been written in conjunction with this Plan on the process of the development of the Regional Plan, whether the Plan could meet the requirements for adoption under the Commonwealth's *Environment Protection and Biodiversity Act* 1999 (EPBC Act) and relevant Western Australian legislation, and lessons learnt through the process of the development of this plan.

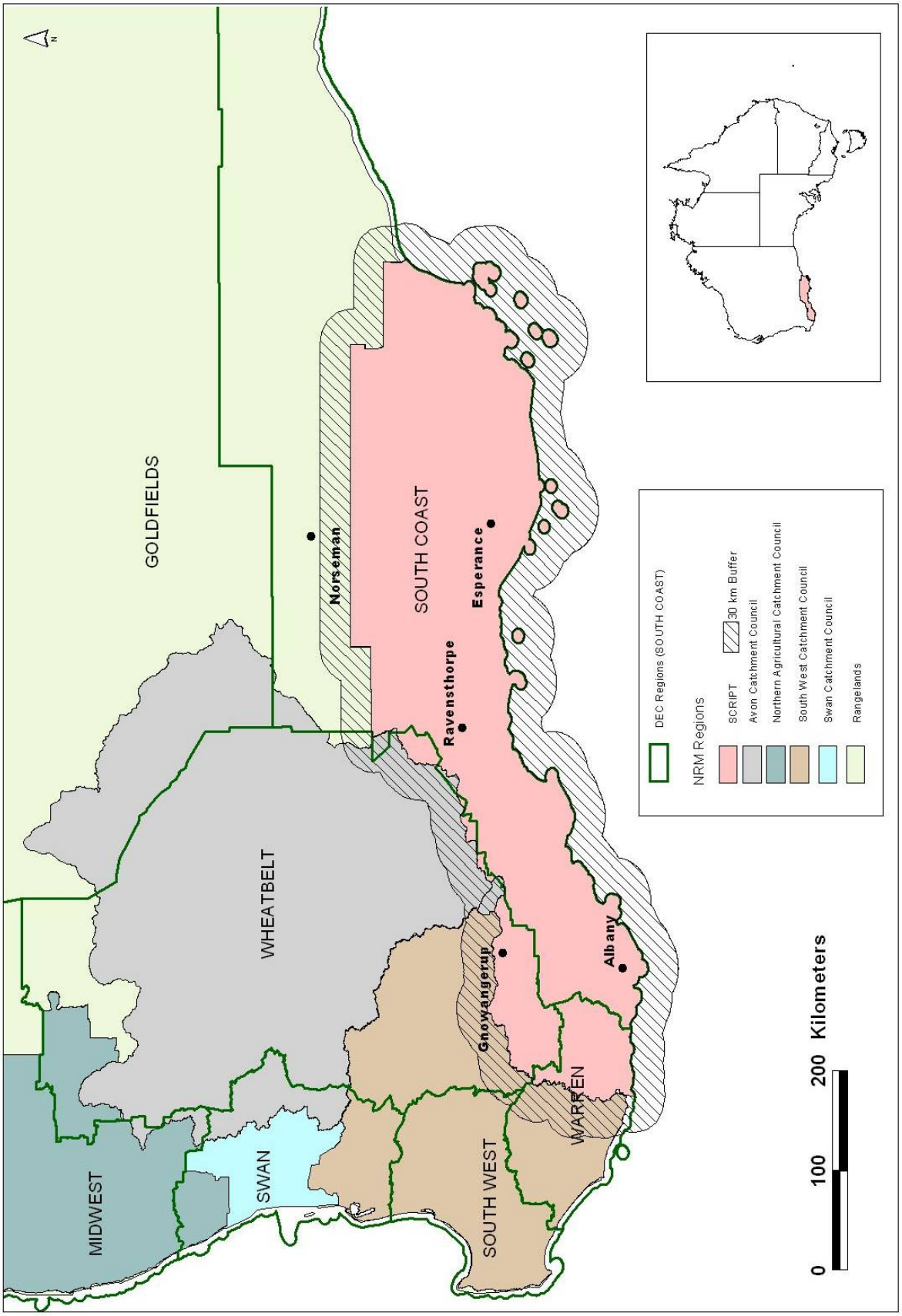

Figure 1: The South Coast NRM Region and associated and surrounding DEC and NRM regions in the southwest of Western Australia. This Regional Threatened Species and Ecological Communities Strategic Management Plan covers the South Coast NRM Region.

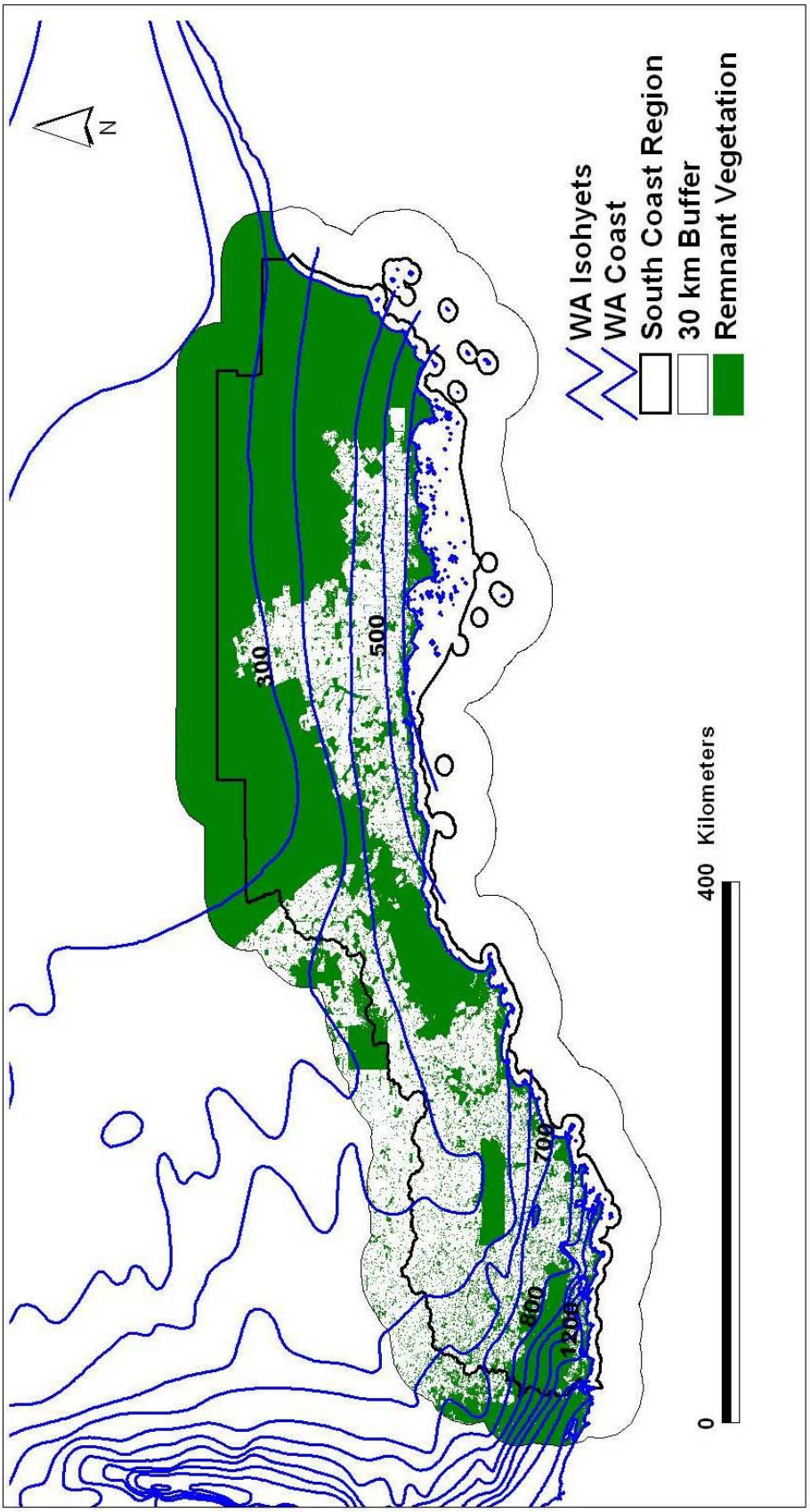

Figure 2: The distribution of remnant vegetation across the South Coast NRM Region and a 30km zone around the Region.

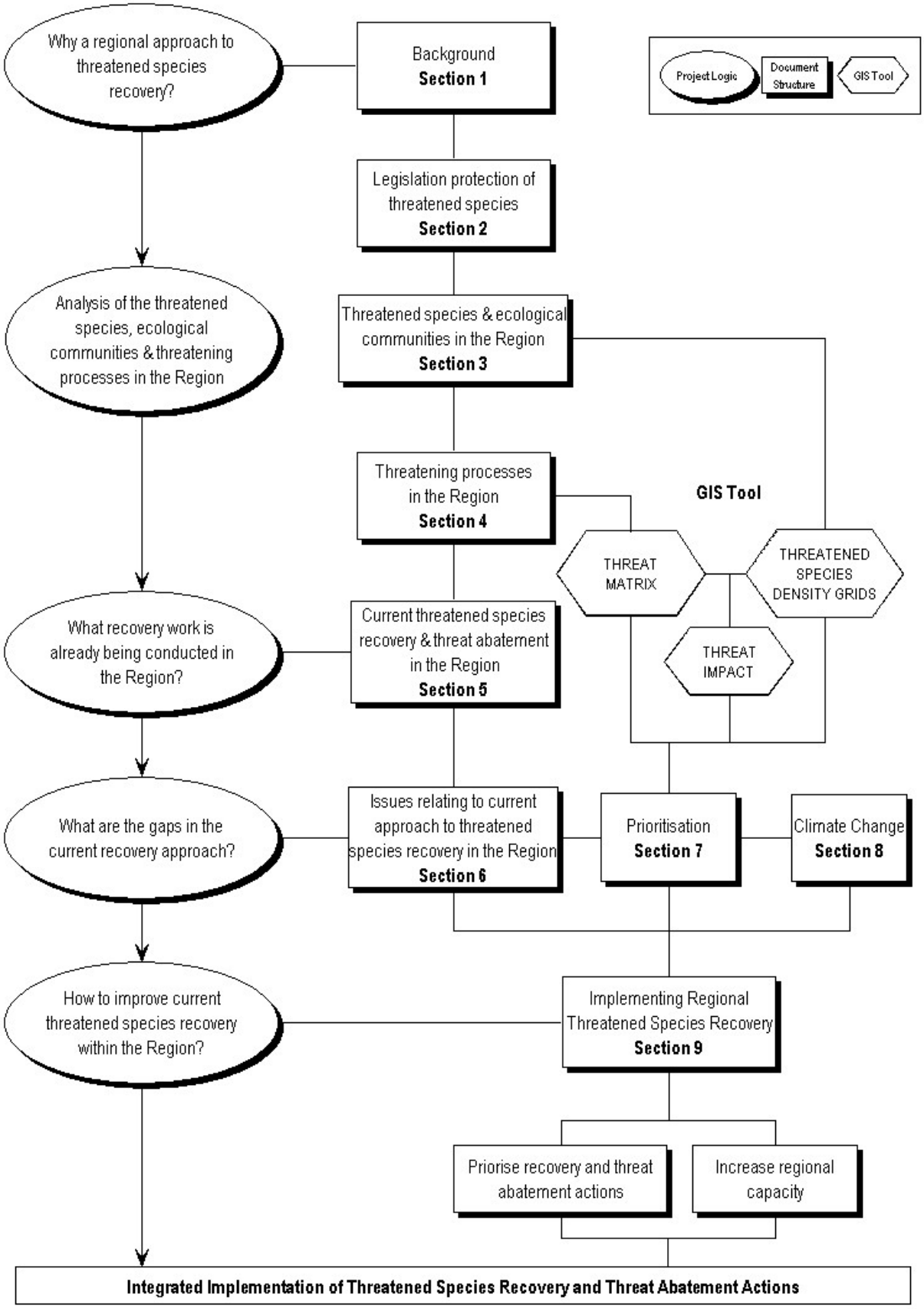

Figure 3: The project logic and document structure of this Regional Threatened Species and Ecological Communities Strategic Management Plan.

2 LEGISLATIVE PROTECTION OF THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

2.1 Legislative Protection

In Australia threatened species and ecological communities are protected under both Commonwealth and State legislation. Additionally a number of species in the South Coast Region are covered under international conventions or agreements.

2.1.1 Commonwealth

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a framework for the protection and management of nationally and internationally important flora, fauna and ecological communities by providing for the:

- identification and listing of species and ecological communities as threatened;
- development of conservation advice and recovery plans for listed species and ecological communities;
- development of a register of critical habitat;
- identification of key threatening processes; and
- where appropriate, reducing the impacts of these processes through threat abatement plans.

2.1.2 State

The main State legislation pertaining to threatened species in Western Australia is the *Wildlife Conservation Act 1950* (WC Act). The Western Australian Department of Environment and Conservation (DEC) is responsible for the implementation of this act and therefore has the lead responsibility for the conservation of threatened species in Western Australia.

A new State Biodiversity Conservation Act is currently under development. The new Act will be wider in its application, be more open to community input and processes, contain more effective decision-making and enforcement mechanisms and incorporate mechanisms to facilitate community conservation efforts. In particular for threatened species, the new Act will have a provision for the listing of threatened ecological communities, which the current WC Act does not.

DEC has a number of Policy Statements and Briefing Papers which provide the Department guidelines/policies relevant to threatened species conservation. These include:

- *Conservation of Threatened and Specially Protected Fauna in the Wild* - Policy Statement No. 33, 1991.
- *Conservation of Threatened Flora in the Wild* - Policy Statement No. 9, 1992.
- *Translocation of Threatened Flora and Fauna* - Policy Statement No. 29, 1995.
- *Wildlife Management Programs* - DEC Policy Statement No. 44, 1992.
- *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*, DEC Policy Statement No. 50, 1994.
- *Conservation of threatened species and threatened ecological communities* - DEC briefing paper, 1994.

All of the above Policy Statements are to be replaced by a new amalgamated Policy Statement No. 9: *Conserving Threatened Species and Ecological Communities*. This Policy statement is currently in a draft format and is available from the DEC website (http://www.dec.wa.gov.au/pdf/projects/tsc_policy_no9.pdf).

A number of other DEC Policy Statements are also relevant to threatened species conservation as they relate to the management of threatening processes. These include:

- *Fire Management Policy* - Policy Statement No. 19, 2005.
- *Weeds on DEC Land* - Policy Statement No. 14, 1986.
- *Management of Phytophthora and disease caused by it*, Policy Statement No. 3, 1998.

2.1.3 International Conventions and Agreements

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention.

Additionally some threatened species in the South Coast Region are covered under an international convention or agreement. These include:

- CITES (Convention on International Trade in Endangered Species),
- JAMBA 1981 (Japan Australia Migratory Bird Agreement),
- CAMBA 1998 (China Australia Migratory Bird Agreement),
- Bonn 1979 (Convention on the Conservation of Migratory Species of Wild Animals), and
- Ramsar 1971 (Convention on Wetlands).

Species that are listed under these international conventions and agreements are protected under the EPBC Act as 'Migratory Species'. Most of these migratory species migrate to Australia and its external territories, or pass though or over Australian waters during their annual migrations. Some migratory species are also listed as threatened species.

2.2 Listing of Threatened Species

In Australia fauna and flora species and ecological communities can be listed at a Commonwealth level under the EPBC Act and/or at a State level under the WC Act. Listing a species provides it legal protection under the relevant legislation.

The International Union for Conservation of Nature and Natural Resources (IUCN) also produces a list of threatened species (IUCN 2008). Although this Red List does not provide any legislative protection for a species in Australia, the categories and criteria used for the Red List are used as a framework for the listing of species at both a Commonwealth and State level.

2.2.1 Commonwealth

Under the EPBC Act any native species (or subspecies or distinct populations that the Minister determines to be a species) or ecological community can be listed as threatened. The EPBC Act also has the provision for the listing of key threatening processes. Any person may nominate a native species, ecological community or threatening process for listing under any of the categories specified in the EPBC Act. Nominations are considered by the Threatened Species Scientific Committee (TSSC). The TSSC assesses the nominations and advises the Minister for the Environment, Heritage and the Arts, who makes the final decision on the listing.

Under the EPBC Act species or ecological communities are listed under the following conservation status categories:

- Species – *Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, and Conservation-dependant*.
- Communities - *Critically Endangered, Endangered and Vulnerable*.

The criteria for these categories used by the TSSC can be viewed on the DEWHA website (www.environment.gov.au).

2.2.2 State

2.2.2.1 Fauna and Flora

The nomination and listing process in Western Australia is similar to that used by the Commonwealth. Nominations may by made by any person. The Western Australian Threatened Species Scientific Committee (WATSSC) considers these nominations and makes recommendations for endorsement by the State Minister for Environment. Threatened flora are declared to be 'rare' (known as Declared Rare Flora (DRF)), while fauna are declared to be 'rare or likely to become extinct' under the WC Act. The listing of threatened species and ecological communities are printed annually in a notice in the Government Gazette.

The WC Act also allows for fauna species to be declared as 'Specially Protected'. These are species that may not be currently threatened but have a commercial value and therefore taking of the species may lead to the species becoming threatened.

2.2.2.2 Ecological Communities

There is currently no specific State legislation or formal policy that provides protection for Threatened Ecological Communities (TEC) in Western Australia. However, DEC has established a non-statutory process for the listing of TECs, similar to that for fauna and flora. The draft DEC Policy Statement No. 9 covers the procedures for the listing and recovery of ecological communities.

Although the current state WC Act does not recognise TECs, state-listed TECs are recognised under other State legislation. For example, TECs have been defined as environmentally sensitive areas under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and any clearing proposals affecting TECs must be approved under a specific permit.

2.2.2.3 Conservation Status

As with the Commonwealth listed species, all species that are recommended for listing as threatened under the state WC Act are prioritised by WATSSC. Each species is allocated to one of the IUCN Red List Categories of conservation status (IUCN 2001) listed below:

- Extinct (EX)
- Extinct in the Wild (EW)
- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)
- Near Threatened (NT)
- Least Concern (LC)
- Data Deficient (DD)

TECs are allocated to similar categories of conservation status as listed below. Definitions and criteria for these categories are included in the draft DEC Policy Statement No. 9.

- Presumed Totally Destroyed (PD)
- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)

2.2.3 Alignment of State and Commonwealth Listed Species

There are currently differences between the Commonwealth and State threatened species lists, both in the actual species listed and the conservation status of each listed species. In the South Coast Region, there are 94 differences in conservation status between State and Commonwealth threatened species lists for the Region, and of the six State-listed TECs that occur in the Region, only one is included on the EPBC list.

DEC and DEWHA are currently addressing the problem of alignment of Commonwealth threatened species lists through a Species Alignment Project. This project is considering the alignment of 200 species, 30 of which occur in the South Coast Region (14 fauna and 16 flora). The project currently involves DEC's Species and Communities Branch developing species information sheets which are then sent to DEWHA and a nomination for amending the EPBC Act list developed from this information.

This Regional Plan uses the State listed species and their conservation status as it is considered that State lists are more likely to accurately reflect status of species at a regional scale in Western Australia, especially given the high level of endemicity in the Western Australian fauna.

2.3 Non-legislative priority lists

DEC maintains a list of priority species and ecological communities that are thought to be threatened but do not meet the adequacy of survey criteria for listing as threatened, are rare and in need of monitoring or are conservation dependent. These priority species and ecological communities are classified into five categories (P1 to P5). P1 to P3 species are those that may be threatened but require further survey, ranked in order of priority for survey. P4 species are those that meet the IUCN criteria for Near Threatened, or have recently been removed from the threatened species list. P5 species are those that are conservation dependent.

Although these species and ecological communities are not protected under legislation, their listing identifies them as priority for further survey and research.

2.4 Recovery Planning and Implementation

There is a 'recovery process' that provides the overall framework for the conservation of threatened species and communities. The State recovery process is outlined in the CALM Briefing Paper: *Conservation of Threatened Species and Threatened Ecological Communities* (WATSCU 1999):

1. review the conservation status of all species and ecological communities,
2. prepare conservation priority lists of threatened species and ecological communities,
3. where insufficient information exists to prescribe conservation actions, conduct the necessary research,
4. produce costed Recovery Plans, and
5. for each Recovery Plan, obtain funding, implement, monitor and review implementation.

Further details on the preparation of Recovery Plans and the operation of Recovery Teams is included in the draft DEC Policy Statement No. 9.

2.4.1 Recovery Plans

Recovery plans are prepared for both Commonwealth and State listed threatened species and ecological communities. These plans may be prepared for a single species of fauna or flora, for groups of species or for a TEC, and may be drafted by a wide range of interested parties including consultants, individuals, groups, researchers or government agencies. The requirements for a recovery plan are detailed in the Commonwealth EPBC Act and DEC Policy Statement No. 44. Recovery plans are generally current for a term of five to ten years.

The aim of a recovery plan is to maximise the long term survival in the wild of the threatened species or ecological community. Recovery plans provide detailed information on the biology, distribution, abundance and threats to individual threatened taxa or communities and outline recovery actions, including costs and responsibilities, needed to halt the decline, or increase the numbers, of any threatened taxon or community. Success or failure in meeting recovery plan aims is measured by various specific criteria. Currently these Plans are the key documents used for guiding the recovery of species and ecological communities. They provide a planned and logical framework for key interest groups and responsible government agencies to coordinate their work to improve the plight of threatened species and/or ecological communities.

At a State level, where there is insufficient information to prepare a full recovery plan or where there is extreme urgency that recovery actions commence, an interim recovery plan will be prepared, which can be current for a period of five years. Survey and scientific research will be undertaken where necessary to clarify threats and recommend cost-effective recovery actions to be included in a full recovery plan.

2.4.2 Threatened Flora Management Programs

Due to the high number of threatened and priority flora in the south west of Western Australia, DEC has developed Regional or District Threatened Flora Management Programs. These provide a brief summary of each threatened and priority taxon, highlight threatening processes and set overall priorities and actions for management and research. In the South Coast Region there is a Threatened Flora Management Program for the Albany (Robinson & Coates 1995), Esperance (Craig & Coates 2001) and Katanning (Graham & Mitchell 2000) districts.

These Management Programs do not replace the Recovery Plan process, but provide priorities and actions for management of threatened and priority flora species that do not have Recovery Plans.

2.4.3 Recovery Teams

Recovery Teams are set up in Western Australia to coordinate the preparation and implementation of Recovery Plans, Interim Recovery Plans and Threatened Flora Management Programs. Where appropriate, one Recovery Team will coordinate the conservation of multiple species and/or ecological communities. Recovery Teams are generally chaired by a Departmental employee and includes representatives of stakeholder groups who are willing to work towards and/or financially support the recovery of the species or ecological community concerned.

2.4.4 Funding

DEC allocates significant resources to threatened species recovery through the employment of key staff. However, threatened species recovery projects in the South Coast Region rely heavily on additional funding from other government programs and outside organisations. As much of this funding is for relatively short term projects, a significant amount of a threatened species managers time is required for applying for and administering funding.

Threatened species recovery programs in the Region prior to 2002 were largely funded through the Commonwealth Natural Heritage Trust (NHT) administered by DEC's Species and Communities Branch (formerly Threatened Species and Communities Unit).

Since 2002, Commonwealth funding for threatened species recovery programs has been generally delivered through regional NRM groups. For the South Coast Region, the NRM group is the South Coast NRM Inc. (formally South Coast Regional Initiative Planning Team).

South Coast NRM currently funds DEC administered threatened species recovery programs (primarily for species that have significant populations on conservation estate and for which Departmental expertise is available) through a single NRM Project: 'Implementation of Recovery Plans for South Coast Threatened Species. DEC projects covered under this program include the recovery of Gilbert's Potoroo, Western Ground Parrot, Noisy Scrub-bird, Dibbler, Numbat, Chuditch, and threatened flora.

Other threatened species recovery projects are currently being implemented in the Region by other non-government organisations, such as Birds Australia (Carnaby's Black-Cockatoo) and the Malleefowl Preservation Group (Malleefowl), with part funding from South Coast NRM and corporation sponsorship (e.g. Western Mining funding The Malleefowl Preservation Group). Most of these threatened species recovery projects are implemented on private land.

2.5 Land Tenure

The broad land tenure of the South Coast Region is shown in Figure 4. In the Region the majority of threatened species and ecological communities occur within protected areas and Unallocated Crown Land (UCL), highlighting the importance of protected areas for the protection of these species (Table 2.1). However, many important populations of threatened species, in particular flora, occur on land of other tenure. This shows the importance of the involvement of all stakeholders in the recovery of threatened species.

Table 2.1: The number of threatened species (flora and fauna) and ecological communities (TECs) (and the percentage of distribution records) that occur in different land tenures in the South Coast Region. The distribution records are from the DEC threatened species and ecological communities databases. This data is current to April 2006.

Threatened Species and Ecological Communities	No. of Species (% of records)		
	Protected Areas and UCL	Other Reserves	Freehold Land and Pastoral Leases
Flora	83 (62%)	28 (11%)	43 (26%)
Fauna	30 (80%)	18 (8%)	23 (12%)
TEC	5 (100%)	0	0

Note: As this only includes DEC data, the percentage of records on freehold land and pastoral leases may be underestimated.

2.5.1 Protected Areas

In Western Australia, terrestrial protected areas are vested in the Conservation Commission of Western Australia and managed by DEC under the *Conservation and Land Management Act 1984* (CALM Act). This legislation applies to eight categories of conservation land, five of which occur in the South Coast Region: National Park, Nature Reserve, Miscellaneous Reserves, State Forest and Timber Reserve.

The South Coast Region includes approximately 1.8 million ha of protected area (approximately 36% of the remnant vegetation in the Region) (Figure 4). This includes 14 National Parks, more than 150 Nature Reserves and several State Forests, Timber Reserves and other Miscellaneous Reserves. DEC manages each of these categories of protected areas for different purposes and conservation values. As the majority of threatened species and ecological communities occur in these protected areas, DEC implements most recovery actions and threatening process abatement programs in these areas.

2.5.2 Unallocated Crown Land

Unallocated Crown Land (UCL) comprises an additional 48% of the remnant vegetation in the Region and includes significant areas important for the conservation of biodiversity (Figure 4). UCL is managed by the Department of Land Information, although DEC has responsibility for fire preparedness and control of feral predators and weeds, and the management of threatened species on this land.

2.5.3 Other Land Tenure

The South Coast Region also includes other tenure types including crown land vested in Local Government Authorities (LGAs), pastoral leases and freehold land. These tenures include significant habitats for many threatened species.

DEC has the primary responsibility for the protection of native flora and fauna (including threatened species), across all land tenures. However, the control of threatening processes (e.g. weeds) is the responsibility of the particular landholders. Cooperative relationships between DEC, landholders and other management agencies are important for the effective and sustainable management of threatened species across these tenures. DEC needs to ensure that these other groups are aware of their obligations in relation to threatened species and offer advice and assistance on matters relating to conservation (CALM 1992b).

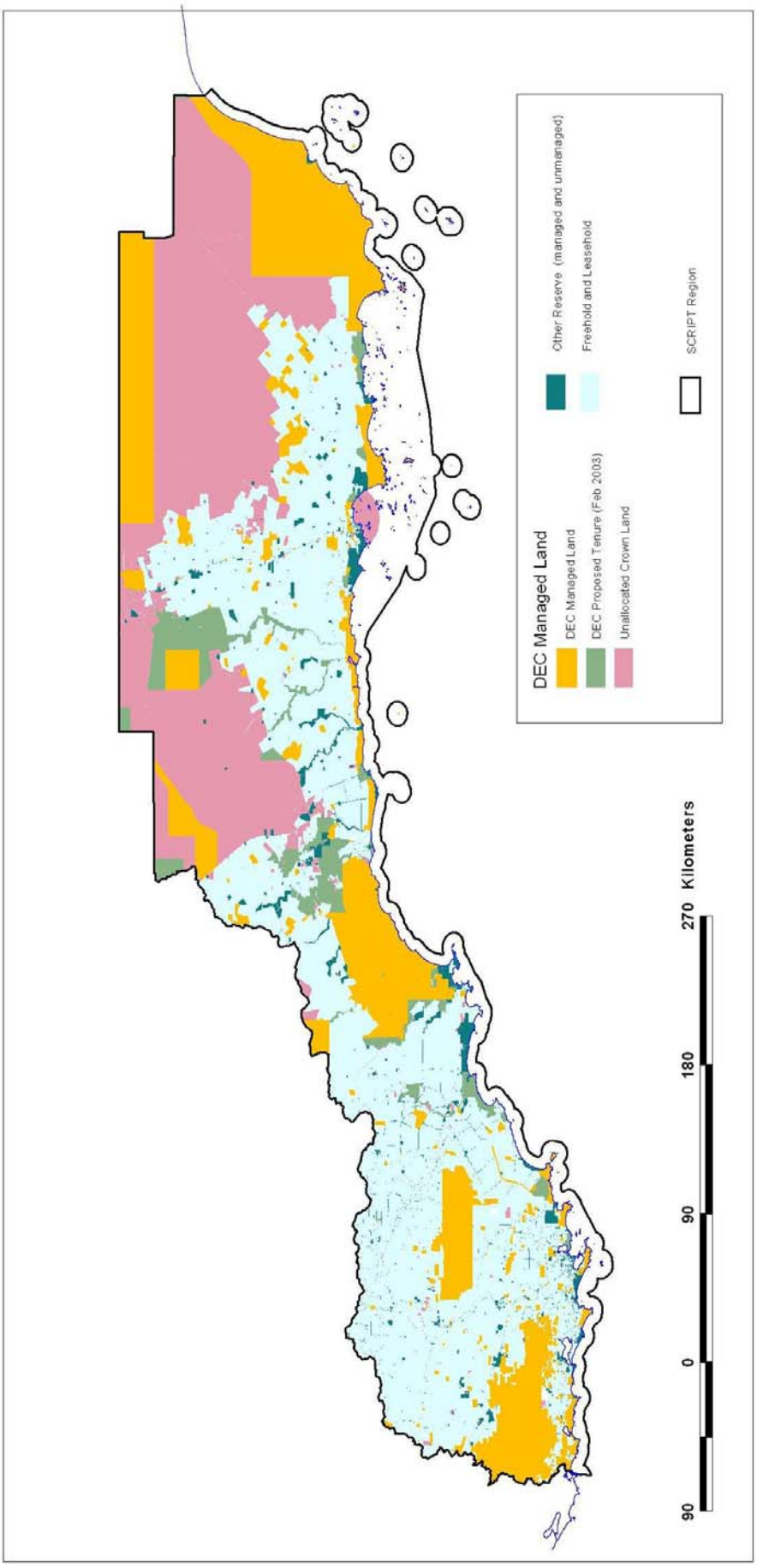

Figure 4: The Land Tenure for the South Coast NRM Region

3 THREATENED SPECIES AND COMMUNITIES OCCURRING IN THE REGION.

3.1 Threatened Species and Communities in the Region

This Regional Plan covers all threatened and priority flora, fauna (terrestrial and marine) and ecological communities listed under either State or Commonwealth legislation occurring within the Region. In the South Coast Region there are 189 species/ecological communities listed under State and 145 species/ecological communities listed under Commonwealth legislation (Table 3.1). This is over 30% of the threatened species in Western Australia (State listing) and nearly 10% of the threatened species in Australia (Commonwealth listing). A further four species are listed under State legislation as Specially Protected and 837 species considered by DEC as Priority. Further details on the threatened species are included in Appendix 1.

Table 3.1: The number of species and ecological communities that are State Threatened, Specially Protected, and Priority species and ecological communities in the South Coast Region. This data is current to April 2008.

		State				Common-wealth
		Threatened	Specially Protected	Priority	TOTAL	
Fauna	**Terrestrial**	34	2	37	**73**	22
	Marine	23	2	2	**27**	21
Flora		126	n/a	778	**904**	101
Ecological Communities		6	n/a	20	**26**	1
TOTAL		**189**	**4**	**837**	**1030**	145

3.1.1 Threatened Fauna

There are 57 threatened fauna species within the Region, 43 of which are also listed under Commonwealth legislation (Table 3.2, Appendix 1). The differences between the State and Commonwealth listed species mainly relate to the terrestrial fauna and specifically the invertebrate species.

Thirty-four of the State listed species are terrestrial fauna (Table 3.2). Three of these are Critically Endangered (CR): Gilbert's Potoroo (*Potorous gilbertii*), Western Ground Parrot (*Pezoporus wallicus flaviventris*) and the Stirling Range Rhytidid land snail (Undescribed *Rhytidid* sp.). Bird and mammal species make up the majority of the terrestrial threatened fauna although three invertebrates and one freshwater fish are Endangered (EN), and one frog, one reptile, two invertebrates and two fish are Vulnerable (VU).

Twenty-three of the state listed species are marine fauna (Table 3.2). Only one is listed as CR, the Amsterdam Albatross (*Diomedea amsterdamensis*), which is only an occasional visitor to the Region. The majority of the threatened marine fauna are seabirds (16 species) although whales, sharks and turtles are also included. Little is known about the distribution or biology of most of these species, and only one, the Southern Right Whale (*Eubaleana australis*), is known to breed within the Region, although the Humpback Whale (*Megaptera novaeangliae*), Great White and Grey Nurse Shark (*Carcharodon carcharias*, *Carcharias taurus*) may also breed here.

Two terrestrial and two marine species listed as Other Specially Protected Fauna under State legislation occur in the South Coast Region (Table 3.1). The Carpet Python (*Morelia spilota imbricata*) is listed due to the potential illegal collection of this species and the Peregrine Falcon (*Falco peregrinus*) due to illegal destruction by pigeon owners and potential for collecting by

falconry enthusiasts. The two marine species are the pinnepeds, the Australian Sealion (*Neophoca cinerea*) and the New Zealand Fur-seal (*Arctocephalus forsteri*). These species are listed because of the potential negative interaction with fisheries operations, and more recently recreation.

The number of fauna species that have become extinct since European settlement is unknown, though the extinct Broad-faced Potoroo (*Potorous platyops*) and Crescent Nailtail Wallaby (*Onychogalea lunata*) are thought to have occurred in the Region (Abbott 2008). Several critical weight range (CWR) mammals are known to have become locally extinct in the Region, including the Banded Hare-wallaby (*Lagostrophus fasciatus*), Bilby (*Macrotis lagotis*), Boodie (*Bettongia lesueur*) Western Barred Bandicoot (*Perameles bougainville*) and Woylie (*B. penicillata*).

3.1.1.1 Migratory Species

At least 35 fauna species listed as 'Migratory Species' under the EPBC Act occur in or migrate through the South Coast Region. The majority of these species are migratory seabirds, though also includes other bird and whales species. Some of these species are also threatened species.

3.1.2 Threatened Flora

There are 126 threatened flora species within the Region listed under State legislation, 25% of which are CR (Table 3.3). Of these, 101 are listed as threatened under Commonwealth legislation. Only one flora species is known to have become extinct in the South Coast Region over the last 200 years (Danks 2004).

Most of these threatened species are angiosperms, with only 2 mosses and 1 fern listed (Table 3.3). The lack of listed lichen and moss species is not necessarily representative of the current status of these groups but is probably due to a lack of information on their diversity and distribution making it difficult to determine their conservation status.

Table 3.2: The threatened fauna listed under State and Commonwealth legislation that occur in the South Coast Region. CR – Critically Endangered, EN – Endangered, and VU – Vulnerable.

	State				Commonwealth			
	CR	**EN**	**VU**	**TOTAL**	**CR**	**EN**	**VU**	**TOTAL**
TERRESTRIAL								
MAMMALS	*Potorous gilberti*	*Parantechinus apicalis* *Phascogale calura*	*Dasyurus geoffroii* *Myrmecobius fasciatus* *Petrogale lateralis hacketti* *Petrogale lateralis lateralis* *Phascogale tapoatafa tapoatafa* *Pseudochierus occidentalis* *Pseudomys shortridgei* *Setonix brachyurus*	**11**	*Potorous gilberti*	*Parantechinus apicalis* *Phascogale calura*	*Dasyurus geoffroii* *Myrmecobius fasciatus* *Petrogale lateralis hacketti* *Petrogale lateralis lateralis* *Pseudochierus occidentalis* *Pseudomys shortridgei* *Setonix brachyurus*	**10**
BIRDS	*Pezoporus wallicus flaviventris*	*Atrichornis clamosus* *Cacatua pastinator pastinator* *Calyptorhynchus baudinii* *Calyptorhynchus latirostris* *Psophodes nigrogularis nigrogularis* *Botaurus poicilptilus*	*Calyptorhynchus banksii naso* *Cereopis novaehollandiae grisea* *Dasyornis longirostris* *Leipoa ocellata* *Platycercus icterotis xanthogenys*	**12**		*Pezoporus wallicus flaviventris* *Calyptorhynchus latirostris* *Psophodes nigrogularis nigrogularis*	*Atrichornis clamosus* *Cacatua pastinator pastinator* *Calyptorhynchus baudini* *Cereopis novaehollandiae grisea* *Dasyornis longirostris* *Leipoa ocellata*	**9**
REPTILES			*Pseudonaja affinis tanneri*	**1**				**0**
AMPHIBIANS			*Spicospina flammocaerulea*	**1**		*Spicospina flammocaerulea*		**1**
FISH (freshwater)		*Galaxias truttaceus hesperius*	*Galaxiella munda* *Nannatherina balstoni*	**3**	*Galaxias truttaceus hesperius*		*Nannatherina balstoni*	**2**
INVERTEBRATES	Undescribed Rhytidid sp.(WAM#2295-69)	*Cynotelopus notabilis* *Moggridgea* sp. (B.Y.Main 1990/24, 25) *Moggridgea tingle*	*Austrarchaea mainae* *Engaewa walpolea*	**6**				**0**
Total Terrestrial	**3**	**11**	**20**	**34**	**2**	**6**	**14**	**22**

MARINE								
MAMMALS		*Balaenoptera musculus intermedia*	*Eubaleana australis* *Megaptera novaeangliae*	**3**		*Balaenoptera musculus intermedia* *Eubaleana australis*	*Megaptera novaeangliae* *Neophoca cinerea*	**4**
BIRDS	*Diomedea amsterdamensis*	*Diomedea dabbenena* *Diomedea sanfordi* *Macronectes giganteus*	*Diomedea epomophora* *Diomedea exulans* *Diomedea gibsoni* *Phoebetria fusca* *Phoebetria palpebrata* *Procellaria aequinoctalis* *Thalassarche carteri* *Thalassarche cauta* *Thalassarche chlororhynchos* *Thalassarche chrysostoma* *Thalassarche melanophrys* *Thalassarche salvini*	**16**		*Macronectes giganteus* *Diomedea amsterdamensis* *Diomedea dabbenena* *Diomedea sanfordi*	*Diomedea epomophora* *Diomedea exulans* *Diomedea gibsoni* *Phoebetria fusca* *Thalassarche carteri* *Thalassarche cauta* *Thalassarche chrysostoma* *Thalassarche melanophrys* *Thalassarche salvini*	**13**
REPTILE		*Caretta caretta*	*Dermochelys coriacea*	**2**		*Caretta caretta*	*Dermochelys coriacea*	**2**
FISH			*Carcharias Taurus* *Carcharodon carcharias*	**2**			*Carcharias Taurus* *Carcharodon carcharias*	**2**
Total Marine	**1**	**5**	**18**	**23**	**0**	**7**	**14**	**21**
TOTAL	**4**	**16**	**37**	**57**	**2**	**13**	**28**	**43**

Table 3.3: The threatened flora listed under State and Commonwealth legislation that occur in the South Coast Region. CR – Critically Endangered, EN – Endangered, and VU – Vulnerable.

	State				Commonwealth			
Species	**CR**	**EN**	**VU**	**Total**	**CR**	**EN**	**VU**	**Total**
Moss	*Brachyscias verecundus* *Rhacocarpus webbianus*			**2**	*Brachyscias verecundus*			**1**
Ferns			*Asplenium obtusatum* subsp. *northlandicum*	**1**				**0**
Angiosperms								
Monocotyledons	*Drakaea confluens* ms *Caladenia drakeoides* *Calectasia cyanea* *Rhizanthella gardneri*	*Caladenia bryceana* subsp. *bryceana* *Caladenia christineae* *Caladenia dorrienii* *Caladenia winfieldii* *Commersonia sp. Mt Groper* *Drakaea micrantha* ms *Reedia spathacea* *Xyris exilis*	*Anigozanthos bicolor* subsp. *minor* *Caladenia harringtoniae* *Calectasia pignattiana* *Chordifex abortivus* *Conostylis lepidospermoides* *Conostylis misera* *Deyeuxia drummondii* *Diuris drummondii* *Diuris micrantha* *Eleocharis keigheryi* *Laxmannia grandiflora* subsp. *brendae* *Microtis globula* *Orthrosanthus muelleri* *Thelymitra psammophila* *Tribonanthes purpurea*	**27**	*Calectasia cyanea*	*Caladenia drakeoides* *Drakaea confluens ms* *Rhizanthella gardneri* *Caladenia bryceana subsp. Bryceana* *Caladenia dorrienii* *Caladenia winfieldii* *Commersonia sp Mt Groper* *Anigozanthos bicolor subsp. Minor* *Chordifex abortivus* *Conostylis lepidospermoides* *Conostylis misera* *Deyeuxia drummondii* *Orthrosanthus muelleri*	*Caladenia christineae* *Drakaea micrantha ms* *Xyris exilis* *Caladenia harringtoniae* *Calectasia pignattiana* *Diuris drummondii* *Diuris micrantha* *Eleocharis keigheryi* *Microtis globula* *Thelymitra psammophila* *Tribonanthes purpurea*	**25**
Dicotyledons	*Adenanthos pungens subsp. effusus* *Andersonia axilliflora* *Banksia anatona* *Banksia brownii* *Banksia ionthocarpa* subsp. *ionthocarpa* *Banksia montana* *Banksia mucronulata* subsp. *retrorsa* *Daviesia glossosema* *Daviesia pseudaphylla* *Eremophila lactea* *Eremophila subteretifolia* ms *Eremophila verticillata* *Gastrolobium luteifolium* *Grevillea maxwellii* *Isopogon uncinatus* *Lambertia echinata* subsp. *echinata* *Lambertia fairallii* *Lambertia orbifolia* subsp. *orbifolia* ms *Latrobea colophona* *Leucopogon gnaphalioides* *Marianthus sp.* Bremer (N.Gibson & M.Lyons 1776) *Myoporum turbinatum* *Persoonia micranthera* *Scaevola macrophylla* *Verticordia apecta*	*Acacia depressa* *Acacia rhamphophylla* *Adenanthos velutinus* *Apium prostratum* subsp. *philippi* *Banksia oligantha* *Banksia pseudoplumosa* *Boronia clavata* *Conostylis drummondii* *Coopernookia georgei* *Darwinia collina* *Darwinia oxylepis* *Darwinia sp. Stirling Range (GJ Keighery 5732)* *Darwinia wittwerorum* *Daviesia megacalyx* *Daviesia obovata* *Eremophila denticulata* subsp. *trisulcata* *Eucalyptus burdettiana* *Eucalyptus coronata* *Eucalyptus insularis* *Goodenia integerrima* *Grevillea involucrata* *Hibbertia priceana* *Kunzea similis* subsp. *mediterranea* *Leucopogan marginatus* *Muehlenbeckia horrida* subsp. *abdita* *Myoporum cordifolium* *Sphenotoma drummondii* *Stachystemon vinosus* *Verticordia densiflora* var. *pedunculata* *Verticordia fimbrilepis* subsp.	*Acacia awestoniana* *Acacia brachypoda* *Acacia leptalea* *Acacia trulliformis* *Adenanthos dobagii* *Adenanthos ellipticus* *Adenanthos pungens* subsp. *pungens* *Allocasuarina tortiramula* *Andersonia pinaster ms* *Banksia goodii* *Banksia sphaerocarpa* var. *dolichostyla* *Banksia verticillata* *Beyeria sp. Bandalup* *Boronia revoluta* *Cryptandra congesta* *Darwinia calothamnoides* *Darwinia meeboldii* *Darwinia squarrosa* *Drummondita longifolia* *Eremophila denticulata subsp. denticulata* *Eucalyptus merrickiae* *Eucalyptus nutans* *Eucalyptus purpurata* *Gastrolobium lehmannii* *Grevillea fuscolutea* *Grevillea infundibularis* *Kennedia glabrata* *Kunzea similis spp similis* *Lepidium aschersonii* *Marianthus mollis* *Meziella trifida* *Ricinocarpos trichophorus* *Roycea pycnophylloides*	**96**	*Daviesia glossosema* *Muehlenbeckia horrida* subsp. *abdita*	*Acacia brachypoda* *Acacia leptalea* *Acacia rhamphophylla* *Adenanthos dobagii* *Adenanthos pungens* subsp. *effusus* *Adenanthos velutinus* *Andersonia axilliflora* *Banksia anatona* *Banksia brownii* *Banksia montana* *Banksia oligantha* *Boronia revoluta* *Coopernookia georgei* *Darwinia collina* *Darwinia oxylepis* *Darwinia wittwerorum* *Daviesia megacalyx* *Daviesia pseudaphylla* *Eremophila denticulata* subsp. *trisulcata* *Eremophila lactea* *Eremophila subteretifolia* ms *Eremophila verticillata* *Eucalyptus burdettiana* *Eucalyptus insularis* *Grevillea infundibularis* *Grevillea involucrata* *Grevillea maxwellii* *Isopogon uncinatus* *Lambertia echinata* subsp. *echinata* *Lambertia fairallii* *Lambertia orbifolia* subsp. *orbifolia* ms *Latrobea colophona*	*Acacia awestoniana* *Acacia depressa* *Adenanthos ellipticus* *Adenanthos pungens* subsp. *pungens* *Allocasuarina tortiramula* *Andersonia pinaster* ms *Apium prostratum* subsp. *phillipii* *Banksia goodii* *Banksia sphaerocarpa var. dolichostyla* *Banksia verticillata* *Darwinia meeboldii* *Darwinia sp. Stirling Range (GJ Keighery 5732)* *Darwinia squarrosa* *Drummondita longifolia* *Eremophila denticulata* subsp. *denticulata* *Eucalyptus coronata* *Eucalyptus merrickiae* *Gastrolobium lehmannii* *Goodenia integerrima* *Kennedia glabrata* *Lepidium aschersonii* *Meziella trifida* *Myoporum cordifolium* *Stylidium galioides* *Tetratheca aphylla* subsp. *megacarpa* *Verticordia carinata* *Verticordia crebra* *Verticordia fimbrilepis* subsp. *australis* *Verticordia helichrysantha*	**75**

		australis *Verticordia pityrhops* *Villarsia calthifolia*	*Stylidium galioides* *Tetratheca aphylla* subsp. *megacarpa* *Verticordia carinata* *Verticordia crebra* *Verticordia fimbrilepis* subsp. *fimbrilepis* *Verticordia helichrysantha*			*Leucopogan marginatus* *Leucopogon gnaphalioides* *Marianthus mollis* *Myoporum turbinatum* *Persoonia micranthera* *Ricinocarpos trichophorus* *Roycea pycnophylloides* *Sphenotoma drummondii* *Verticordia densiflora var. pedunculata* *Verticordia pityrhops* *Villarsia calthifolia* *Verticordia fimbrilepis* subsp. *fimbrilepis*		
TOTAL	**31**	**40**	**55**	**126**	**4**	**57**	**40**	**101**

3.1.3 Threatened Ecological Communities

A total of six ecological communities in the South Coast Region are listed as threatened on the State TEC Database, though as yet there is no specific State legislation on the listing of ecological communities (Table 3.4). Only one ecological community in the Region, the Montane Thicket of the Eastern Stirling Range, is listed under Commonwealth legislation.

Table 3.4: The Ecological Communities listed as Threatened Ecological Communities (TEC) under State and Commonwealth legislation for the South Coast Region and 30 km Buffer zone.

Conservation Status	State		Commonwealth	
	TEC	No.	TEC	No.
CR	Lake Bryde Montane Thicket of the Stirling Range	2		0
EN	Mt Lindesay – Little Lindesay Vegetation Complex	1	Montane Thicket of the Stirling Range	1
VU	Russell Range Mixed Thicket Complex *Eucalyptus acies* mallee heath Herblands and Bunch Grasslands	3		0
TOTAL		**6**		**1**

3.2 Priority Species and Communities in the Region

Priority species and communities are not listed under legislation but are recognized by DEC as having conservation importance or as near threatened (Section 2.3). Overall 837 Priority fauna, flora and ecological communities occur in the South Coast Region, the majority of which are flora species (Table 3.5). The management and conservation of such a large number of Priority species is logistically difficult if not impossible, highlighting the need for a regional approach to prioritisation of species and management actions.

Table 3.5: The number of Priority (P1-P5) fauna, flora and ecological communities (PEC) that occur in the South Coast Region.

	Priority Category					TOTAL
	P1	P2	P3	P4	P5	
FAUNA	**6**	**7**	**4**	**20**	**2**	**39**
TERRESTRIAL FAUNA	6	7	3	19	2	37
Mammals				4	2	6
Birds		1	1	12		14
Reptiles	2			1		3
Amphibians				1		1
Fish (freshwater)	1		1			2
Invertebrates	3	6	1	1		11
MARINE FAUNA			1	1		2
Mammals				1		1
Birds			1			1
Reptiles						0
Fish						0
FLORA	**133**	**249**	**243**	**153**	**-**	**778**
PEC	**19**		**1**		**-**	**20**

3.2.1 Priority Fauna

Thirty-nine species of fauna in the Region are currently assigned Priority status, the majority of which are terrestrial birds (14 species) (Table 3.5). Invertebrates have the second highest

number of Priority species, many of which are short-range endemics with highly restricted distributions (Harvey 2002) e.g. *Bothriembryon glauteri*, *Bothriembryon brazieri* and *Daphina jolli*.

3.2.2 Priority Flora

The South Coast Region contains 778 species of Priority flora, with numbers quite evenly spread over the categories of P1-P4 (Table 3.5). Sixty of these Priority flora species occur only in the 30 km buffer, or beyond, although further survey may reveal populations of these species within the Region.

3.2.3 Priority Ecological Communities

Twenty Priority Ecological Communities occur in the Region, the majority of which are classified as P1 (Table 3.5). Some of these Priority Ecological Communities have been recommended for listing as TECs, but have not yet been endorsed.

3.3 Distribution of Threatened Species Across the Region

3.3.1 Threatened fauna records

The distribution of records of all threatened terrestrial fauna species across the South Coast Region is shown in Figure 6. This shows that records of threatened fauna species are distinctly concentrated in the western half of the Region. Most of the records east of Hopetoun are largely near-coastal and island (Recherche Archipelago) records. Other gaps in the records include north of the Stirling Range National Park, between Pallinup River and the Fitzgerald River National Park and directly north of the park. There are also few records of marine species in the Region. These gaps in distribution are probably a factor of both the distribution of threatened species and an uneven survey effort across the Region.

3.3.1.1 Threatened Terrestrial Fauna

Records for CR terrestrial fauna species across the South Coast Region occur in the Stirling Range National Park (Stirling Range Rhytidid Snail (Undescribed Rhytidid sp.), the Two Peoples Bay/Manypeaks area (Gilbert's Potoroo (*Potorous gilberti*) and Western Ground Parrot (*Pezoporus wallicus flaviventris*), the Fitzgerald National Park and Cape Arid National Park/Nuytsland Nature Reserve (Western Ground Parrot) (Figure 6). These areas of the Region are also generally the areas with high concentrations of other threatened species, with particularly high concentrations of EN species around the Albany area.

Thirteen threatened fauna species are endemic to the Region, including the three CR terrestrial species (Western Ground Parrot, Gilbert's Potoroo and Stirling Range Rhytidid Snail). Four EN (the Noisy Scrub-bird (*Atrichornus clamosus*), Western Whipbird (western heath) (*Psophodes nigrogularis nigrogularis*), Western Trout Minnow (*Galaxias truttaceus hesperius*), Stirling Range Moggridgea Spider (*Moggridgera sp*.) and six VU (Recherche Rock Wallaby (*Petrogale lateralis hacketti*), Western Bristlebird (*Dasyornis longirostris*), Recherche Cape Barren Goose (*Cereopis novaehollandiae grisea*), Western Archaeid Spider (*Austrarchaea mainae*), Recherche Dugite (*Pseudonaja affinis tanneri*), Sunset Frog (*Spicospina flammocaerulea*)) species are also endemic. Several threatened species, although not endemic, have significant sub-populations or habitat within the Region.

3.3.1.2 Threatened Marine Fauna

There is little information available on the distribution of threatened marine species within the waters of the South Coast Region (includes up to 3 nautical miles off shore), but none of these species are permanent residents in the Region, with possible exception of the sharks.

The Southern Right Whale is the only threatened marine taxon known to breed in the Region. Adult females (cows) migrate to warmer temperate waters from Antarctica after mating to give birth in the austral winter-spring. Along the South Coast, there are numerous localities that provide protected calving areas. Two stretches of coastline in the Region are particularly important for calving cows, between Cheyne Bay to Hopetoun and between Yokinup Bay and Israelite Bay, east of Esperance (Peter Collins and Andrew Halsal pers. comm.).

The South Coast is an important part of the northward migratory route of Humpback Whales, particularly west of the Fitzgerald River National Park. Calving generally occurs off the west coast with the South Coast providing some important areas for resting. However, cows with calves are regularly seen off the South Coast and the young age of some of the calves suggest that they were born in the Region. Also, some juveniles have been known to remain in south coast waters over the migratory period (April to October), not continuing their migratory journey up the west coast (Peter Collins pers. comm.).

The Blue Whales, both the 'True' (*Balaenoptera musculus intermedia*) and the 'pygmy' (*B. m. brevicauda*) subspecies, are infrequently reported in the waters of the South Coast, mainly at Point Anne in the Fitzgerald River National Park, and around King George Sound (inshore of Breaksea and around Seal Island) (pers. obs. Peter Wilkins, Ian Tarbotton, Barb Green and Paul Guest). Blue whale migration is oceanic and specific routes are difficult to determine, with no specific migration routes yet identified in the Australasian region.

The distribution of the two threatened shark species (Great White and Grey Nurse) is relatively unknown within the Region. Both species have broad distributions in temperate and sub-tropical waters. In Western Australia the Grey Nurse Sharks distribution is broadly defined as the coastal waters of the south-west, and the Great White Shark occurs broadly along the southern coast to the North West Cape. It is not known whether they breed in the waters off the South Coast (Commonwealth of Australia 2001b, 2002).

Loggerhead and Leatherback Turtles (*Caretta caretta*, *Dermochelys coriacea*) are occasional visitors to the South Coast, usually as a result of a strong Leeuwin current carrying the animals (both juveniles and adults) southward and becoming washed up on beaches and islands in the Region suffering from exhaustion (Peter Collins pers. comm.).

Sixteen threatened seabird species (Albatrosses and Petrels) have been recorded in waters off the South Coast Region. Little is known about the distribution and foraging areas of these species within the waters of the Region, though all species are known to forage within waters under Australian jurisdiction (with the possible exception of the Amsterdam Albatross), and six of these species breed on islands within Australian waters (Commonwealth of Australia 2001a). However none are known to breed in the South Coast Region. The CR Amsterdam Albatross is uncommon and has only been recorded once or twice in the South Coast Region (pers. comm. Peter Collins).

3.3.2 Threatened Flora Records

The distribution of records of all threatened flora species across the Region is shown in Figure 7. This shows a number of areas without records, including a large part of the northern Fitzgerald River National Park, the coastal areas east of Ravensthorpe and the woodlands and mallee in the north-east of the Region.

Hopper and Gioia (2005) compiled a flora collection density map for the South West of Western Australia based on the number of specimens lodged with the WA Herbarium per 10 km^2 (Figure 5). This shows that the highest flora collection density within the Region is in the Albany area

and surrounds, the Stirling Range National Park and in small areas around Walpole and Esperance.

A comparison of Hopper and Gioia (2005) flora collection density map (Figure 5) and the distribution of records of threatened flora (Figure 7) reveals that the gaps without records in threatened species follow quite closely areas of low collection density for flora. These areas without threatened species records and low collection density could be a result of lower species numbers and/or factors such as lack of survey, difficulty of access and lack of personnel. Although similar data is not available for fauna, similar constraints on fauna survey would suggest that the pattern of collection effort for fauna would be similar to that of flora.

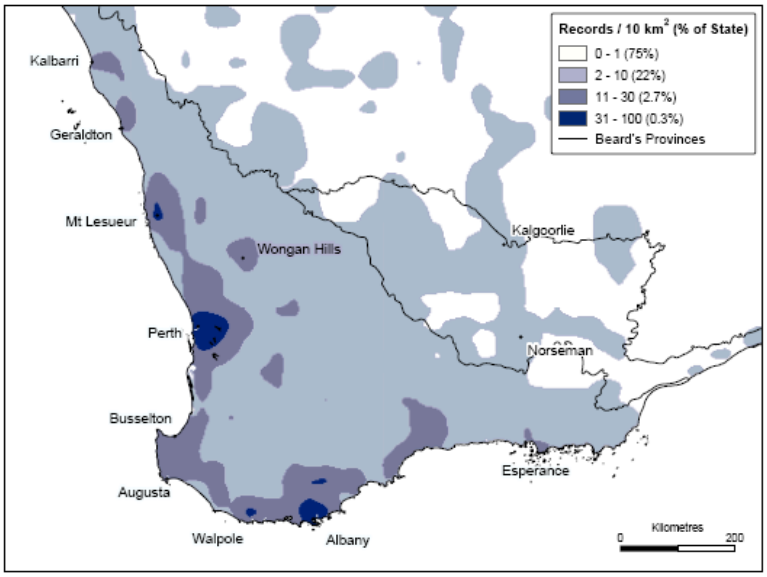

Figure 5: A flora collection density map based on the number of specimens per 10 km 2 lodged with the WA Herbarium (Hopper & Gioia 2005).

A large majority (65%) of the threatened flora that occur within the Region are endemic to the Region, spread quite evenly over CR, EN and VU threat categories (Appendix 1). This reflects the generally patchy nature of south-west Western Australia flora with many species having very restricted distributions e.g. a large number of the CR endemic species in the Region are restricted to the peaks of the Stirling Range.

A further 10% of the threatened flora, although not endemic to the Region, have significant populations or habitat within the Region e.g. sub-populations of *Centroleopis caespitosa* are disjunct from the more northern sub-populations and therefore may constitute important genetic variation for the species. It should be noted that some species may possibly become classed as endemic pending genetic work e.g. *Asplenium obtusatum* subsp. *northlandicum*.

3.3.3 Threatened Ecological Community Records

All the TECs in the South Coast Region are endemic to the Region, except the CR TEC (Lake Bryde) that is only within the 30 km Buffer of the South Coast Region in the southern Wheatbelt region (Figure 7). The other CR TEC (Montane Thicket) is endemic to the Stirling Range. The other four TECs span the Region in the west (Mt Lindesay – Little Lindesay Vegetation Complex), central portion in Fitzgerald River National Park (*Eucalyptus acies* mallee heath) and near Lake Magenta (Herblands and Bunch Grasslands), and east (Russell Range Mixed Thicket Complex).

3.3.4 All Threatened Species Records

The distribution of all threatened flora and fauna species records together again demonstrates that most records are in the western portion of the Region, with few records east of the Ravensthorpe Range, most notably in the inland areas (Figure 8). Other notable gaps in records are in the north-east portion of the Region, north of the Stirling Range and between the Pallinup River and the Fitzgerald River National Park, and directly north of this park.

Despite the existence of gaps in records, it is not expected that areas with high concentrations of threatened species would be uncovered in these gap areas due to the naturally more diverse ecosystems and the greater degree of impact through development in the west of the Region. It can therefore be concluded with some degree of certainty that the general pattern of threatened species distribution across the Region is represented by the spatial data presented here.

3.3.5 Limitation to use of Point Records

The maps of point records were a first attempt to display the distribution of threatened species across the South Coast Region (Figure 6, Figure 7, Figure 8). However at the scale used they cannot show the numbers of threatened species in a given area and are likely to be strongly biased by survey effort. They do however highlight differences between the western and eastern parts of the Region. This is explored further in the threatened species density maps (Section 7.3).

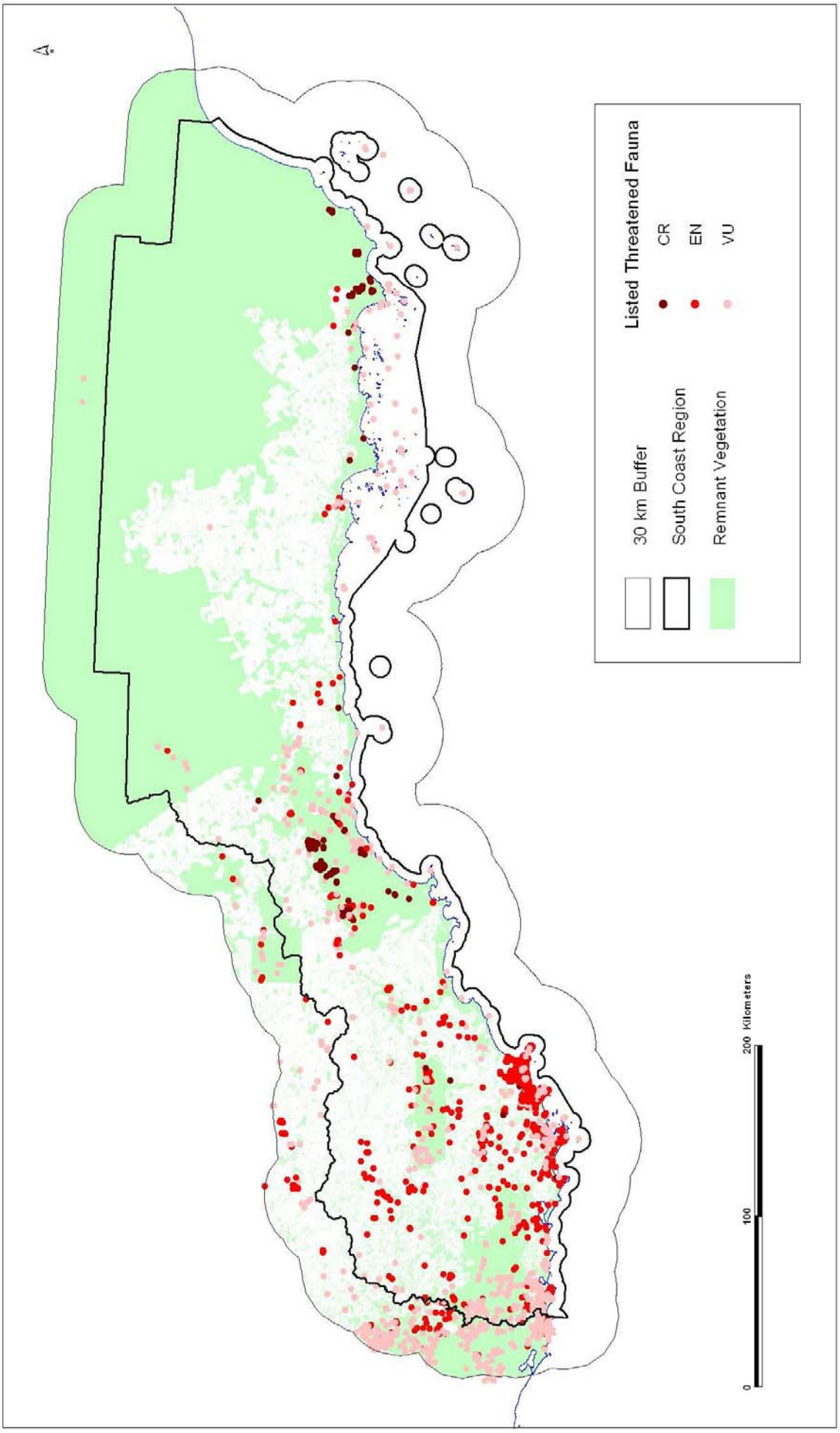

Figure 6: The location records of threatened fauna species (CR – Critically Endangered, EN - Endangered, VU – Vulnerable) across the South Coast Region. This includes all available records from 1980 to 2006.

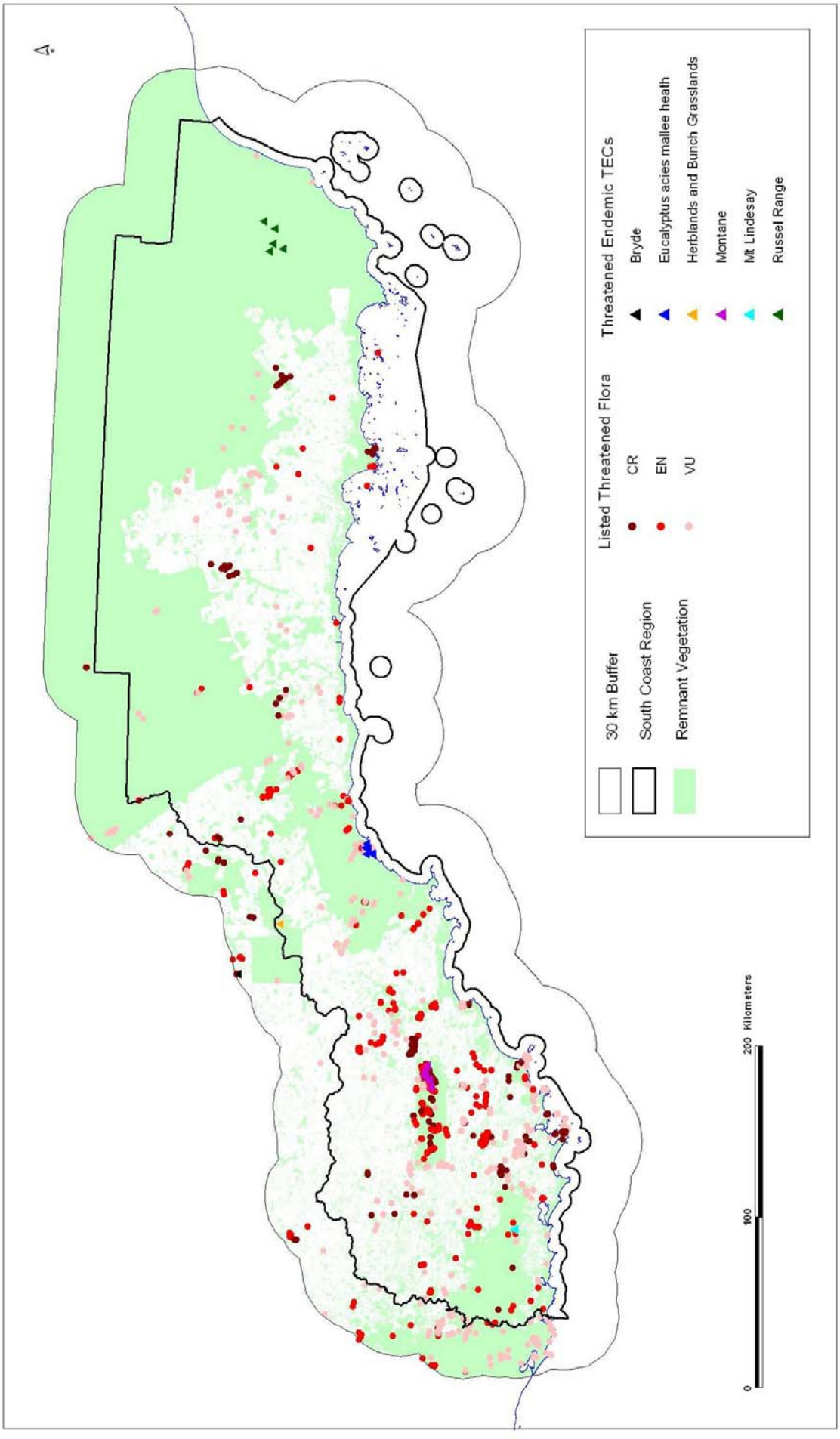

Figure 7: The location records of Threatened flora species (CR – Critically Endangered, EN - Endangered, VU – Vulnerable) and Threatened Ecological Communities (TECs) across the South Coast Region. This includes all available records from 1980 to 2006.

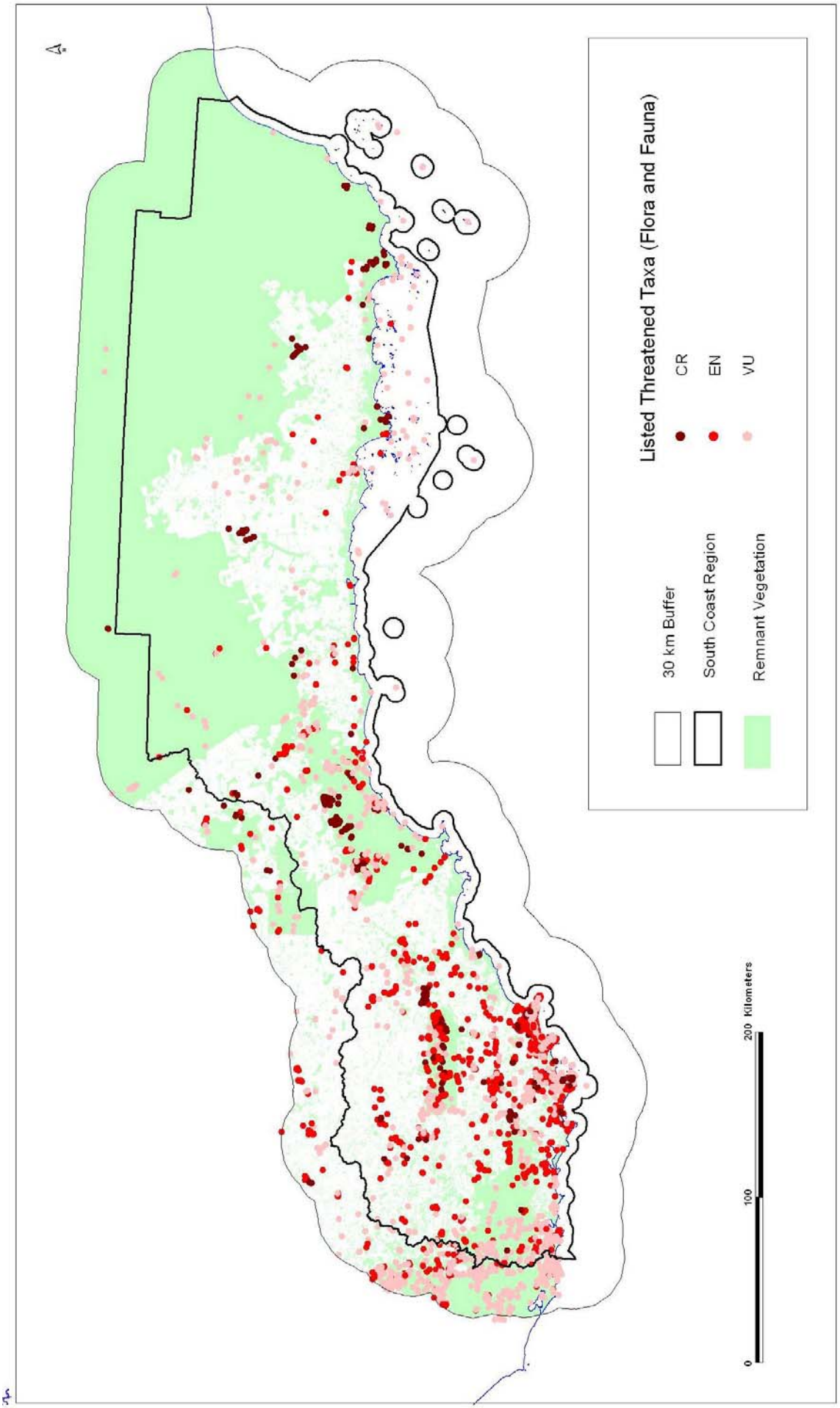

Figure 8: The location records of threatened fauna and flora species (CR – Critically Endangered, EN - Endangered, VU – Vulnerable) across the South Coast Region. This includes all available records from 1980 to 2006.

4 THREATENING PROCESSES IN THE REGION

A threatening process is a factor that threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Key threatening processes, factors that have caused species to become threatened or that are currently threatening the survival of already listed species, are listed under the EPBC Act (Commonwealth of Australia 2008).

A number of threatening processes are known to be in the Region (CALM 1992b; Danks 2004; SCRIPT 2005). The primary threatening processes that are currently known to be having significant impacts on threatened species (referred to in this Plan as PTPs) are:

- Inappropriate fire regime;
- *Phytophthora cinnamomi* infestation;
- Introduced predators (cats and foxes);
- Environmental weed invasion;
- Fragmentation of habitat;
- Small population size;
- Salinisation or altered hydrology;
- Climate change.

Although not identified in this Regional Plan as PTPs, there are other threatening processes that are known to be having low impacts on threatened species, or impacting only a low number of species, including grazing or disturbance by herbivores, competition with invasive species, land clearing, recreational activities, mining, illegal collection, and disease.

This Section provides background on the PTPs and other threatening processes in the South Coast Region and what is currently known about their impact on threatened species and communities within the Region. Further details can be found in relevant Recovery Plans, Management Plans and Action Plans which are listed in Appendix 2.

Climate change is not discussed in this Section, but separately in Section 8. Climate change is an internationally recognised threatening process specifically for montane communities and refugial species that are highly restricted and display little adaptive capacity.

4.1 Primary Threatening Processes

4.1.1 Inappropriate Fire Regimes

Fire is a natural part of South Coast ecosystems and one of the major evolutionary forces affecting the structure and function of these systems. The South Coast is subject to regular summer lightening strikes which ignite intense broad scale wildfires. Aboriginal burning practices are thought to have reduced the incidence of intense summer wildfires through small regular fires that maintained relatively small scale mosaics of burnt and unburnt patches (Hallam 1975 in CALM 1999c). Since European settlement the fire regime reverted back to one of larger scale wildfire events, although in recent years fire management has tried to decrease these large scale wildfires using prescribed burning.

The flora and fauna of the Region have adapted to particular fire regimes (frequency, intensity and season) and so a taxon is threatened if the fire regime is inappropriate for that particular taxon. Species adapted to longer cycles between fire events can be eliminated by frequent, high intensity fire (Danks 2004). On the other hand, long periods without fire can lead to senescence, reduced regeneration and vulnerability to wildfire. No fire regime is optimal for all species, but large scale, intense fires present the greatest threat to species in the Region due to the fragmentation of the landscape.

The fire regime that is required by many threatened flora and some fauna species can be determined by the taxon's traits that allow them to survive fire. For example, *Banksia brownii* plants are killed by fire and as it is non-sprouting it relies entirely on seed for regeneration (Gilfillan & Barrett 2008). These seeds remain in the plants canopy in woody cones which require fire to trigger seed release. Therefore this species requires fire for regeneration, but too frequent fires, before the plants reach reproductive maturity, will cause the local extinction of that population (Galea & Lamont 1993).

Many threatened species in the South Coast Region are restricted to, and thus appear to require, areas of long unburnt vegetation. These includes the Noisy Scrub-bird (*Atrichornis clamosus*) (Danks *et al.* 1996), Western Ground Parrot (*Pezoporus wallicus flaviventris*) (Garnett & Crowley 2000), Gilbert's Potoroo (*Potorous gilberti*) (Courtenay & Friend 2004) and the Stirling Range *Moggridgea* Spider (*Moggridgea* sp.) (Main & Gaull 1993). However, for most of these species, the most suitable post-fire age is not known, neither is whether there is a maximum post-fire age at which the vegetation can support these species (Danks *et al.* 1996).

The season is also an important factor of a fire regime for some threatened species as they are seasonally vulnerable and/or resistant to fires depending on their life cycle and behaviour (Main 1987). For example, some millipedes such as the threatened WA Pill Millipede (*Cynotelopus notabilis*), burrow into the soil during dry conditions and thus may survive if a fire coincides with such climatic conditions (Framenau *et al.* 2008).

Due to the different fire regime requirements of threatened species across the Region, fire management needs to consider the biological response of the species in particular areas. However, this requires an understanding of the most appropriate fire regimes for the threatened species so research into the biological response to fire of threatened species is important.

4.1.2 Phytophthora Cinnamomi Infestation

Phytophthora cinnamomi is a soil-borne plant pathogen that causes dieback disease, a slow moving destructive root disease that results in the death of susceptible plant species through the destruction of their root systems. Over 40% of the plant species in Western Australia are susceptible to the disease, mostly in the plant families Proteaceae, Epacridaceae and Papilionaceae, as well as *Xanthorrhoea* species (CALM 2000). The impact of the disease on plant communities is variable between sites, depending on temperature, soil type, nutrient status and water (Nichols 1998). However, with the death of the susceptible plant species, resistant species such as sedges (Cyperaceae, Restionaceae) become dominant, generally resulting in dramatic changes in species richness and structure of the plant community (Weste & Marks 1987; Shearer & Tippett 1989; Wills 1993; Wills & Keighery 1994; Wilson *et al.* 1994). *P. cinnamomi* is listed as a KTP under the Commonwealth EPBC Act and is covered by a Threat Abatement Plan (Environment Australia 2001).

Phytophthora cinnamomi is widespread in the South Coast Region, particularly in areas that receive more than 400mm annual average rainfall (which is over 50% of the Region). Most of the vegetation types in the Region are dominated by susceptible plant species. The impact of *P. cinnamomi* tends to be lowest in coastal communities on coastal limestone and associated calcareous soils and in forest communities on relatively fertile red earths associated with major valleys. High impacts occur on lateritic soils supporting jarrah (*Eucalyptus marginate*) forest and *Banksia* woodlands associated with leached sands and laterites on the southern sandplains (Shearer 1994).

Over 25% of the threatened flora species in the Region are susceptible to *P. cinnamomi*, and the susceptibility of another 25% of the species is unknown. Four out of the six TECs are dominated by susceptible flora species. *Phytophthora cinnamomi* infestation of an area with a susceptible threatened flora taxon will result in a significant decline and eventual elimination of that population of the taxon. For example, *P. cinnamomi* is prevalent throughout the Stirling Range National Park, where it has caused the local extinction of a number of populations of threatened flora species and is severely reducing numbers and causing a reduction in the health of many other populations.

The impacts of *P. cinnamomi* infestation on threatened fauna in the Region is not well understood, though it is thought that the vegetation structure and floristic changes caused by the pathogen would effect the abundance and composition of fauna in those communities (Wills 1993). Predicted impacts on fauna of *P. cinnamomi* include direct (e.g. seeds, pollen) or indirect (e.g. invertebrates) loss of food sources, loss of habitat in the form of thick ground cover and increased predation risk (Wilson *et al.* 1994; Nichols 1998). A number of threatened fauna species in the Region occur in habitats dominated by flora susceptible to *P. cinnamomi* infestation and so are likely to be impacted by the infestations.

There is currently no known way to eradicate *P. cinnamomi* from an area once it is there. Regular application of Phosphite (phosphonate) to susceptible plants boosts the plant's own natural defences, allowing them to survive within a *P. cinnamomi* infestation. However this is only a relatively short term solution as the Phosphite needs to be reapplied at regular intervals. Therefore the prevention of the spread of *P. cinnamomi* is extremely important.

4.1.3 Introduced Predators (Cats and Foxes)

Predation by European Red Foxes (*Vulpes vulpes*) and Feral Cats (*Felis catus*) has been implicated as a major factor in the decline of Australian mammals that weight between 35-5500g (referred to as critical-weight range (CWR) mammals) (Burbidge & McKenzie 1989; Burbidge & Manly 2002) and some ground nesting birds (Garnett & Crowley 2000). Predation by both foxes and cats are listed as KTPs under the Commonwealth EPBC Act and are covered by National Threat Abatement Plans (DEWHA 2008c, 2008d).

Both foxes and cats are widespread throughout the South Coast Region. The fox has been implicated as a significant cause of the local extinction of several mammals from the Region (e.g. Greater Bilbies (*Macrotis lagotis*), Boodies (*Bettongia lesueur*), Woylies(*B. penicillata*)) (Abbott 2008) and is currently a PTP for most of the remaining CWR mammals. Feral cats are thought to represent a similar threat to native fauna although their impact in the South Coast Region is not as apparent as in arid areas (Danks 2004).

The threatened CWR mammals that occur in the Region are Gilbert's Potoroo (*Potorous gilberti*), Dibbler (*Parantechinus apicalis*), Red-tailed Phascogale (*Phascogale calura*), Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*), Chuditch (*Dasyurus geoffroii*), Numbat (*Myrmecobius fasciatus*), Recherche Rock Wallaby (*Petrogale lateralis hacketti*), Black-flanked Rock Wallaby (*Petrogale lateralis lateralis*), Western Ringtail Possum (*Pseudochierus occidentalis*), Heath Mouse (*Pseudomys shortridgei*) and Quokka (*Setonix brachyurus*). Fox control has been linked to a number of successes in the recovery of most of these threatened species, including the re-discovery of Gilbert's Potoroo (Sinclair *et al.* 1996) and the de-listing of the Tammar Wallaby (*Macropus eugenii*) and Quenda (*Isoodon obesulus fusciventer*) (Morris *et al.* 1998).

Fox predation has been strongly implicated in the decline of the threatened ground-nesting bird the Malleefowl (*Leipoa ocellata*) (Short 2004). Both fox and cat predation is also suspected to be a threat to other ground nesting birds in the Region, particularly those that inhabit more open vegetation types, though the impacts are poorly understood. These include the Western Ground Parrot and the Western Whipbird (western mallee) (*Psophodes nigrogularis nigrogularis*) and the Western Bristlebird (*Dasyornis longirostris*) in Fitzgerald River National Park (Gilfillan *et al.* in prep.).

4.1.4 Environmental Weed Invasion

Environmental weeds are plants that establish themselves in natural ecosystems and modify natural processes, usually adversely, resulting in the decline of the communities they invade (CALM 1999a). The invasion of environmental weeds can have significant impacts including resource competition, prevention of seedling recruitment, alteration to geomorphological processes, alteration of hydrological cycle, changes to soil nutrient status, alteration of fire regimes, changes to the abundance of indigenous fauna and genetic changes.

Environmental weed invasion has been identified as a significant threat to many populations of threatened flora, and to a number of threatened ecological communities within the Region (Brown *et al.* 1998). Weed invasion is of most threat in areas that have been disturbed or degraded, in particular road sides and small remnants. The most invasive environmental weeds in the Region include Bridal Creeper (*Asparagus aspargoides*) Blackberry (*Rubus fruticosa* sensu *lato*), Victorian Tea-tree (*Leptospermum laevigatum*), Watsonia (*Watsonia* sp.) and Pampas Grass (*Cortaderis selloana*). The Porongurup National Park is of particular concern for weeds. The area contains 113 weed species (CALM 1999c) which has resulted in devastating infestations after the 2006/07 fire.

Invasion of environmental weeds is also a significant threat for threatened fauna in the Region, as weeds, in particular woody weeds, change the structure and floristic composition of the fauna's habitat. Woody weeds are particularly a problem when they form monocultures with little structural variation, decreasing the suitability of the habitat for fauna. Key weed species that are likely to have this impact include Victorian Tea-tree (*Leptospermum laevigatum*), Sydney Golden Wattle (*Acacia longifolia)*, Taylorina (*Psoralea pinnata)* and African Boxthorn (*Lycium ferocissimum).*

Aquatic weeds can also severely impact aquatic systems by clogging water courses and preventing transport for instream biota. The Endangered Western Trout Minnow (*Galaxias truttaceus hesperius)* migrates up and down stream during spawning and is potentially significantly impacted by the presence of *Typha orientalis* within the system (Mitchell & Newell in prep.).

4.1.5 Fragmentation of Habitat

Fragmentation through land clearance is a significant threat to threatened species in three ways, through habitat loss, habitat reduction and increased isolation of habitats. In fragmented landscapes features such as the size, shape, heterogeneity, configuration and connectivity of suitable habitat patches have major influences on the persistence of species whose survival and movements are limited by such fragmentation (Hobbs & Yates 2003).

In the South Coast Region approximately 50% of the original vegetation has been cleared, leaving the remaining native vegetation highly fragmented. Despite this large scale clearing, large areas of remnant vegetation still remain, most notably the Fitzgerald River National Park, and the large continuous tracts of remnant vegetation in the north-west. Some of these areas of remnant vegetation are very isolated (e.g. the Stirling Range and Porongurup National Parks) but the Region also contains some important connectivity between other remnants. These include the "Coastal Corridor" spanning approximately 500 km from Walpole in the west to Cape Arid National Park in the east and the "Forest to Fitzgerald Corridor" which is a series of stepping stones of remnants from the Jarrah forest in the west to Fitzgerald National Park (Wilkins *et al.* 2006).

Despite the existence of these large remnants and some degree of connectivity in the Region, the past separation of native vegetation into many small, isolated fragments surrounded by an altered matrix continues to threaten the long-term viability of many species. Small and isolated populations are vulnerable to edge effects, stochastic events (e.g. fire), loss of genetic variation and increased inbreeding, and the Allee effect (in which reproductive capacity drops below a threshold and an organism can no longer replace itself) (Hobbs & Yates 2003).

Little is known about the consequences of fragmentation for threatened flora in the South Coast Region, although there has been some research on a few individual flora species in south-west Western Australia. Lamont *et al.* (1993) demonstrated the Allee effect through decreased seed production in small populations of the threatened species *Banksia goodii*, a mammal pollinated shrub. For the threatened species *Verticordia fimbrilepis* subsp. *fimbrilepis*, a small insect pollinated shrub, populations in isolated fragments were more likely to be vulnerable to stochastic events (such as fire) than factors associated with reproduction such as pollination and seed production (Yates & Ladd 2005; Yates *et al.* 2006).

The consequences of fragmentation on threatened fauna in the Region are also not well known. The isolation of fauna in small populations makes them susceptible to stochastic events and means they can't alter their range or expand in the event of climate change.

4.1.6 Small Population Size

Small population size is a threat as it is a measure of the genetic sustainability or fitness of a taxon as a whole and results in the same vulnerabilities as described under fragmentation (loss of genetic variation, vulnerability to stochastic events and Allee effect).

Species occurring in a number of small completely isolated sub-populations with no interaction between them may experience local population extinctions, perhaps eventually resulting in total extinction, or reduced viability of the population as a whole. However, for most species within the South Coast Region that occur in small isolated sub-populations, insufficient data is available on the degree of isolation between sub-populations to enable any conclusions about the threat of extinction of the whole population through small sub-population size.

The size of the population that will impact on genetic sustainability will differ between plants and animals and between groups within. The IUCN criterion for a Critically Endangered species is <250 mature individuals (plus other criteria relating to declining populations and fragmentation), or <50 individuals alone (IUCN 2001). For plants it is estimated that a total population size of less than 100-200 individuals will likely render the population genetically unviable (David Coates pers. comm.).

Small population size is a significant threat for many of the South Coast Region's threatened species, in particular the Gilbert's Potoroo (estimated 30 individuals in 2003 (Courtenay & Friend 2004)), Noisy Scrub-birds (estimated to have been down to 50 individuals when rediscovered in 1961 (Danks *et al.* 1996)) and *Dryandra montana* (45 adults in four populations (Gilfillan *et al.* 2005a)).

4.1.7 Salinisation or Altered Hydrology

Dryland salinity (hereafter referred to as salinisation) results from the clearing of deep-rooted perennial vegetation and its replacement by annual crops with relatively shallow roots which do not dry out the soil profile as deeply resulting in a rising water table. As a consequence, salt stored in the soil above previous water tables dissolves and rises to the surface, causing, along with water-logging, the death of native vegetation (George *et al.* 1995; Halse *et al.* 2003). Landforms that are particularly vulnerable to salinisation include riparian zones, woodlands and valley floors, wetlands and remnant vegetation in lower parts of catchments.

Western Australia has the largest area of salinisation in Australia and the highest risk of increased salinisation in the next 50 years. An estimated 4.3 million hectares (16%) of the southwest of Western Australia has a high potential of developing salinisation from shallow water tables (NLWRA 2001). In 2000, the risk was predominantly in the eastern wheatbelt in valley floors and adjacent areas. Predicted salinisation expansion by 2050 is mainly in the Great Southern and South Coast regions.

Although there has been much research into the impacts of salinity on agriculture, there has been limited studies on its impact on biodiversity (Dillon & Lewis 2001; Briggs & Taws 2003). However, a recent biological survey of the Wheatbelt zone, from 600 mm annual average isohyet inland to the eastern edge of land clearing (which includes much of the South Coast Region apart from the far south-west) examined the extent to which the biodiversity was threatened by salinisation (Keighery *et al.* 2005). The survey found that approximately 1500 out of over 4000 species are at risk of extinction from salinisation and hydrological changes as they occur low in the landscape, in riverine valleys, freshwater or primarily saline lands (CALM 1999b). Of these 1500 species, 450 are endemic to the agricultural zone.

A recent comparison of salinity hazard and the location data for threatened species in the South Coast Region suggests that salinisation is potentially a significant hazard for aquatic fauna species, eight (one DRF, seven priority) flora species, one TEC and two PECs (Utber & Newell 2008). However, this was only a basic comparison and further research is needed to determine the significance of these results.

Altered hydrology is also a threat to some threatened species in the Region. The introductions of weirs, Blue Gum plantations and run-off into aquatic systems have all impacted the Goodga and Angove Rivers in the Two Peoples Bay Nature Reserve which contains the threatened Western Trout Minnow (Mitchell & Newell in prep.).

4.2 Other Threatening Processes

4.2.1 Other Introduced or Native Invasive Species

An invasive species is one that occurrs, as a result of human activities, beyond its accepted normal distribution and threatens valued environmental, agricultural or other social resources (Commonwealth of Australia 2008). Such species are a threatening process for threatened species through competition, predation and/or habitat alteration. In the South Coast the most significant invasive species include rabbits, pigs, feral horses, goats, honey bees, house mice, black rats, starlings, introduced fish and native invasive species, as the already discussed feral cats and foxes. The impact of these invasive species on threatened species in the Region has in a limited number of cases been observed and in others strongly inferred. The detrimental impacts of rabbits, goats and pigs have been identified as KTPs under the EPBC Act, and all have National Threat Abatement Plans (DEH 2005; DEWHA 2008a, 2008b).

4.2.1.1 Feral Rabbits

At times rabbits (*Oryctolagus cuniculus*) occur in high numbers on deep sandy soils in remnant vegetation on agricultural land in the Region. These remnants provide ideal habitat for rabbits in which they use the native vegetation for cover and graze on the surrounding pasture (Lowe *et al.* 2003). Rabbits also occur throughout large remnants, for example the Stirling Range National Park. Here they are suspected of having a large impact through grazing on threatened flora, including *Dryandra montana* and *Persoonia micrantha* in the Eastern Stirling Range, although Quokkas also occur in this area and may be contributing to this grazing (Gilfillan *et al.* 2005b).

In semi-arid systems rabbits, as a primary prey species, have been shown to have a significant impact on the abundance of foxes and feral cats (Robley *et al.* 2004). However the interactions and influence of rabbit numbers on fox and cat numbers is poorly understood in temperate systems.

4.2.1.2 Feral Pigs

There has been a recent explosion of feral pig (*Sus scrofa*) numbers in the western part of the Region, specifically in coastal swamps of the Denmark area and forest areas around Walpole. They have only become established in the South Coast in the last decade through transportation from established feral pig populations to non-infested areas by recreational hunters (Hampton 2004). Pigs have been implicated in the spread of dieback, destruction of stands of rare flora (Hampton 2004) and disturbance of preferred Quokka habitat (de Tores *et al.* 2007).

4.2.1.3 Feral Goats and Horses

Feral Goats (*Capra hircus*) are known to be extremely destructive to native vegetation due to their non-specific dietary requirements (Environment Australia 1999). Goats were reported in Fitzgerald National Park in the 1990s but subsequently destroyed (Alan Danks pers. comm.). A small number of feral Horses (*Equus caballus*) have been reported in the Cape Le Grand National Park with a larger population of Horses and Camels (*Camelus dromedarius*) known in Cape Arid.

4.2.1.4 Honey Bee

Feral colonies of the Honey Bee (*Apis mellifera*) are widespread throughout the Region. Little is known about their interactions with native flora and fauna, though this may include competition for nectar resources, affecting seed production and competition for hollows with hollow-nesting fauna (Paton 1996). Competition for nesting hollows and killing of nesting females and chicks by feral Honey Bees is considered one of the most significant threats to Baudin's and Forest Red-tailed Black Cockatoos breeding and survival (Chapman 2007).

4.2.1.5 Small Mammals

The House Mouse (*Mus musculus*) occurs across the entire Region. Little is known however on any possible competition this species has with native fauna. It is possible however that its presence may impact positively on Chuditch numbers by providing an alternative food resource.

The presence of the Black Rat (*Rattus rattus*) is of concern particularly on island habitats where seabirds nest. The lack of native predators has resulted in seabirds nesting on the ground resulting in extreme vulnerability of the nests and eggs to predators such as Black Rats. For this reason, Black Rats were eradicated from Mutton Bird Island, near Albany, by DEC to protect the petrel, shearwater and penguin populations on the island (Peter Collins, pers. comm.).

4.2.1.6 Starlings

Common Starlings (*Sturnus vulgaris*) are listed as one of the world's worse invasive bird species (Kirkpatrick & Woolnough 2007). There have been outbreaks of Starlings in the South Coast Region since the early eighties (CALM 1992a) but small populations have recently established near the townships of Munglinup and Condinup (Kirkpatrick & Woolnough 2007). This has raised concern about the potential explosion of this invasive pest species.

The potential impact of the Starling on threatened species in the Region is unknown. Starlings are mainly a threat to agriculture though they have the potential to affect native fauna and flora through competition for nesting hollows and food resources, spread of weed seeds, destruction of roost vegetation and spread of disease (Higgins *et al.* 2000).

4.2.1.7 Fish

Invasive fish are a significant issue for native aquatic diversity. Although currently not in the system, the introduction of non-native fish e.g. *Gambusia,* into the Goodga Creek or Angove River systems would have a devastating impact on the endangered Western Trout Minnow (Mitchell & Newell in prep.). Past practices of introducing non-native fish species for recreation fishing are highly regulated by the Department of Fisheries though not banned.

4.2.1.8 Native Species

In the Stirling Range National Park Quokkas are thought to be a threat to some threatened flora species through over-grazing of regeneration after fire, in particular the large 2000 fire in the Eastern Stirling Range (Sarah Barrett, pers. comm.).

For the threatened Carnaby's Cockatoo competition for nest hollows from the native Australian Shelduck (*Tadorna tadornoides*), Australian Wood Duck (*Chenonetta jubata*) and Grey Teal (*Anas gracilis*) is considered a significant threat (Cale 2002).

4.2.2 Mining

Mineral exploration and mining activities can impact on flora and fauna in a number of ways including clearing of native vegetation or death of individual plants, change in drainage, loss of habitat, habitat fragmentation and potential spread of *Phytophthora cinnamomi*.

The South Coast Region contains a number of mineral deposits, some of which are currently being mined and some of which are prospective. In particular is the Ravensthorpe Range area where there are currently two major mining projects, the Tectonic Resources Gold operation at Kundip and the Ravensthorpe Nickel operations (BHP Billiton) at Bandalup Hill, as well as extensive exploration in the surrounding areas. Due to its unique geology and landform the Range contains a large number of endemic flora species, many of which are just beginning to be

discovered and which are likely to be under threat from activities associated with current mining in the range.

Part of the approvals process for mining activities is an assessment by the Western Australia Environmental Protection Authority (EPA) if threatened flora or fauna are within the location. Permission from the Minister of the Environment is required for any activity that is likely to take any threatened flora or fauna, though there is currently no legislation that protects threatened fauna and its habitat from disturbance from an activity that does not intend to remove or harm individuals of the species.

4.2.3 Recreational Activities

Many of the National Parks and other reserves in the South Coast Region are popular for recreational activities including bushwalking, wildflower photography, bike riding, rock-climbing, and paragliding. Such activities may impact threatened species through the spread of *Phytophthora cinnamomi* through vehicle or foot access, trampling, spread of weeds, wildflower and faunal collection and feeding of wildlife (Kelly *et al.* 2003). The piling of rocks as markers or cairns on rock outcrops is also thought to be a significant threat to the specialised, and often endemic, invertebrates that live on these rock outcrops through the destruction of habitat (Framenau *et al.* 2008).

Specific parks within the Region where recreational activities are having an impact on threatened species are the Stirling Range and Fitzgerald River National Parks. In the Stirling Range, in particular around Bluff Knoll, many threatened flora species (e.g. *Dryandra montana* and the Montane Heath and Thicket TEC) are threatened directly by trampling and indirectly by the potential spread of *P. cinnamomi* (Barrett 2005). Recent increases in human populations in Hopetoun and Ravensthorpe from mining activities have already increased the recreational use in surrounding coastal areas including the Fitzgerald River National Park.

4.2.4 Current Clearing of Habitat

Although widespread clearing of native vegetation for agricultural purposes has largely ceased, clearing still occurs in the South Coast Region for a number of purposes, including road and track maintenance, timber harvesting (such as blue gum plantations), urban growth and farming activities.

Most threatened species in the Region occur primarily on protected reserves and so are not threatened by current clearing of habitat. However a number of threatened flora species have significant populations in roadside vegetation and so are threatened by road works e.g. *Banksia goodii, Banksia brownii, Caladenia bryceana, Banksia pseudoplumosa*.

In the Jarrah/Marri forests in the west of the Region, timber harvesting has the potential to affect the habitat of several threatened species. For example, the Western Ringtail Possum has been found to be at higher abundance in areas not logged or less intensely logged than logged areas (Richardson in prep.).

4.2.5 Illegal Shooting

Illegal shooting is recognised as a threat for the Baudin's and the Forest Red-tailed Black Cockatoos (Chapman 2007). Illegal killing of these species has been known to occur because of damage to pome fruit crops (Baudin's) or damage to blue gum plantations (Forest Red-tailed).

4.2.6 Other Plant Pathogens

Phytophthora cinnamomi is considered a PTP, but there are also other plant pathogens impacting native flora on the South Coast. Many of these species are (normally benign) native and secondary pathogens that only cause significant impacts when a plant or community is already under stress by a process such as *P. cinnamomi*, fire, drought, or fragmentation. Of most concern are several aerially dispersed canker (including *Botryosphaeria* sp., *Pestalotiopsis* sp. and *Zythiostroma* sp.) and the root rot fungus *Armillaria luteobubalina*.

Aerial cankers are native fungi that attack the foliage and stems of plants causing rot. They are currently impacting threatened flora species in coastal Banksia heath and in the Stirling Range National Park (CALM 1999c; Gilfillan & Barrett 2008). Although these are native pathogens there have been examples where their impacts have been epidemic e.g. the aerial canker *Cryptodiaporthe melanocraspecia* nearly wiped out *Banksia coccinea* along the South Coast.

4.2.7 Animal Diseases

Disease is currently not a significant factor in the recovery of threatened species in the South Coast Region, although it is considered a potential factor in the past local extinction of some mammal species (e.g. Marl, Bilby, Boodie and Woylie) (Abbott 2008). Generally little is known about the diseases of the threatened fauna but in some cases, disease has the potential to be a significant threat under certain conditions.

The introduced cestode, *Ligula intestinalis*, is currently a significant threat to the endangered Western Trout Minnow (Mitchell & Newell in prep.). The cestode does not kill individuals, but causes deformities that reduce mobility, increasing it's vulnerability to bird predation. There is no known control or eradication method for the parasite.

4.3 Threats to Marine Species

Threats to marine species have largely been unquantified within the State waters covered by the South Coast Region. All but one of the threatened marine species in the Region are covered by National Recovery Plans, which outline the particular threats impacting on these species on a National scale. The most significant threats in the South Coast Region are probably tourism/recreation, commercial fishing and shipping activity.

The South Coast is a significant region for coastal tourism and recreation including boating, fishing, snorkelling, swimming and whale watching. Whale watching has the potential to be a significant threat to Southern Right and Humpback Whales through boats disturbing the whales, in particular cows suckling calves (Peter Collins, pers. comm.).

Commercial fishing is a threat to marine species through overfishing or bycatch. Occasionally there are whales, seals or albatrosses found entangled in fishing lines, nets and aqua culture lines. This is currently presumed to be a minimal threat to the survival of these species though it is unknown.

The South Coast Region includes relatively large shipping ports at Albany and Esperance. These ports pose significant threats to marine species including oil spills and the introduction of invasive species from unclean ships and ballast waters.

5 THREATENED SPECIES RECOVERY AND THREAT ABATEMENT IN THE REGION

5.1 Roles and Responsibilities

In Western Australia DEC has statutory responsibility to ensure the conservation of flora and fauna, including threatened species. Most threatened species management has been conducted by DEC on DEC managed land. However, as threatened species also occur on other land tenures, the recovery of threatened species relies on the involvement of other conservation groups. Key groups that are involved in threatened species recovery include government agencies, non-government organisations (e.g. Gondwana Link), tertiary institutions, NRM groups, zoos and wildlife parks and community groups (Appendix 3).

DEC relies heavily on volunteers and community groups for assistance with many aspects of threatened species recovery and threat abatement, and the Commonwealth and NRM groups for funding. Volunteers play an important role in threatened species recovery, with many people who volunteer their time to do hands-on work assisting in research and management for threatened species. For example, the Albany-based Gilbert's Potoroo Action Group was founded to provide an avenue for direct community support for the Gilbert's Potoroo recovery program through fund raising, project assistance, providing information and raising public awareness of the potoroo. The Friends of the Western Ground Parrot provide similar support for the Western Ground Parrot recovery program. The Malleefowl Preservation Group conducts Malleefowl research and monitoring, community education programs and provides support for local landholders to address the decline of the Malleefowl and associated habitat.

5.2 Recovery Planning

The South Coast Region has a long history of active threatened species management and research. Since the early 1990's the Recovery Plan/Recovery Team approach has become the norm in threatened species recovery planning, though prior to this protection and management of threatened species was occurring across the Region. The rediscovery of the Noisy Scrub-bird and its subsequent management, including the commencement of translocations in 1983, is an example of threatened species recovery which was primarily instigated by interested groups and research scientists. Captive breeding programs, Stirling Range flora surveys, recognition and listing of threatened flora, Bristlebird and Whipbird research in the 1970s and Chuditch research in the late 1980s are also all examples of recovery actions implemented prior to the adoption of the formal Recovery Plan/Recovery Team approach.

5.2.1 Recovery Plans

There are 75 Recovery Plans (including Commonwealth and State Recovery Plans and Interim Recovery Plans) that relate to threatened species in the South Coast Region, 15 of which are currently only draft or in preparation plans (Appendix 2). Most of these plans have been written by DEC staff working in the Region, or these staff have had a large input into the plan.

These plans cover over half (57%) of the threatened species and ecological communities in the Region (Table 5.1). Nearly all CR species are covered by Recovery Plans, except two flora species, *Latrobea colophona* and *Marianthus sp.* Bremer (N.Gibson & M.Lyons 1776). Most of these Recovery Plans are for single species. The majority of threatened flora species (DRF) are covered under the DEC District Wildlife Management Programs, even though nearly half (46%) of these species have their own single species Recovery Plans.

Table 5.1: The percentage (%) of threatened species and ecological communities in the Region that are covered by either Recovery Plans (RP) or Interim Recovery Plans (IRP) (adopted or in prep.). The numbers in brackets are the number of species or ecological communities that do not have Recovery Plans.

	Conservation Status			Total
	CR	EN	VU	
Fauna	100%	88% (2)	76% (9)	81%
Flora	94% (2)	40% (24)	24% (42)	46%
TECs	100%	100%	0% (3)	50%
Total	95%	54%	43%	57%

5.2.2 Recovery Teams

Recovery Teams oversee the implementation, review progress and make necessary changes to Recovery Plans. A Recovery Team is usually composed of people with expert knowledge of the threatened species including representatives of state and local government, research and teaching institutions, and the community.

There are 23 Recovery Teams for threatened species and ecological communities that occur in the South Coast Region (Appendix 4). All the threatened flora species and TECs are covered by a Recovery Team as Flora and TEC Recovery Teams are set up for each DEC District to cover all the species within that District. Recovery Teams for fauna species are more commonly only concerned with one species but in some cases multiple species (e.g. the South Coast Threatened Birds Recovery Team). Only 57% of the Region's threatened fauna species are covered by an active Recovery Team.

5.2.3 Species that do not have a Recovery Plan

In the South Coast Region, 43% of the threatened species or ecological communities are not covered by Recovery Plans. This has not meant that these species are not being managed as research or monitoring is often being carried out by special interest groups or integrated into routine DEC operations at the District level, and habitat is protected if it occurs within the reserve system. However, not having a Recovery Plan means that there is no overall strategic approach to identifying appropriate recovery actions for that taxon.

An important strategy that DEC uses to assist the listing, prioritising and conservation management of vascular plants is the development of Regional and District Threatened Flora Management Programs. These review the status of threatened priority species in a DEC Region or District, develop local priorities and outline management needs for declared rare and priority species. A similar process has been developed for ranking threatened ecological communities.

5.3 Threatened Species Recovery and Management

The main threatened species recovery and management actions for each of the threatened species and ecological communities in the South Coast Region are listed in Appendix 5. These recovery and management actions generally involve protection of habitat, managing and removing threats, and monitoring of the status of the taxon's status. In general recovery actions for threatened fauna are species specific, whereas many recovery actions for flora cover multiple species that occur in the same location. Threatened species recovery may take many decades and require considerable resources to achieve full recovery of a taxon. Most threatened species recovery programs are on-going though some have resulted in the de-listing of taxon e.g. the Tammar Wallaby and Quenda (Morris *et al.* 1998) and some flora species.

5.4 Threat Abatement Management

The South Coast Region contains many threatening processes impacting on the threatened species and ecological communities (Section 4). The main threat abatement work that is currently being conducted which is directly related to reducing threat to threatened species in the region is summarized in Appendix 5. Most of this work is carried out by DEC on DEC managed land. However, there is a lot of other threat abatement carried out in the region for social and economic reasons (e.g. weed control on agricultural land). Such threat abatement is mainly carried out by organisations other than DEC (e.g. Agriculture Department, CSIRO, NRM groups). Although this work may not be aimed at threatened species recovery its outcomes may have indirect impact on threatened species.

5.5 Research

Research to increase understanding of threatened species and threatening processes in the South Coast Region is carried out by a number of organisations including DEC, CSIRO, universities, Cooperative Research Centres (CRCs), Department of Agriculture, Department of Fisheries, and South Coast NRM. Priorities for research relating to threatened species are outlined in Recovery Plans and implementation is dependent on funding. The main research that is currently being conducted in the Region relating to threatened species is included in Appendix 5. Research into threatened species is important for informing adaptive management. The dissemination and accessibility of this data for use by management groups is also vital for effective and efficient threatened species recovery.

Research into threatening processes may have a focus other than threatened species e.g. salinity and weeds for agricultural production and hence is carried out by agencies other than DEC, e.g. CSIRO, Department of Agriculture, Department of Water, Department of Fisheries. This research is still beneficial to threatened species with increased understanding of location and potential impacts of the threatening process.

Biological surveys not necessarily focused on threatened species can also indirectly assist in increasing knowledge of threatened species and threats. The recent biological survey of the Wheatbelt (Keighery *et al.* 2005) provided information on the distribution of many groups of organisms and the threat of salinisation for a large part of the Region.

6 ISSUES RELATING TO CURRENT THREATENED SPECIES RECOVERY IN THE REGION

6.1 Issues Relating to Current Approaches to Threatened Species Recovery

A number of issues in the current approaches to threatened species recovery and threat abatement have been identified that are currently impediments to threatened species recovery on a regional scale. Essentially these are related to lack of:

- prioritisation of the allocation of the limited resources,
- collaboration/coordination of recovery actions between individual threatened species,
- coordination of threat abatement programs across tenures,
- knowledge of many of the threatened species and threatening processes, and
- dissemination of information on threatened species recovery and threat abatement.

The issues listed below are generalisations for recovery and threat abatement programs across the Region, and may not be issues for some particular programs. This Regional Strategic Management Plan addresses many of these issues through strategic management actions in Section 9.

6.1.1 Single Species/ Multi-species Recovery Planning

Issues relating to the current Recovery Planning Approach

- Recovery Plans are written and implemented in isolation from each other, even though many of the species occur in the same area, may be impacted by similar threats and require similar abatement/recovery actions.
- There is no strategic approach to prioritising the writing of Recovery Plans or the implementation of recovery actions between flora, fauna or TECs, except the basic priorisation of species according to conservation status.
- Ineffectual review process for success/failure of Recovery Plans and their implementation, even though this process is an action in most Recovery Plans. Many Recovery Plans are old and require reviewing and updating.
- There is no systematic approach to this review process for the success/failure of a recovery plan or a 'database' that highlights those plans needing review, those species still declining with a plan or those species responding positively to the recovery actions.
- There is no monitoring and evaluation of Recovery Teams or their effectiveness.
- There is little collaboration between districts in terms of threatened species data.
- Some groups, such as invertebrates and fungi, are significantly under-represented in survey effort and threatened species nomination proposals.

6.1.2 Threatening Process Abatement

Issues relating to current Threatening Process Abatement

- A lack of coordination of threat abatement programs between tenures, particularly in relation to 'mobile' threatening processes. This negates much of the work conducted, e.g. a lack of weed control on a private property could directly impact the success of a weed control program in an adjacent reserve.
- There is limited amount known about the susceptibly and response of most individual threatened species/communities to many of the primary threatening processes.

- Spatial data on the distribution of many of the primary threatening processes is not available, or many of these processes would be difficult to spatially represent.
- Limited ability within the Region to identify any responses of threatened species to climate change due to a lack of suitable long term data.

6.1.3 Regional Capacity

Issues relating to the current Regional Capacity

- There is little to no coordination of threatened species recovery across the Region, in part due to a lack of capacity to do so.
- There is no central database that contains all the information on threatened species status, monitoring results, significant populations, threat response etc. This limits adaptive management for changes in status and review of management practices.
- Funding for threatened species recovery and threat abatement is generally short term, making longer term actions difficult, if not impossible, to implement.
- There is limited ability for community groups to be trained in monitoring techniques and educated on threatened species recovery across the Region.
- There is limited ability to disseminate information on threatened species recovery to land managers.
- there is no universal communication strategy to provide landowners and natural resource managers with information on threatened species and methods of protection.

6.2 Directions for a Regional Approach

Two directions are seen as the key to increasing the effectiveness and efficiency of threatened species recovery and threat abatement across the South Coast Region. These included:

- Prioritisation of threatened species/ communities and the identification of significant areas for threatened species for more efficient allocation of resources and;
- Increasing regional capacity for threatened species recovery to increase the ability for adaptive management and coordination of current and future recovery and threat amelioration projects.

7 PRIORITISING THREATENED SPECIES RECOVERY AND THREAT ABATEMENT

Allocation of resources for threatened species recovery in the Region has been, in many cases, *ad hoc* with many species receiving support due to their charisma rather than conservation status. Establishing priorities and developing recommendations for threatened species and ecological community recovery on a regional scale should lead to addressing some of the issues in the current approach to threatened species recovery planning identified in Section 6 and more effective resource use.

Key to a regional approach to threatened species recovery is therefore developing a more efficient approach to prioritising threatened species recovery and threat abatement across the Region. The following three criteria have been used to identify these regional priorities:

1. The status and regional significance of threatened species and ecological communities;
2. The distribution of threatened species and ecological communities;
3. The vulnerability of threatened species and ecological communities to threatening processes.

These three criteria were used to identify regional priorities for threatened species recovery and threat abatement in three ways:

- **Significant Threatened Species and Ecological Communities** (Section 7.2)
  By prioritising individual species according to their distribution (degree of endemism) and conservation status, we are able to identify the significant species whose recovery is most dependent on the Region.
- **Key Threatened Species Areas** (Section 7.3)
  By identifying the areas where threatened species are concentrated and where threatening processes are having the greatest impact (or species are most vulnerable), we are able to locate areas of regional significance.
- **Primary Threatening Processes** (Section 7.4)
  By identifying the threatening processes that are having the greatest impacts or affect the most threatened species/communities we are able to prioritise the threat abatement work and resilience building actions for threatened species in the Region.

7.1 Development of GIS Tool

The concept and prototype of a GIS tool that allows the distribution and significance of threatened species and threatening processes to be mapped spatially across the South Coast Region was developed as part of this Regional Plan. This GIS tool, and its use for Regional Planning, is further discussed in Sections 7.3 to 7.4.

The prototype of this GIS tool was developed in April 2006 using ArcGIS 3.x. Limited time and resources available has prevented this prototype from been further developed or up-dated. Even so, it provides an example of how this tool could be used for increasing the efficiency of threatened species recovery and threat abatement on a regional scale. It is planned to further develop this GIS tool as a package that could be used by land managers at different scales with detailed interactive spatial, biological and threatened species response data.

7.1.1 Data

7.1.1.1 Threatened Species Distribution Data

The distribution of the threatened species and ecological communities data used for Section 7.2 is current to April 2008, while analysis for the GIS tool in Sections 6.3 and 6.4 was conducted using data current to April 2006. This data was primarily obtained from the Species and Communities Branch of DEC, though additional data points were sourced from the Western Australian Museum, Western Australian Herbarium, and the Malleefowl Preservation Group. The only marine taxon included in this analysis is the Southern Right Whale, due to the lack of accurate and comprehensive spatial data on other marine threatened species.

The GIS tool is based on a 5 km grid over the Region. In this way, the exact locations of the threatened species and ecological communities are not included in the tool, due to the sensitivity of some of this data.

7.1.1.2 Primary Threatening Processes Distribution Data

The identification of areas in the landscape that are susceptible to particular threatening processes requires regional scale mapping of the threat. Such data is available for *Phytophthora cinnamomi* (DEC 2006b), salinisation (NLWRA 2001) and native vegetation (DAWA 2007). Broad scale mapping is available for climate change (IOCI 2005), feral animals (including cats and foxes) and some weeds (BRS 2003). Distribution data is not available for the other PTPs, either due to the difficulty in spatially representing some PTPs (e.g. small population size), or the data is unavailable. For fire, the location of past fires is mapped by DEC, though in the South Coast Region this only includes fires for approximately the last 20 years and does not provide data such as the fire history for the area or fire intensity.

7.2 Identifying Significant Threatened Species and Ecological Communities.

DEC currently prioritises threatened species by their conservation status according to IUCN criteria (as per CALM Policy Statement no. 50) (Section 2), but due to the large number of threatened species in the South Coast Region, further prioritisation is required. Therefore it was determined to prioritise species according to two criteria: a taxon's conservation status and its level of endemism to the Region.

Level of endemism to the Region has been used as a criterion for prioritising threatened species as it is an indication of their dependence on the Region for their conservation. Table 7.1 shows the distribution categories used to classify the level of endemism of each of the threatened species and ecological communities.

The conservation status and distribution category of each threatened species and ecological community within the South Coast Region are included in Appendix 1. Over half (52%) of these threatened species and ecological communities are endemic to the Region (category 1). As such their conservation is solely dependent on the Region and are therefore considered of high priority (Table 7.2). A further 14% are near-endemic (category 2) or have significant populations or habitat within the Region (category 3). The recovery of these species is also considered a priority as their conservation is largely dependent on the Region.

Table 7.1: Distribution categories used to classify the level of endemism to the South Coast Region of the threatened species and ecological communities.

Category	Description
1. Endemic	Species or ecological community whose current distribution is solely within the Region (NB: includes species which have translocated populations outside of the Region but which are not yet self-sustaining)
2. Near-endemic	Species or ecological community whose current distribution is almost solely (> 80%) within the Region
3. Non-endemic with significant sub-populations or habitat in the Region	Species or ecological community that is not endemic to the Region but has significant populations or habitat in the Region which, if not conserved, would severely reduce the recovery of the taxon as a whole. Significant sub-populations or habitat include: breeding or feeding habitat, migratory paths, geographically disjunct or genetically distinct populations, least threatened sub-populations, or the only mainland sub-population
4. Non-endemic	Species that are not endemic or near-endemic to the Region and have no known sub-populations or habitat in the Region that are considered essential to the survival of the taxon
5. Buffer only	Species or ecological community occurs only in the 30 km Buffer

Table 7.2: The number of threatened species and ecological communities (State and Commonwealth listed) within each of the distribution categories (Table 6.1) in the South Coast Region.

Conservation Status	Distribution Categories				
	1	**2**	**3**	**4**	**5**
State Listed					
Critically Endangered	26	0	3	2	6
Endangered	30	3	6	9	10
Vulnerable	40	5	10	27	13
Total	**96**	**8**	**19**	**38**	**29**
Commonwealth Listed					
Critically Endangered	4	0	0	0	2
Endangered	42	2	7	9	12
Vulnerable	24	4	7	23	9
Total	**70**	**6**	**14**	**32**	**23**

7.2.1 Prioritising the Development of Recovery Plans

The above categorisation of threatened species and ecological communities in the Region could be used to prioritise the writing of single and multi-species Recovery Plans. Currently 20 Critically Endangered or Endangered species within the distribution categories 1 and 2 do not have Recovery Plans (Table 7.3). Therefore the development of Recovery Plans for these species is considered a priority.

Table 7.3: Critically endangered and endangered species that are endemic or near endemic to the South Coast Region that do not currently have Recovery Plans. The development of Recovery Plans for these species is considered a priority.

Conservation Status	Distribution Categories	Threatened Species
Critically Endangered	1. Endemic	*Latrobea colophona*
		Marianthus sp .Bremer (N.Gibson & M.Lyons 1776)
	2. Near-endemic	*Cynotelopus notabilis*
Endangered	1. Endemic	*Adenanthos velutinus*
		Apium prostratum subsp. phillipii
		Boronia clavata
		Coopernookia georgei
		Commersonia sp Mt Groper
		Darwinia sp.Stirling Range (G.J.Keighery 5732)
		Daviesia obovata
		Dryandra pseudoplumosa
		Eucalyptus burdettiana
		Eucalyptus coronata
		Eucalyptus insularis
		Hibbertia priceana
		Kunzea similis sp mediterranea
		Myoporum cordifolium
		Verticordia fimbrilepis subsp. Australis RFA
		Verticordia pityrhops
		Xyris exilis

It has been identified that a collation of all recovery actions from current Recovery and Management Plans and Plans could also be an important process in prioritising recovery planning (Section 9.3). This would ensure that current recovery actions are not overlapping or conflicting and would enable further prioritising of recovering planning. For example *Latrobea colophona* is one of only two critically endangered flora species without a Recovery Plan and therefore writing a Recovery Plan has been identified in Table 7.3 as a priority. Yet *Latrobea colophona* is part of the Montane Heath TEC of the Stirling Range and so as such receives protection under the TECs Recovery Plan, hence reducing the urgent need for an individual Recovery Plan.

7.3 Prioritising Regional Threatened Species Areas

The distribution and density of threatened species and ecological communities across the South Coast Region has been used to identify and prioritise areas for threatened species management at a regional scale. The GIS tool developed to do this (Section 7.1) is able to be used at different scales and can be focused on different aspects of an area or threatened species.

7.3.1 Threatened Species Density Grids

As the basis of the GIS tool, a Threatened Species Density Grid was developed in order to display the pattern of threatened species distribution and density on a regional scale. The Region was divided into 5 km grid squares for which the number of threatened species and ecological communities occurring in each grid square was determined. This enabled the areas of high and low threatened species density across the Region to be identified.

The Threatened Species Density Grid for all threatened species (Appendix 7 Figure 1) shows that the highest density of threatened species occurs in the eastern Stirling Range with four grid cells in the highest category (10-18 species). In addition, one TEC (Montane) occurs within the grid that covers Coyanarup Peak and Bluff Knoll. The high threatened species density and presence of a TEC makes this an area of high importance for threatened species and communities.

Another area of high threatened species density is the Two Peoples Bay/Manypeaks area. Here, one grid at the eastern end of Mt Manypeaks falls into the highest category with 11 species. In addition, five grids in this area fall into the second highest category (6-9 species). No TECs occur in this area, but it is considered a high priority in terms of the density of threatened species.

The Fitzgerald River National Park and Ravensthorpe Range both contain grids in the second highest category (6-9) species. In the Fitzgerald River National Park these grids occur in the north-west section, the mountain ranges in the southern coastal area of the park (Thumb Peak and East Mt Barren). In the Ravensthorpe Range the area just north of Kundip Nature Reserve contains six threatened species.

When only threatened fauna is included in the Threatened Species Density Grid (Appendix 7 Figure 2), both similarities and differences to the density of all threatened species are apparent. Only three grids are of the highest threatened fauna density category (8 species), one at the eastern end of Mt Manypeaks (corresponding to a highest category grid for total threatened species density), one encompassing Mt Gardner at Two Peoples Bay Nature Reserve and one in an urban area of the City of Albany. Whilst the former two areas are well known as strongholds for a large number of threatened fauna (Gilbert's Potoroo, Noisy Scrub-bird and Western Bristlebird), the high density in the urban area is surprising. Further examination of this grid reveals that it encompasses an area of King George Sound in which two species of Albatross have been recorded and also Lake Seppings where Australasian Bitterns have been sighted.

When only threatened flora density is included in the Threatened Species Density Grid (Appendix 7 Figure 3), both similarities and differences to the density of all threatened species are apparent. As with all threatened species the eastern Stirling Range still emerges as the most significant area in the Region, and is the only area containing highest category grid cells. These grid cells correspond to the highest category grid cells when all threatened species are considered. The eastern Stirling Range is also the only area in the Region containing second highset category grid cells. This demonstrates the strong contribution of threatened flora species to the high overall threatened species density in this area.

The Threatened Species Density Grid has been designed so that subsets of the threatened species density dataset (e.g. endemic species, Critically Endangered species) can be viewed separately. Also, once development of this GIS tool has been completed, the species that occur in each grid square will also be able to be determined.

7.3.2 Key Regional Threatened Species Areas

The Threatened Species Density Grid tool was used to identify and prioritise important areas for threatened species management on a regional scale, based on the number of threatened species or ecological communities in an area. These important areas were identified by defining areas that encompassed all the 5 km grid squares that contained at least one threatened species or ecological community. The areas were also defined by any natural clumping of grid squares or by natural landscape features e.g. Stirling Range.

Twenty-seven Threatened Species Areas were identified across the Region (Appendix 7 Figure 4). The number of threatened fauna, flora and ecological communities that occur within each of these regions is shown in Table 7.4. The Stirling Range, Albany and Fitzgerald areas contain the highest number of threatened species and therefore are considered priority or key areas. The highest number of flora species occurs in the Stirling Range while the highest number of fauna occurs in the Albany area. The areas containing small numbers of threatened species are important for smaller scale conservation initiatives and provide the opportunity for community based conservation projects.

Table 7.4: The number of threatened species (fauna, flora and ecological communities) that occur with each of the Threatened Species areas in the South Coast Region and the 30km buffer around the Region. These areas were identified using the Threatened Species Density Grid tool.

Threatened Species Areas	Number of Threatened Species			
	Flora	Fauna	TEC	Total
Stirling Range	28	9	1	37
Albany	15	18	0	32
Fitzgerald	18	10	1	29
Pallinup - Corackerup	11	7	0	18
Porongurup	12	4	0	16
Cranbrook	8	5	0	13
Mt Lindesay	4	8	1	13
Ravensthorpe Range	6	6	0	12
Denbarker	8	3	0	11
Oldfield	5	1	0	6
Cape Le Grande	2	2	0	4
Beaumont	4	0	0	4
Cape Arid	0	4	0	4
Frank Hann	2	2	0	4
Grass Patch	3	1	0	4
Esperance	1	2	0	3
Recherche	2	3	0	5
Nuytsland	1	1	0	2
Lake Shaster	1	3	0	4
Russell Range	0	0	1	1
Dundas	0	1	0	1
Munglinup	1		0	1
30km buffer zone				
Walpole	11	13	0	24
Muir-Unicup	14	9	0	23
Lake Magenta-Lake King	12	4	2	18
Southern Wheatbelt	7	7	0	14
Peak Charles	1	0	0	1

Five of the Threatened Species Areas (Muir-Unicup, Walpole, Southern Wheatbelt, Peak Charles and Lake Magenta- Lake King) fall largely within the 30 km buffer of the Region (Table 7.4, Appendix 7 Figure 4) and therefore are flagged here as being important areas for threatened species management but are excluded from the prioritisation process for the Region. It is important to note that although these areas were not included in the Regions prioritisation, they are significant areas for threatened species, particularly Walpole and Muir-Unicup, and should be prioritised for cross-regional management.

The Threatened Species Areas can be prioritised by the conservation status and distribution categories (level of endemism to Region) (Section 7.2) of the threatened species that occur in the

area (Figure 9; Figure 10). The importance of the Stirling Range as an area is highlighted due to it containing high numbers of both Critically Endangered and endemic species, mainly flora. Consideration of the conservation status and distribution categories of the species also indicates the importance of some of the areas with low numbers of threatened species overall. For example although Denbarker is ranked ninth for total number of species it contains the third highest number of Critically Endangered species. It should also be noted that although three of the areas are considered regional priorities (Stirling Range, Albany and Fitzgerald) if recovery actions were concentrated on all the other areas combined we would potentially be protecting more species than if recovery actions were focused specifically on those three priority areas.

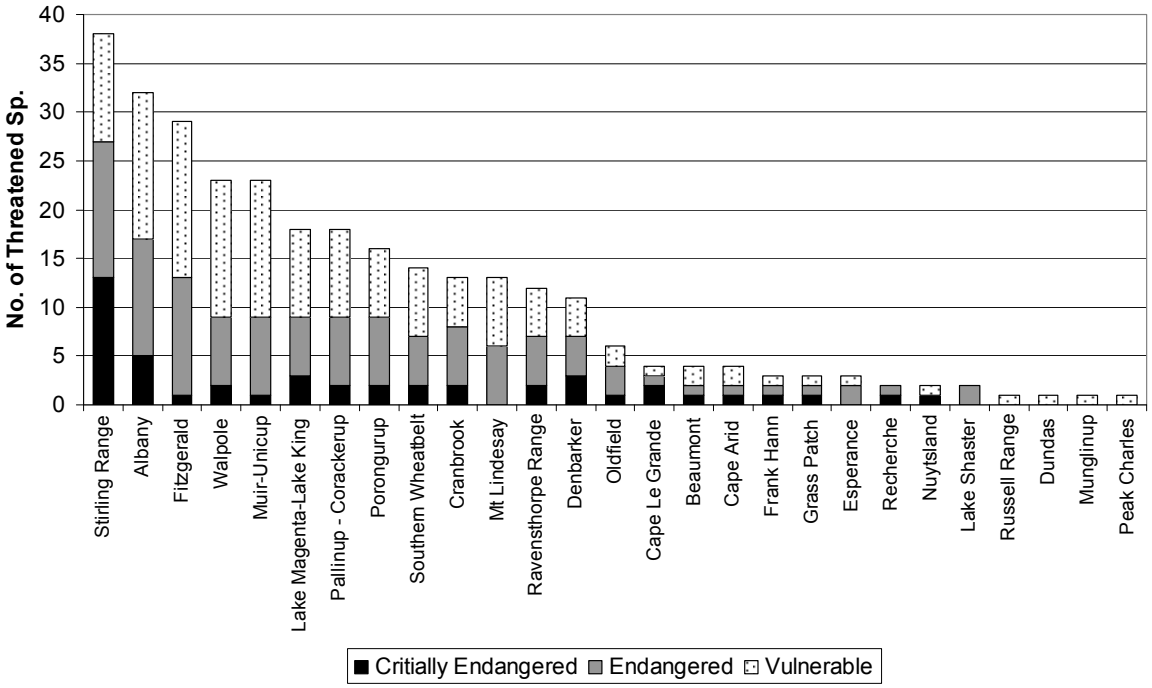

Figure 9: The number of each conservation status (Critically Endangered, Endangered or Vulnerable) of the threatened species that occur in each of the Threatened Species areas in the South Coast Region.

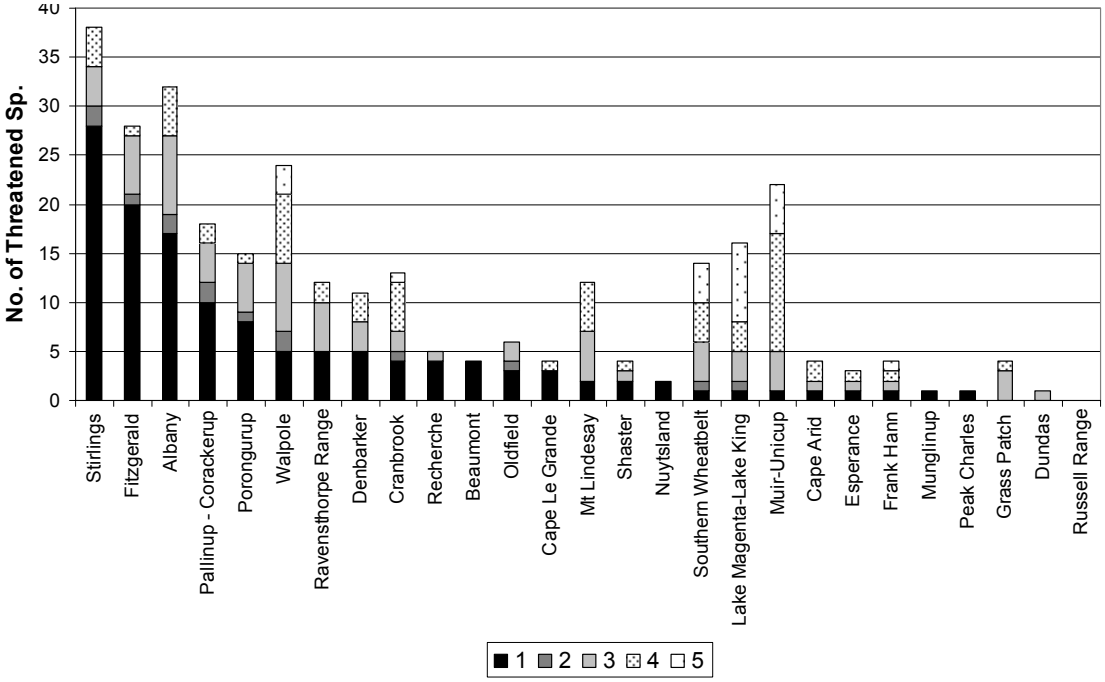

Figure 10: The number of each distribution category (level of endemism to the Region) of the threatened species that occur in each of the Threatened Species areas in the South Coast Region.

This analysis and priorisation has identified three key areas (Stirling Range, Albany and Fitzgerald) as highest priority due to them containing the highest numbers of threatened species with the most regional significance, with the next highest (Pallinup and Porongurup) having substantially lower numbers of species. The Threatened Species Density Grid and this analysis could later be used for future prioritisation of areas as resources become available.

7.4 Primary Threatening Processes

The South Coast Region contains many threatening processes (Section 4), some of which have a greater impact on threatened flora, fauna and TECs than others. The threatening processes that were known to impact to some degree the most threatened species in the Region were classified as the Primary Threatening Processes (PTPs). These are:

- *Phytophthora cinnamomi*;
- Inappropriate fire regime;
- Introduced predators (cats and foxes);
- Salinisation or altered hydrology;
- Fragmentation of habitat;
- Small population size;
- Weed invasion;
- Climate change.

Other threats occurring in the Region, although not considered PTPs, may have significant impacts on a small number of species or in restricted areas.

To identify the vulnerability of threatened species and ecological communities to the PTPs a Threat Matrix has been developed as part of the GIS tool. The following Section details the development of the Threat Matrix and the PTPs identified to currently have or could potentially have the most significant impacts.

7.4.1 Threat Matrix

The Threat Matrix has been developed to identify the vulnerability of threatened species and ecological communities to the PTPs in the Region. This matrix categorises the degree of impact or vulnerability of each species of threatened flora, fauna and ecological community to the main threatening processes in the Region and then identifies the processes that most significantly threaten the most species/communities.

In the Threat Matrix each threatened species and ecological community is categorized as either Extreme, High, Low, None/Unlikely Impact or Insufficient Data for the expected impact of each threatening process based on one or more of the following criteria:

- the biological response (of the species or component species or its habitat) to the threat;
- the distribution, size and number of sub-populations across the landscape;
- the degree of current impact of the threat;
- the risk of occurrence to the threat.

Each threatening processes is unique and our degree of knowledge of each differs, therefore a different number of the above criteria were used for each threatening process. For example the degree of susceptibility to *P. cinnamomi* is known for many species in the Region, however a species susceptibility to weed competition is generally not known. Therefore an assessment of the degree of threat of weed invasion has to be made on different criteria (current impact) to that of *P. cinnamomi* (biological response). The specific criteria for each threatening process are included in Appendix 6.

7.4.2 Significant Threatening Processes

The Threat Matrix Tool identified climate change and inappropriate fire regimes as the most significant PTPs for threatened flora, fauna and ecological communities alike (Figure 11). Introduced predators (cats and foxes) was identified as the next highest impact threat on fauna, while small population size was next for flora and *P. cinnamomi* for TECs.

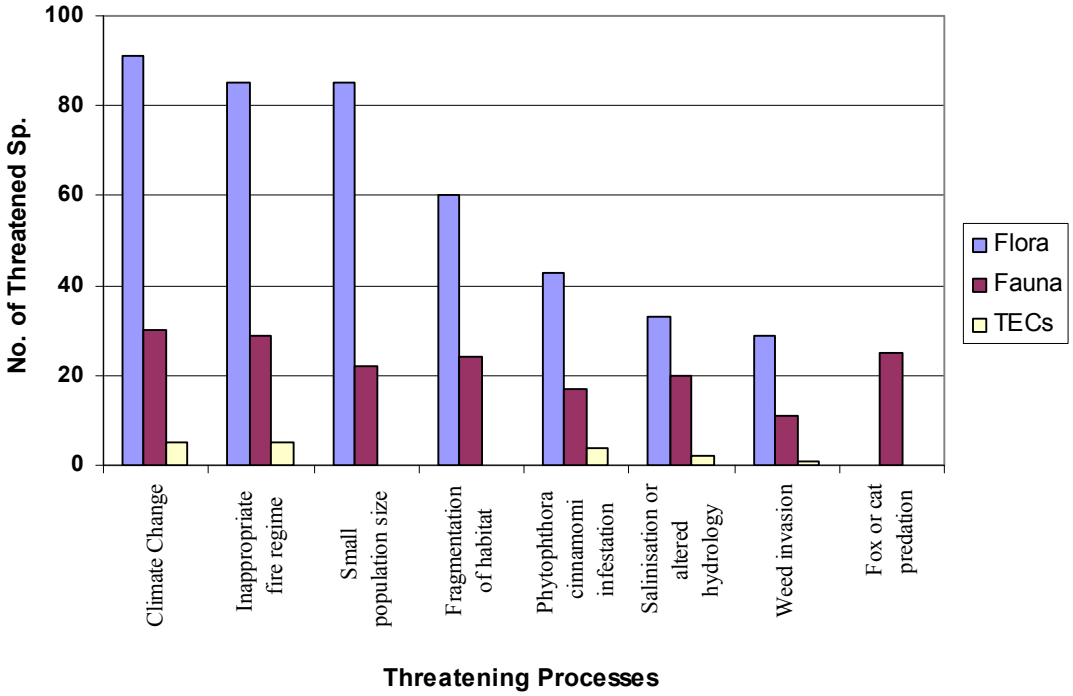

Figure 11: The number of species of flora, fauna and TECs in the South Coast Region that the Threat Matrix Tool identified as vulnerable (combined extreme, high and low categories) to the Primary Threatening Processes.

Although climate change was identified as a significant threatening process, it has been excluded from any further analysis of the Threat Matrix tool due to the lack of data and the complexity of assessing vulnerability of individual species to climate change. Climate change as a threatening process is discussed in further detail in Section 8.

By separating out the categories of vulnerability from the Threat Matrix we are better able to see the threats that are presently or have the potential to have the greatest impact on threatened species (Figure 12; Figure 13; Figure 14). The most significant PTPs for each species group (threatened flora, fauna and TECs), as based on the Threat Matrix's extreme and high categories of vulnerability and threat, are shown in Table 7.1. The differences between this list of PTPs for each species group and those determined by combining the Threat Matrix categories (Figure 11) highlights the possible misinterpretations from combined analysis. For example from the combined figure of threat impacts (Figure 11), *P. cinnamomi* was ranked fourth (excluding climate change) for its impact on flora yet it has the second highest number of 'Extreme' categories on the threatened flora species of the region (Figure 13).

The Threat Matrix could also be used to identify the threatening processes for which there is a lack of information on the responses of particular threatened species or communities to that particular threat. Although the susceptibility to *P. cinnamomi* is known for many flora species, this tool has shown that the susceptibility of over 30% of threatened species is unknown. Also, of particular interest this matrix has indicated that very little is known on TEC responses to threatening processes, in particular to salinisation and weed invasion (Figure 14).

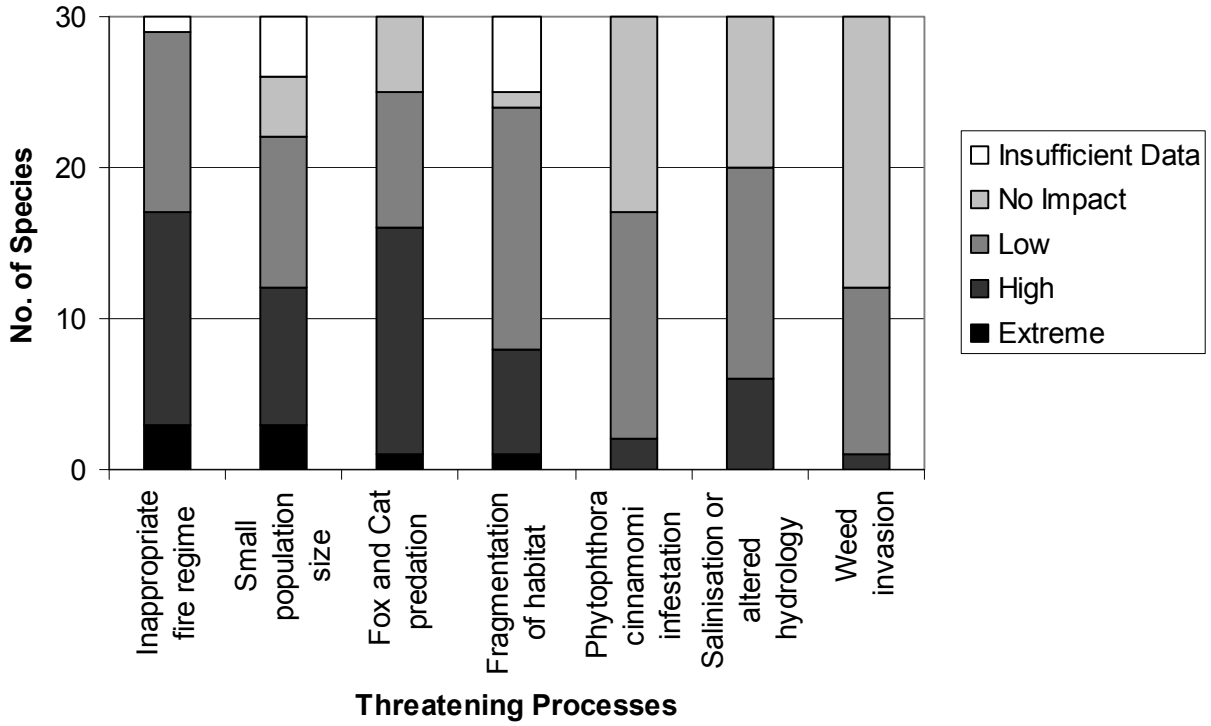

Figure 12: The number of species of fauna in the South Coast Region that the Threat Matrix Tool classified as Extreme, High, Low, None/Unlikely Impact or Insufficient Data vulnerability to particular threatening processes.

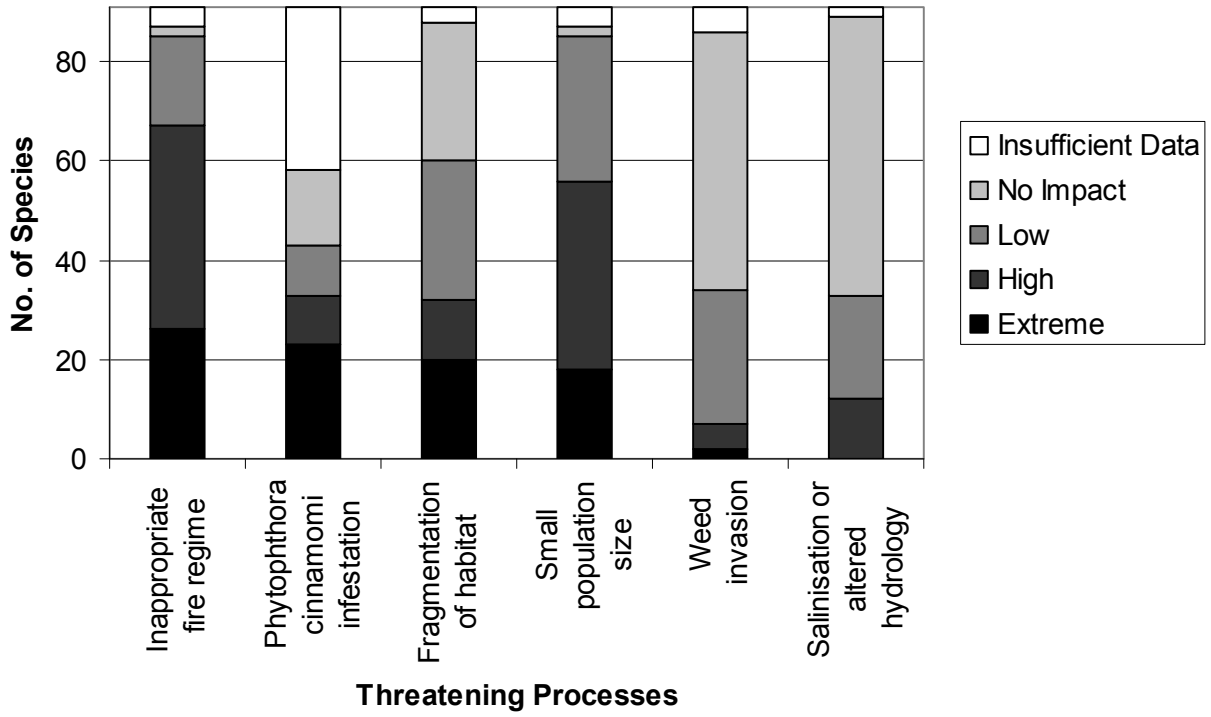

Figure 13: The number of species of flora in the South Coast Region that the Threat Matrix Tool classified as Extreme, High, Low, None/Unlikely Impact or Insufficient Data vulnerability to particular threatening processes.

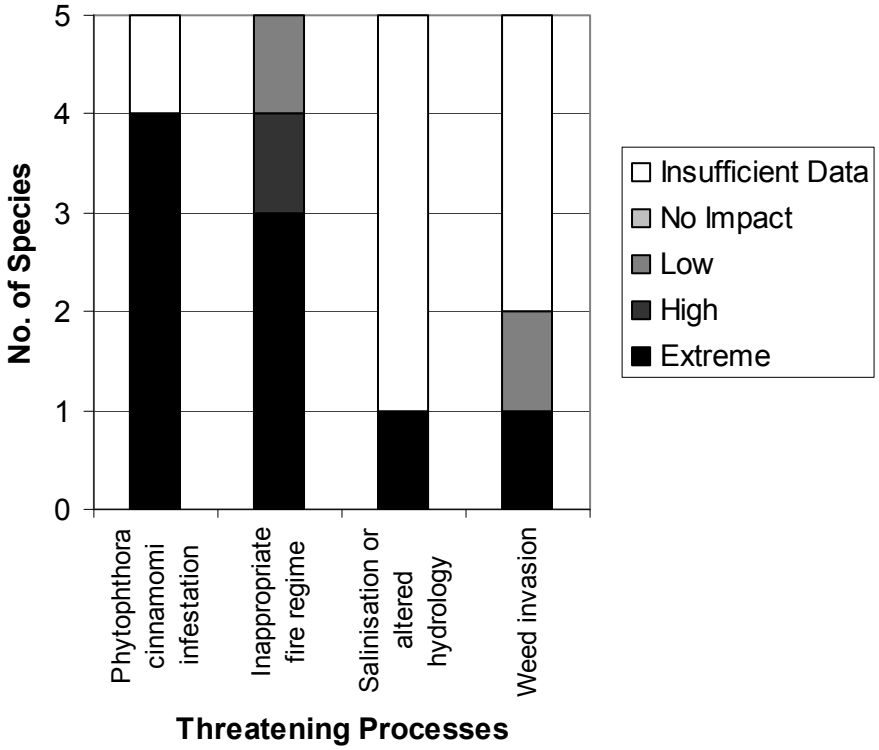

Figure 14: The number of Threatened Ecological Communities (TECs) in the South Coast Region that the Threat Matrix Tool classified as Extreme, High, Low, None/Unlikely Impact or Insufficient Data vulnerability to particular threatening processes**.**

Table 7.5: The Primary Threatening Processes (PTPs) for Threatened flora, fauna and ecological communities (TEC) identified using the Threat Matrix Tool based on the Extreme and High categories.

Threatened Species Groups	Primary Threatening Processes (PTPs)
FLORA	Inappropriate fire regimes *Phytophthora cinnamomi* Small population size Habitat fragmentation
FAUNA	Inappropriate fire regimes Introduced predators (cats and foxes) Small population size Habitat fragmentation
TEC	Inappropriate fire regimes *Phytophthora cinnamomi*

It should be noted that other non-primary threatening processes may be having a similar or greater impact on particular threatened species than the PTPs. This document is a regional analysis of threats and as part of this process the threatening processes that are having the greatest impact on that species or community need to be defined for use by smaller management groups.

7.4.3 Threat Impact Tool

As part of the GIS tool, a Threat Impact tool was developed to identify areas where the PTPs are having or have the potential to have the greatest impact on threatened species. This combines the Threatened Species Density Grid and the Threat Matrix by mapping for each PTP the density and distribution of the threatened species that were classified in the Threat Matrix as Extreme or High. As the assessment of species vulnerability in the Threat Matrix was of the current impact

(e.g. weed invasion) for some PTP while for others it was of the potential impact (e.g. *P. cinnamomi*), this Threat Impact tool gives an indication of the distribution of either the current or potential impacts of particular threats.

The most significant PTPs for each of the 10 Threatened Species Areas in which the most threatened species occur (Section 7.3.2) are shown in Figure 15. This indicates that some of the most significant PTPs (e.g. fire and small population size) are widespread over the Areas while some PTP are most significant in only some areas (e.g. weed invasion in the Porongurups). This shows that in some cases threat abatement programs need to be focused on particular areas and not just region-wide.

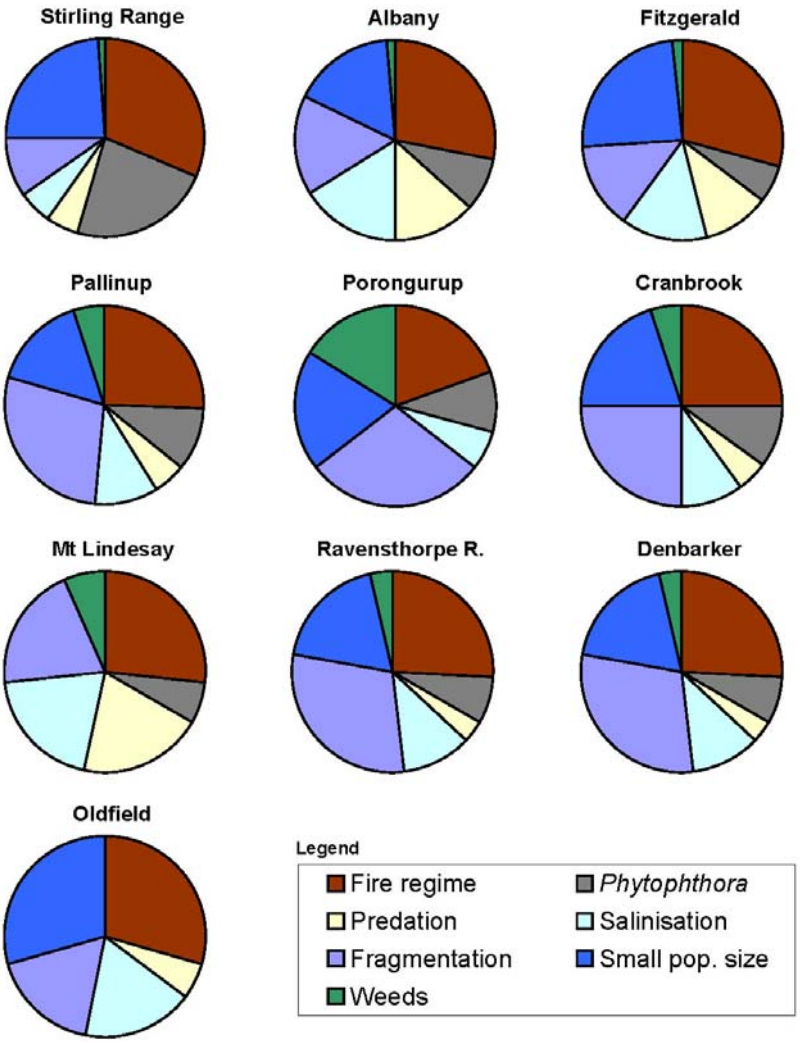

Figure 15: The most significant Primary Threatening Processes (PTPs) that are currently affecting, or have the potential to affect, each of the top 10 Threatened Species Areas (as determined by the number of threatened species/communities that were classified as Extreme or High vulnerability in the Threat Matrix to the particular PTP).

The Threat Impact tool allows us to display the current or potential threat of the PTPs spatially at multiple scales from a regional scale to the individual 5 km grid squares. For example, Figure 16 shows the Threat Impact tool for fire at a regional scale. At this scale the key areas where there is grouping of impacts can be seen in the Albany, Fitzgerald, Stirling Range and Muir-Unicup areas. The Muir-Unicup area is primarily in the 30 km buffer zone around the region, highlighting the importance of cross-regional threat abatement programs.

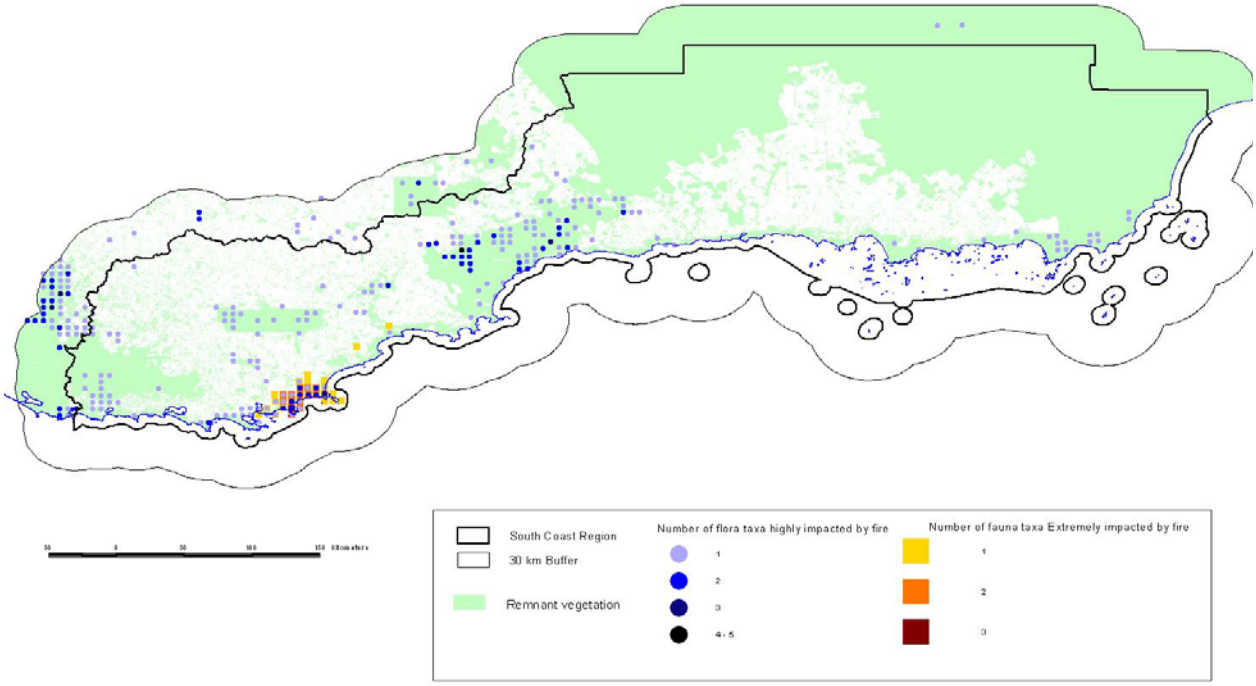

Figure 16: The Threat Impact tool for fire showing distribution of threatened species classified as Extreme or High vulnerability to fire in the South Coast Region.

The use of this tool at a finer scale is demonstrated by Figure 17 and Figure 18 for two of the key Threatened Species Areas. The vulnerability of threatened flora to *Phytophthora* infestation in the Stirling Range is shown in Figure 17. This shows the areas at the 5 km grid square scale within the area that is most susceptible to the threatening process (i.e. the eastern block of the Stirling Range), which could be used to determine target sites for management programs, such as phosphite spraying.

The vulnerability of fauna species to fire in the Albany area is displayed in Figure 18. This highlights the vulnerability of the threatened species around Mount Gardener where populations of the Gilbert's Potoroo, Noisy Scrub Bird and Bristle Bird are located. This tool can be used to focus fire management plans to specific locations within priority areas prior to a fire event but also be updated during a fire event for preventative fire exclusion strategies best suited for threatened species protection.

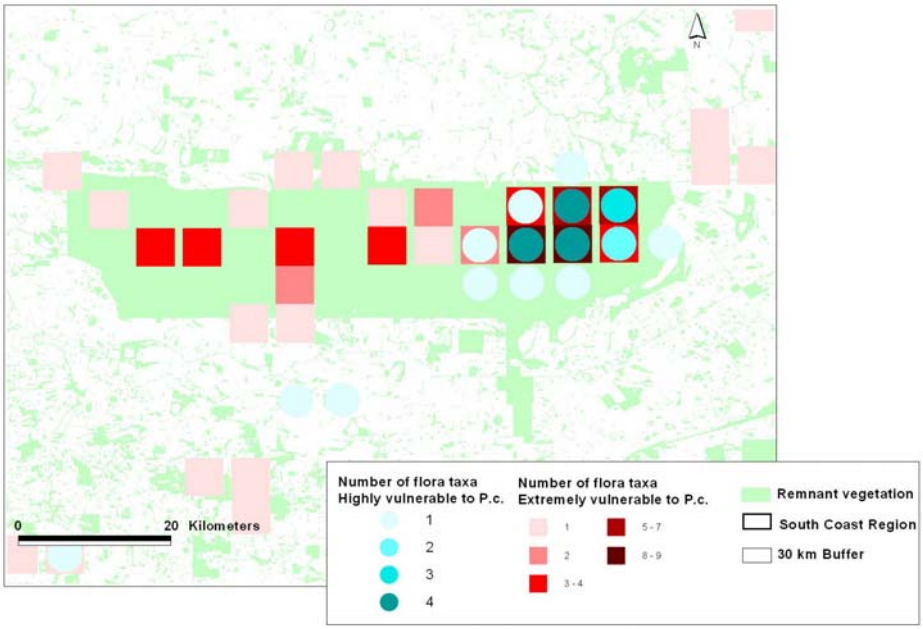

Figure 17: The Threat Impact tool for *Phytophthora cinnamomi* showing the distribution of threatened flora species classified as Extreme or High vulnerability in the Stirling Range Threatened Species Area.

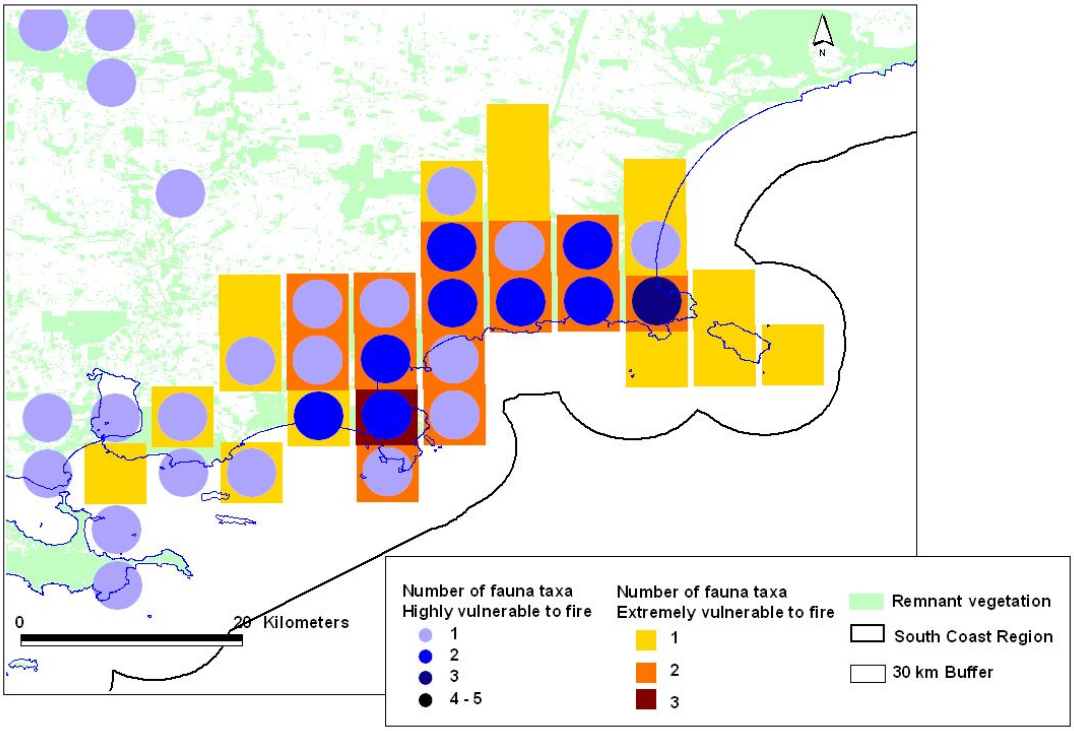

Figure 18: The Threat Impact tool for fire showing distribution of threatened fauna species classified as Extreme or High vulnerability to fire in the Albany Threatened Species Area.

7.5 Summary of Prioritisations

Through the development and use of this GIS tool the following recommendations have been developed for Regional Planning for prioritisation of threatened species recovery and threat abatement for the South Coast Region. These recommendations are addressed by Recovery Actions in Section 9 of this Plan.

Prioritisation Recommendations

- Regionally significant threatened species are those that are Critically Endangered or Endangered and are endemic or near-endemic to the Region. These species should be a priority for the development of Recovery Plans and Recovery Actions.
- A collation and review of all the Recovery Actions from current Recovery Plans which cover the Region would allow identification of any overlapping or conflicting actions and would enable further prioritising of recovery planning.
- Key Regional areas for threatened species include the Stirling Range, Albany and Fitzgerald areas. Integrated recovery planning should be developed for these areas.
- Climate change and inappropriate fire regimes were identified as the most significant PTPs, though this differed for flora, fauna and ecological communities, and for the Key Threatened Species Areas.
- The development of the Threat Matrix identified several knowledge gaps relating to threatened species response to threatening processes including:
    - Susceptibility of flora to *Phytophthora cinnamomi*, salinity tolerance, fire response, impact of fragmentation and weed invasion.
    - Impact of altered habitat (e.g. *Phytophthora cinnamomi* infestation, salinisation, fragmentation and weed invasion).
    - TECs response to threatening processes in particular weed invasion, salinisation, and *Phytophthora cinnamomi.*
- More detailed and accurate regional mapping of threatening processes would enable more rigorous identification and nomination of threat abatement priorities.
- Further development of the GIS tool into a package that could be used at different scales with detailed interactive spatial, biological and threatened species response data.

8 CLIMATE CHANGE

Climate change has been identified world-wide and within Australia as a key threat to the conservation of biodiversity (IPCC 2002b; Howden *et al.* 2003; Natural Resource Management Ministerial Council 2004). The south-west of Western Australia has been identified as being as one of six biodiversity hotspots in the world which are especially vulnerable to climate change, in terms of the potential for the extinction of threatened species within them (Malcolm *et al.* 2006).

A workshop 'Climate Change and Biodiversity on the South Coast', hosted by DEC, DEWHA and South Coast NRM, was held in February 2005 in Albany. The objective of this workshop was to gain expert opinion on the likely effects of climate change on threatened species in the South Coast Region and identify appropriate management responses within our current knowledge. The forum also addressed specific knowledge gaps in relation to climate change. The workshop attendees included government, community and industry. Thoughts and concepts from this workshop are included in this Section.

One of the objectives of the Regional Plan is to incorporate climate change as a threatening process into regional recovery and threat abatement planning. This chapter describes climate change in the Region, looks at how climate change may impact on threatened species in the Region, identifies the level of risk to threatened species from climate change, and describes potential effects of climate change on other key threats in the region. Finally this chapter summarises actions for incorporating climate change into threatened species recovery.

8.1 Climate Change in South Coast Region

8.1.1 Past Rainfall Trends for Southwest Western Australia and the Region

The seasonal rainfall trends for the southwest of Western Australia are shown in Figure 19. Winter rainfall in the southwest has decreased substantially since the mid-20th century (IOCI 2002; Hope & Foster 2005). In particular, in the mid-1970s the winter rainfall decreased by about 15-20%, at about the same time as changes in large-scale global atmospheric circulation. It is thought that both natural variability and the enhanced greenhouse effect have contributed to the rainfall decrease.

Specifically for the South Coast Region, the seasonal rainfall trends have been (Figure 19):

- A decrease in spring rainfall in the west, central and eastern areas, but an increase in the area around the Fitzgerald National Park, and the Munglinup/Lort River area
- An overall increase in summer rainfall, except for the lower south-west coastal area, with highest increases in the central area around Ravensthorpe
- An overall decrease in autumn, with highest decrease in the north-west corner
- An almost overall decrease in winter rainfall, with the exception of some small areas, around the Pallinup River, the southern part of the Fitzgerald River NP and the Ravensthorpe Range

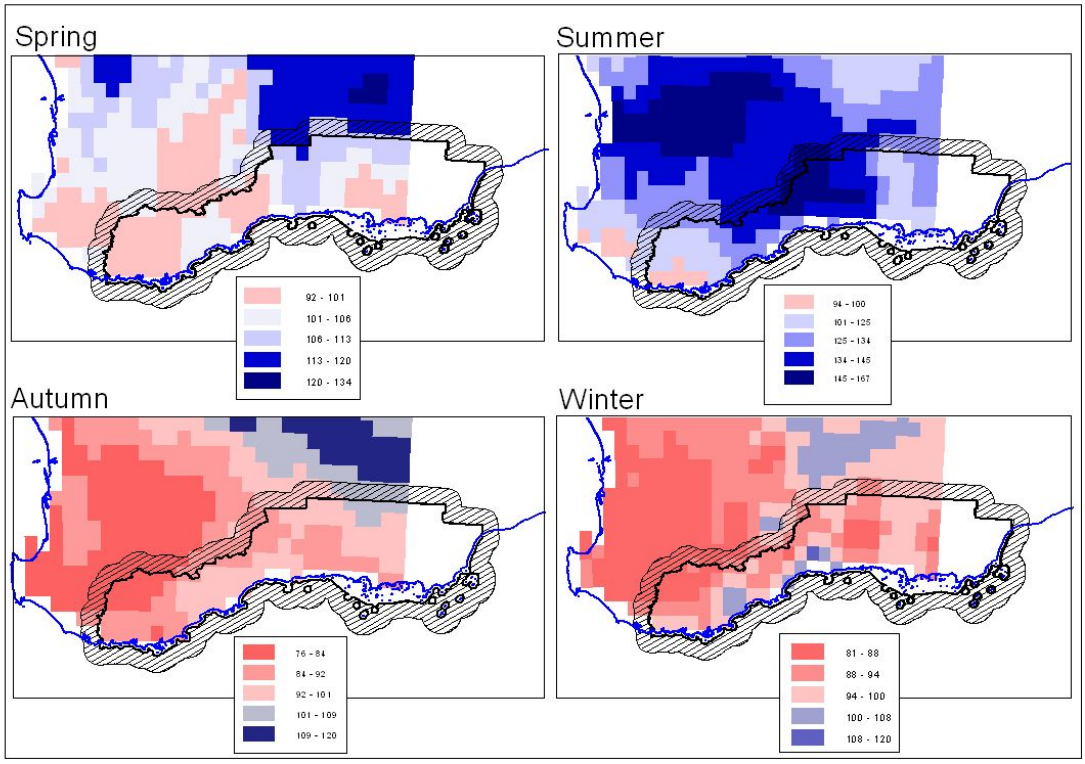

Figure 19: Past seasonal rainfall trends (average rainfall for the period 1976-2003 as a percentage of the rainfall for the 1925-1975 period) for the southwest of Western Australia with the South Coast Region shown. Red indicates a decline in rainfall in the later period, blue an increase. This data was obtained from the National Climate Centre at the Bureau of Meteorology and mapped following the method of Jones and Weymouth (1997).

8.1.2 Climate Change Scenarios for the South Coast Region.

CSIRO (2001) has produced climate change projections for the Australian region using a range of international climate models, while IOCI (2005) have used these models to give better resolution for the southwest of Western Australia. These climate change projections for southwest Western Australia, assuming no policies to reduce greenhouse gases, are shown in Figure 20. Scenarios which assume stabilising of CO_2 emissions at 450 ppm by 2090 or 550 ppm by 2150 show, in general, similar trends but smaller changes in rainfall and temperature (IOCI 2005).

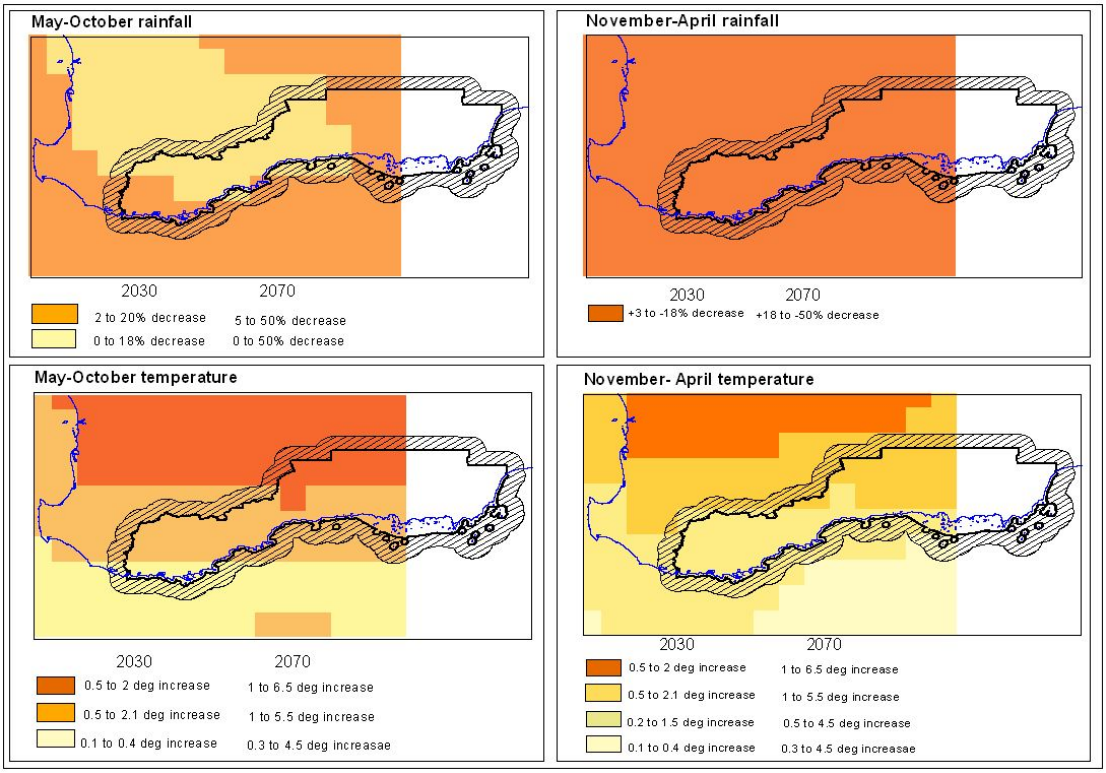

Figure 20: Climate change projections for southwest Western Australia (border of South Coast Region shown), showing projected changes in winter (left) and summer (right) rainfall (top) and temperature (bottom) by 2030 and 2070 relative to 1990. These projections, produced by IOCI (IOCI 2005), are based on a scenario without policies to reduce greenhouse gas emissions.

For the South Coast Region, these climate change projections predict (Figure 20):

- Continued decrease in winter (May - Oct) rainfall, with this decrease greater in the east and west than in the central area of the Region.
- Possible increase in summer (Nov - April) rainfall, although decreases are also within the range of the projections. These predictions are uniform across the Region.
- Increase in both average winter and summer temperatures, though greatest increase in minimum and maximum temperatures in spring and least in winter. These changes are predicted to be greater in the east than the west of the Region.
- Change in evaporation uncertain though predicted to be an increase in inland areas.

The following provisos apply to these predictions:

- It is unclear as to whether there will be an increase in extremes. There is some indication that larger storms do not appear as often now in winter, some increase in winter 1 in 10 yr events, but for extremes greater than this it is impossible to tell.
- Summer rainfall variation in the southwest of Western Australia is very high, it is therefore difficult to detect a trend.
- A small increase in average or trend can mean large increase in extremes.
- The changes in rainfall are through a decrease in winter and an increase in summer of the number of high rainfall days.

8.2 Impacts of Climate Change on Threatened Species in the South Coast Region

8.2.1 Observed Impacts

There is clear evidence internationally that the relatively modest climatic changes over the past century have already had significant impacts on many species and communities (reviewed in Hughes 2000; McCarty 2001; Walther *et al.* 2002). These impacts include shifts in the distribution of species, earlier fruiting and flowering times, and earlier reproduction in amphibians and birds in response to warmer temperatures. However, similar evidence is lacking for Australian species, due to the lack of long-term datasets and little support for such research until very recently (Howden *et al.* 2003; Hughes 2003). This said there are some recently documented trends of species distribution changes that offer circumstantial evidence of climate change impacts in Australia (reviewed in Hughes 2003).

8.2.2 Potential Impacts

There has been extensive investigations of the potential ecological impacts of climate change both in Australia (Howden *et al.* 2003; Hughes 2003; Pittock 2003; Gibbs 2004; Chambers *et al.* 2005) as well as worldwide (IPCC 2002a). There is a reasonable consensus on the expected general impacts of climate change on species and ecosystems (Natural Resource Management Ministerial Council 2004). However, there is still much uncertainty about how individual species and ecosystems will respond to the combined impacts of future climate change and other threatening processes.

Potential impacts of climate change on species and communities have been considered by numerous authors (Sutherst *et al.* 1996; e.g. Chambers *et al.* 2005) and may include the following responses:

- range contraction,
- range shift,
- shifts in phenology (including indirect effects of changes in flowering date on other plants and pollinators),
- demography (breeding success, survival),
- changed movement patterns,
- changes in abundance (local extinction),
- changes in community composition,
- changes in physiology, morphology or behaviour, and
- impacts on pests, weeds and diseases.

8.2.3 South Coast Region

There is a strong relationship between climate and patterns of species and communities distribution in southwest Western Australia (Churchill 1961). Over the last two million years the climate of the southwest has been highly variable, experiencing unusually turbulent climatic fluctuations associated with increased aridity. The increase in climate dynamism led to periodic waxing and waning, isolation and colonisation of plant populations. The process forced many plants into small fragmented populations, some of which remain today and others that either went extinct or evolved ways to cope and evolved into new species in the process (Brown *et al.* 1998). Those species that evolved in the climate fluctuations of the last few million years may be able to adapt or have flexibility in their response to climate. Relictual species that have evolved little will have a limited capacity to adapt.

The way in which climate change is predicted to impact threatened species in the South Coast Region will differ between species. For example it has been shown that the distributions of the south-west Eucalypt tree species, karri (*Eucalyptus diversicolor*), jarrah (*E. marginata*) and marri (*Corymbia calophylla*) are influenced primarily by water availability (Churchill 1968). Threatened species dependent on the habitat provided by these species include large iconic Baudin's and Forest Red-tailed Black Cockatoos, and invertebrates such as the Tingle Moggridgea.

Water and temperature also both play an important part in the germination process of many species. For many species, temperature-mediated germination cues are important to ensure population persistence as temperature synchronises germination to environmental conditions most suitable for seedling establishment, e.g. high likelihood of adequate water availability (Bell 1993; Fenner & Thompson 2005). Once moisture requirements have been satisfied, germination in some threatened species in the Region have been shown to be influenced primarily by temperature (e.g. *Banksia montana*, *Sphenotoma drummondii*) (Anne Cochrane pers. comm.). Increasing CO_2 concentrations in the atmosphere has been shown to enhance growth and water efficiency in plants (although this is likely to be muted in nutrient limited systems) (Midgley et al. 2003), but has an indirect negative impact on herbivorous fauna by reducing the plants nitrogen content (Hughes 2003). Drought events are already impacting on some threatened species (e.g. *Dryandra ionthocarpa* subsp. *ionthocarpa*). Many indirect consequences of climate change will impact on threatened species including river/stream flows, sea level and salinity/hydrology.

Where organisms are able to persist in the face of a changing climate, there are likely to be either contractions or expansions in range, so long as dispersal is facilitated. Where dispersal is not possible and habitat parameters are no longer suitable extinction is the ultimate fate. Resilience through adaptation or dispersal is the only option available, and speciation is not a factor we can plan for. Building resilience through improving dispersal capacity, in addition to assisted migration through species reintroduction to more favourable sites, remains the most pragmatic action that will improve the chances of successful recovery.

8.3 Identifying Vulnerability of Threatened Species to Climate Change

Sensitivity to climate change for a given taxon depends on its ecological niche and geographic distribution (Broenniman *et al.* 2006) as well as its life history characteristics and its genetic and phenotypic plasticity. Most species can tolerate some short term variability in climate through phenotypic plasticity, though recent adaptation to global warming has involved shifts in seasonality rather than increases in thermal tolerance that is necessary for long term persistence (Jump & Penuelas 2005). The most vulnerable species to a warming climate will be those with restricted niches, those in regions with high anomalies in climate or those with barriers to migration such as in fragmented habitats (Broenniman *et al.* 2006; Malcolm *et al.* 2006). Plants with limited dispersal ability and slow reproductive rate are also likely to be threatened, and species already restricted to the physical limits of their range, like higher latitudes and upper montane locations, are presumed with some certainty to be at risk of extinction (Walther *et al.* 2002; Root *et al.* 2003). If species cannot tolerate or adapt to changed conditions or migrate to more suitable sites, there is a high probability that they will go extinct.

The vulnerability of threatened species in the South Coast Region to the drying and warming trend associated with climatic variability was assessed through considering both *direct* impacts on species' habitat or functionality (e.g. growth and reproduction), and *indirect* impacts, such as

the restricted nature of many populations due to fragmentation of the landscape which makes them unable to respond to climate change by shifting their distribution.

During the 'Climate Change and Biodiversity on the South Coast' workshop in Albany the following characteristic groups of threatened species were identified as those which will potentially be most impacted by climate change within the South Coast Region:

- Montane species (species occurring above 400 m above sea level).
- Climate refugial and relictual species.
- Species dependent on freshwater wetlands (especially seasonal wetlands and damplands).
- Short range endemics (i.e. geographically localised species).
- Migratory species.
- Species occurring in highly fragmented remnants OR highly patchy habitat.
- Species occurring in small populations (i.e. genetically impoverished species).

Certain biological attributes of species were identified as attributes that would determine a taxon/communities resilience to climate change or its ability to 'adapt' to changes. These attributes were used in the Threat Matrix to assess the susceptibility of South Coast threatened species to climate change (Section 7.4; Appendix 6). These attributes include:

- Dispersal ability (poor).
- Habit preferences (e.g. habit of burrowing or aestivation reduces exposure to drying and temperature and so could potentially tolerate higher temperatures.
- Reproductive capability/fecundity (low).
- Susceptibility to *Phytophthora cinnamomi* (i.e. spread of *P. cinnamomi* may increase with an increase in summer rainfall).
- Susceptibility to seasonal variability (e.g. requirement for winter rain).
- Dependence on fire for regeneration strategy (i.e. opportunities for regeneration are likely to be limited by the fire interval).
- Dependence on late stage ecosystems (i.e. long periods since fire or long juvenile period).

It is important to note that if a taxon was not considered to fit in any of the above categories it could still potentially be impacted by climate change through a possible 'de-coupling' of ecological communities, i.e. species that make up a community are unlikely to shift together (IPCC 2002a). Also there could be indirect effects of changes in one species on other species (e.g. changes in flowering date of plants may affect pollinators) (Keatley & Hudson 2005).

8.3.1 Vulnerability of South Coast Threatened Species

The vulnerability of threatened species in the Region was identified using the Threat Matrix (Section 7.4; Appendix 6). Each species was categorized as either Extreme, High or Low vulnerability depending on the number of the above biological attributes (Section 7.3). Threatened species were categorized as at least Low, as it is predicted that even those not considered particularly vulnerable to climate change will be affected indirectly. Some attributes that affect a taxon's resilience to climate change in this matrix were assumed on the basis of expert opinion, and so may be amended as new information becomes available.

Nearly 80% of threatened fauna and 95% of threatened flora in the South Coast Region were categorized as either Extremely or Highly vulnerable to climate change (Figure 21, Table 8.2). This shows how large the impact of climate change could potentially be on the South Coast.

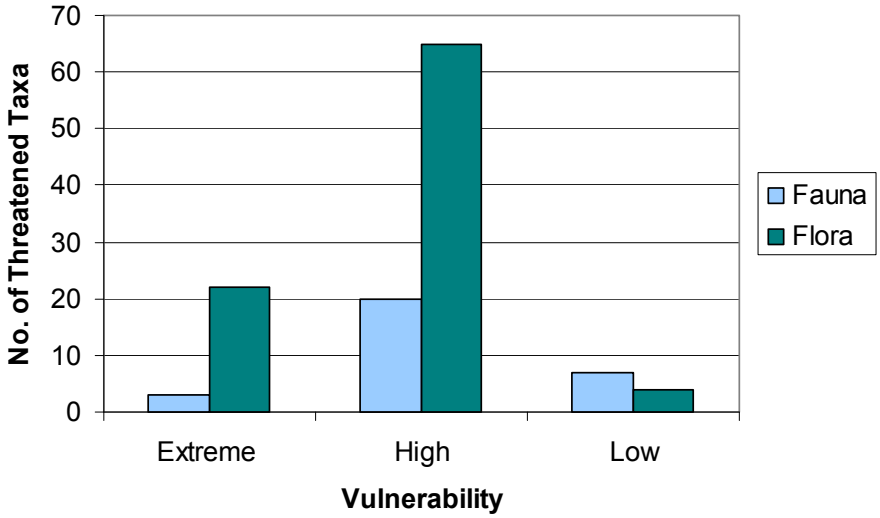

Figure 21: The number of threatened fauna and flora in the South Coast Region that were categorized as either Extreme, High or Low vulnerability to climate change using the Threat Matrix (Section 7.4; Appendix 6).

8.3.2 Interactions of Climate Change with Other Primary Threatening Processes in the Region

Climate change is also likely to impact threatened species through their interactions with other threatening processes. The ways that climate change is predicted to interact with other threatening processes are listed in Table 8.1.

Table 8.1: The potential impacts of climate change on the Primary Threatening Processes in the South Coast Region

Primary Threatening Processes	Impact of Climate Change
Fire Regimes	– Increased frequency, intensity and extended fire season – Increased risk especially in integrated land systems – Decreased recovery of species following fire due to lower rainfall impacting on physiological processes
Phytophthora cinnamomi	– Change in climatically suitable area for *P. cinnamomi* – Increased flood events may increase *P. cinnamomi* spread – Climatically stressed plants may be more vulnerable to *P. cinnamomi* – Increase in summer rainfall will create optimal conditions for the pathogen to reproduce and spread
Predation	– Increased risk of invasion by feral and invasive species due to their ability to rapidly disperse and invade "new" climatically suitable areas
Altered Hydrology	– Fewer recharge events, decrease in salinity and waterlogging – Reduced water availability for aquatic species
Fragmentation	– Fragmentation of habitat will substantially reduce the ability of species to move to areas of suitable climate – Increased edge effects – Low genetic variability
Small population size	– Decreased genetic variability of small populations will reduce the ability of species to adapt to changing climatic conditions
Weeds	– Increased risk of invasion by feral and invasive species/diseases due to their ability to rapidly disperse and invade "new" climatically suitable areas.

8.4 Incorporating Climate Change into Threatened Species Recovery

Identifying and quantifying the impacts of climate change on threatened species is challenging, given the intrinsic uncertainty of climate change projection in combination with the lack of knowledge on the capacity for adaptation and biological responses of species to change. However, there are some key principles that can be incorporated at the threatened species and ecosystem level. Specific objectives and actions are detailed in Section 9.

8.4.1 Current Threatened Species Recovery Related to Climate Change

Current threatened species recovery and threat abatement actions are summarized in Appendix 5. Many of these actions already take into account the management of threats likely to be exacerbated or altered by climate change such as fire and disease.

8.4.1.1 Landscape Connectivity

Resilience of species to climate change will be increased through the maintenance of existing large reserves and increasing the connectivity of these reserves across the landscape. Strategic connectivity across the Region was identified in the South Coast Macro Corridor Project (Wilkins *et al.* 2006). Increasing connectivity across the Region is being implemented within the Region through Gondwana Link, a privately funded project, which is improving connectivity in the Forrest to Fitzgerald Corridor, by aiming to reconnect the forest to the Stirling Range National Park and then the Stirling Range east to the Fitzgerald River National Park.

8.4.1.2 Threat Abatement Programs

An important component of increasing the resilience of threatened species to climate change is the management of other threatening processes that may be exacerbated by climate change (e.g. fire and *Phytophthora*). This should include an increased focus on species or areas which may be particularly vulnerable to climate change.

8.4.1.3 Threatened Flora Seed Centre

Since 1992 the seeds of threatened flora from the South Coast Region have been conserved in long term storage at DEC's Threatened Flora Seed Centre (Anne Cochrane, pers. comm.). Seeds are a ready source of plant material for use in restoring degraded lands and for reintroducing threatened species back in to the wild. Seeds of eight South Coast region threatened species (*Lambertia orbifolia* subsp. *orbifolia, Dryandra montana, Banksia brownii, Banksia anatona, Lambertia fairallii, Lambertia echinata* subsp. *echinata, Myoproum turbinatum* and *Eremophila lactea*) have been utilized in single species reintroductions in the past 10 years. Seeds from the Centre have also been used in research aimed at understanding direct physiological tolerance to temperature for germination.

8.4.1.4 Translocations/Reintroductions

A changing climate increases the significance of small population size, restricted distribution and low fecundity as threatening processes because these factors usually mean fewer offspring and therefore reduced opportunities for adaptation. Continuing those recovery projects that are increasing population size and ex situ populations will also build on any individual species resilience to climate change.

8.4.1.5 Conservation of Refugia

In a drying environment there will be refuges where climate sensitive species can persist. Potential Gondwanan invertebrate refugia, which were modelled in the South Coast Invertebrate Refugia Project (Gilfillan 2002), may also provide a framework for identifying important

climatic refuges. Through recognition as important conservation areas these can be targeted for management of threats such as fire and weeds which may be exacerbated by climate change.

8.4.2 Recommendations for Threatened Species Recovery Related to Climate Change

The best management options for climate change in relation to threatened species recovery are to continue to build the resilience of threatened species by:

- Improving landscape connectivity,
- Maximising population viability, and
- Reducing the impact of other threatening processes.

Improving the resilience will improve the capacity of threatened species populations to adapt as best they can to an altered climate. Education and community involvement are all important elements in the capacity of the South Coast to manage climate change.

8.4.3 Recommendations for Threatened Species Research Related to Climate Change

Research on, and monitoring of, threatened species responses to climate change will increase management capacity through an adaptive management framework.

Due to their inherent complexity there are many gaps in our knowledge of ecosystem processes and functions and the likely response and role of specific species in particular systems in climate change scenarios. For example, in fire-prone environments studying the variation in plant traits known to respond to specific environmental stresses such as temperature may assist our understanding of the impact of warming temperatures on the persistence of threatened flora species at the limits of their geographic range. Assessing direct physiological constraints on recruitment of flora, for example the upper and lower germination temperature limits for germination, provides data on recruitment potential of obligate seeding species, with germination sub-optimal or inhibited below or above certain temperatures. As droughts become more severe under the predicted warming and drying trend for the region the timing of germination will become more crucial as available moisture becomes limited. Inadequate understanding of physiological constraints to threatened fauna breeding requirements or microhabitat and food resources leads to significant knowledge gaps.

Current research and knowledge gaps identified for threatened species in the South Coast include:

- A comprehensive network of weather/climate stations across the South Coast Region. Suggested areas for such stations include the major peaks and lowlands below the peaks, significant islands (such as Bald, Mondrain, Middle Islands) and other sites containing significant threatened species occupying communities considered at high risk of climatic sensitivity (e.g. Western Ground Parrot (*Pezoporus wallicus flaviventris*) habitat in sandplain systems of Cape Arid and Fitzgerald River National Parks).
- Biological and ecological knowledge of threatened species that will enable further assessment of the potential impacts of climate change on these species e.g. fecundity, dispersal ability, generation time, habitat restrictions and population size.
- Vulnerability of threatened species to climate change based on threat matrix attributes (Table 8.2, Appendix 6). This assessment was based on expert knowledge of species, and requires review and modelling for different climate change scenarios.
- Resilience needs to be defined for different scales, i.e. landscape/single species.
- Ecological processes and interactions with climate change and other threatening processes need to be summarised for the South Coast Region.

- Knowledge of basic physiological tolerances of threatened species, (we know that species have climate preferences but we don't know their climate tolerances) and capacity to respond to natural climatic variation is poor, and needs further research.
- Identification and monitoring of threatened species as indicators of climate change would increase the capacity within the Region to address the impacts of climate change on other threatened and near threatened species. Suitable climate change indicator species would have the following characteristics:
  - Display measurable responses to changes in the environment,
  - Strongly suspected to be sensitive to climate in terms of distribution , physiology or life cycle,
  - Less affected by other changes in the environment (e.g. predator control etc),
  - Has baseline historical data available,
  - Mobile,
  - Easily recognizable from other species (taxonomic certainty),
  - Advantage if representative of a whole functional group so that results can be readily generalized to other species, and
  - Cost effective to monitor on a repeatable basis.

    In the South Coast there are a number of examples of threatened species that could be considered as indicator species including the Noisy Scrub-bird (*Atrichornis clamosus*) and Australasian Bittern (*Botaurus poiciloptilus*).

One of the fundamental management objectives for climate change is to enhance threatened species resilience to change in climate by amelioration of other threatening processes. While threat abatement is currently addressed through existing recovery actions improved coordination to improve ecosystem resilience is required. For threatened species and communities addressing knowledge gaps in species threat responses will enable improved landscape management for multiple conservation outcomes. This highlights the importance of continuing research.

Table 8.2: The Threat Matrix (Section 7.4; Appendix 6), classifying the vulnerability of threatened species in the South Coast Region depending on the number of identifying biological attributes (Section 7.3) the species have.

	Threat categories of expected impact of climate change on threatened species in the South Coast region			
	EXTREME (3 or more criteria)	**HIGH (1-2 criteria)**	**LOW (No criteria)**	**UNKNOWN**
Fauna	Gilbert's Potoroo Noisy Scrub-bird Stirling Range Moggridgea Spider	Australasian Bittern Dibbler Heath Mouse Malleefowl Numbat Quokka Recherche Cape Barren Goose Recherche Dugite Recherche Rock Wallaby Red-tailed Phascogale Spotted or Trout Minnow Stirling Range Rhytidid Snail Sunset Frog Tingle Trapdoor Spider WA Pill Millipede Western (Muirs) Long-billed Corella Western Bristlebird Western Ground Parrot Western Ringtail Possum Western Whipbird (western heath subsp.)	Baudin's Black Cockatoo Black-flanked Rock Wallaby Carnaby's Black Cockatoo Chuditch Forest Red-tailed Black Cockatoo Western Rosella (inland species)	Western Archaeid Spider
Flora	*Adenanthos velutinus* *Chamelaucium sp.Hamersley(N.McQuoid 379)* *Conostylis misera* *Coopernookia georgei* *Darwinia collina* *Darwinia sp. Stirling Range (GJ Keighery 5732)* *Daviesia pseudaphylla* *Dryandra ionthocarpa subsp. Ionthocarpa* *Dryandra montana* *Eucalyptus coronata* *Grevillea infundibularis* *Grevillea maxwellii* *Lambertia echinata subsp. echinata* *Lambertia orbifolia subsp. Orbifolia ms* *Leucopogon gnaphalioides* *Scaevola macrophylla* *Sphenotoma drummondii* *Tribonanthes purpurea* *Xyris exilis*	*Acacia awestoniana* *Acacia rhamphophylla* *Acacia trulliformis* *Adenanthos dobagii* *Adenanthos ellipticus* *Adenanthos pungens subsp. effusus* *Adenanthos pungens subsp. pungens* *Andersonia axilliflora* *Andersonia pinaster ms* *Anigozanthos bicolor subsp. minor* *Apium prostratum subsp. phillipii* *Asplenium obtusatum subsp. Northlandicum* *Banksia brownii* *Banksia goodii* *Banksia verticillata* *Boronia clavata* *Boronia revoluta* *Caladenia bryceana subsp. bryceana* *Caladenia christineae* *Caladenia dorrienii* *Caladenia harringtoniae* *Calectasia cyanea* *Centrolepis caespitosa* *Chordifex abortivus*	*Isopogon uncinatus* *Kennedia glabrata* *Leucopogon marginatus* *Marianthus mollis* *Ricinocarpos trichophorus*	*Lepidium aschersonii*

	Threat categories of expected impact of climate change on threatened species in the South Coast region			
	EXTREME (3 or more criteria)	**HIGH (1-2 criteria)**	**LOW (No criteria)**	**UNKNOWN**
		Conostylis lepidospermoides *Darwinia meeboldii* *Darwinia oxylepis* *Darwinia squarrosa* *Darwinia wittwerorum* *Daviesia glossosema* *Daviesia megacalyx* *Daviesia obovata* *Deyeuxia drummondii* *Diuris drummondii* *Drakaea confluens ms* *Drakaea micrantha ms* *Drummondita longifolia* *Dryandra anatona* *Dryandra mucronulata subsp. retrorsa* *Dryandra pseudoplumosa* *Eremophila denticulata subsp. denticulata* *Eremophila lactea* *Eremophila subteretifolia ms* *Eucalyptus burdettiana* *Eucalyptus insularis* *Eucalyptus merrickiae* *Gastrolobium lehmannii* *Gastrolobium luteifolium* *Hibbertia priceana* *Lambertia fairallii* *Microtis globula* *Myoporum cordifolium* *Myoporum turbinatum* *Orthrosanthus muelleri* *Persoonia micranthera* *Rhacocarpus webbianus* *Rhizanthella gardneri* *Stylidium galioides* *Thelymitra psammophila* *Verticordia apecta* *Verticordia carinata* *Verticordia crebra* *Verticordia fimbrilepis subsp. australis* *Verticordia helichrysantha* *Verticordia pityrhops* *Villarsia calthifolia*		

9 IMPLEMENTING REGIONAL THREATENED SPECIES RECOVERY

The goal of this Threatened Species and Ecological Communities Regional Strategic Management Plan is to improve the conservation status of threatened species and ecological communities occurring in the South Coast Region. This plan provides a strategic regional approach to integrating threatened species and ecological community recovery and threat abatement.

9.1 Regional Strategic Management Framework

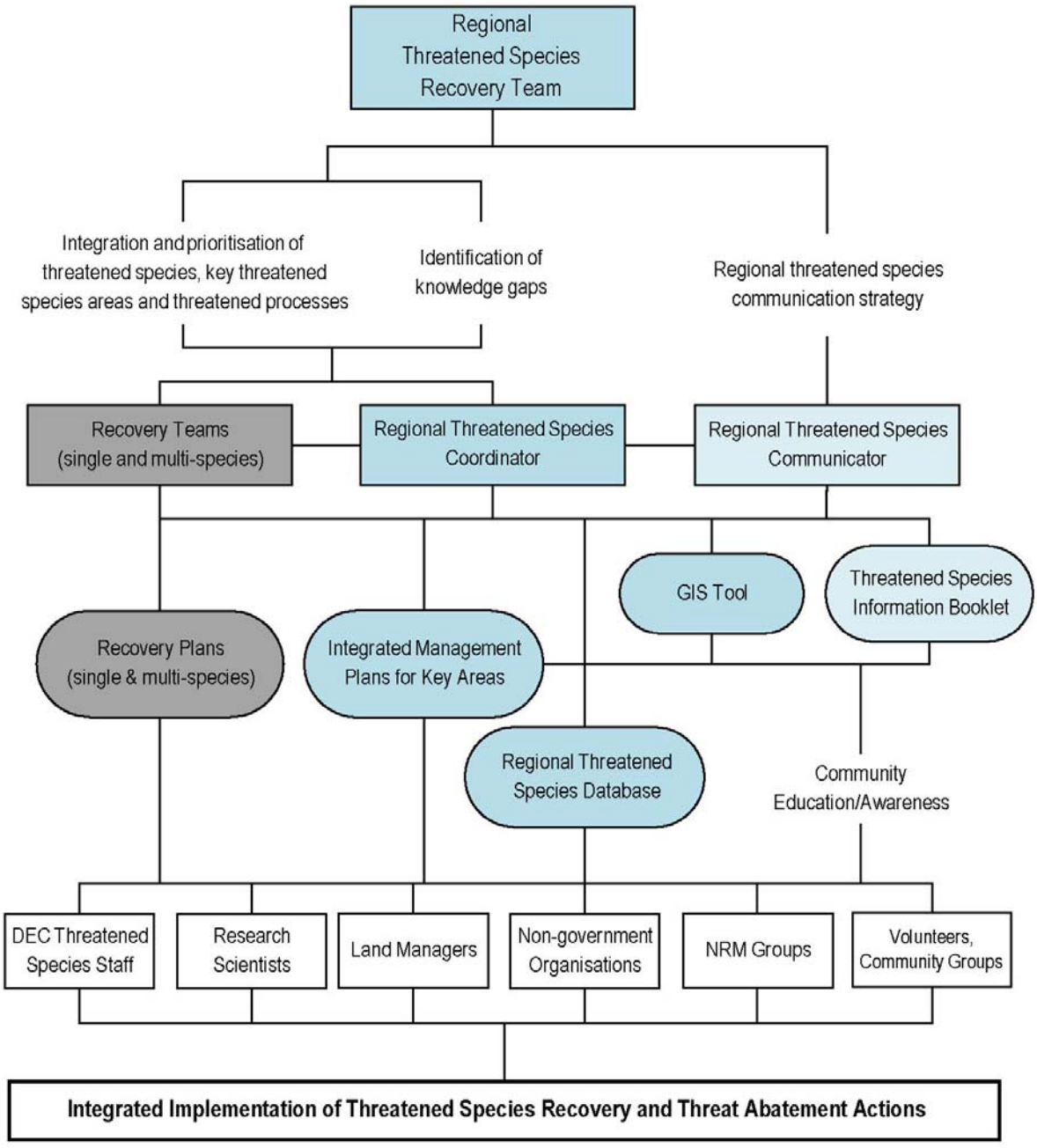

Figure 22: This strategic framework developed for the South Coast Region as part of this Regional Plan, is for a regional approach to threatened species and threat abatement. The blue sections are the new components recommended by this Regional Plan, with the darker blue priority over the lighter blue for implementation. Further details on these elements are discussed as part of the Recovery Actions of this Plan.

A strategic management framework for the regional recovery planning approach for the South Coast Region is shown in Figure 22. This approach will increase the Regions capacity for threatened species recovery and threat abatement and its ability to prioritise recovery actions.

It is recommended that the first steps for implementing this approach be the development of the GIS tool and integrated management plans for key areas. Priority should also be given to establishing a Regional Recovery Team and a Regional Threatened Species Coordinator. Establishing these key roles in this approach will increase the Region's capacity through providing strategic guidance and coordination of the efficient allocation of limited resources available for threatened species recovery.

Continuing current single species recovery planning will be an important component of this regional planning approach as many species will still require specific actions to be developed and implemented through individual plans. The regional approach will however replace the need for recovery plans for all individual species through the integrated recovery planning which will complement those required single species plans.

The management actions for this Regional Strategic Management Plan are detailed in Sections 9.2 and 9.3. These management actions are to provide guidance for recovery and threat abatement in the Region over the life of this Plan. These actions have not been prioritised in this Plan, but it will be a role of the Regional Recovery Team to prioritise their implementation.

9.2 Increase Regional Capacity

One of the major deficiencies of threatened species recovery and threat abatement in the South Coast Region was found to be a lack of integration of actions, both between species and across land tenures (Section 6). This Regional process proposes the development of a Regional Threatened Species Recovery Team and a Regional Threatened Species Coordinator that would provide the Region with the capacity to provide strategic guidance and integration to the current Recovery Teams.

Objective 1: Develop the Regional approach

Regional Recovery Team
A Regional Recovery Team is seen as having an important role to oversee and coordinate the implementation of this Regional Threatened Species Strategic Management Plan. This Recovery Team is not to replace single and multi-species Recovery Teams, but will provide a strategic role for threatened species recovery to complement the on-ground role of the other recovery teams.

As DEC has statuary responsibility for threatened species conservation in Western Australia, DEC will be responsible for the establishment of the Regional Recovery Team. Membership of this Recovery Team will be determined following an initial workshop of the key stakeholders involved in the development of this Plan. Membership of the Recovery Team may include DEWHA, DEC (Regional, Species and Communities and Science branches), South Coast NRM, non-government organisations (e.g. Gondwana Link), indigenous groups, tertiary institutions (e.g. University of Western Australia), and community and interest groups.

The specific responsibilities of the Regional Recovery Team will be developed by DEC following the initial stakeholder workshops. However, it is anticipated that the Recovery Team would be responsible for, in the South Coast Region:

- Promoting and prioritising the integration of threatened species recovery and threat abatement actions between species and across tenures,
- Prioritising and overseeing the production of recovery plans for species and communities that occur in the Region,
- Overseeing the development of integrated management plans for Key Threatened Species Areas,
- Developing a regional communication strategy to promote awareness of threatened species recovery,
- Making recommendations to DEC Species and Communities Branch regarding the conservation status of threatened species in the Region,
- Liaising with single and multi-species recovery teams and other stakeholders,
- Developing a process on how to manage for cross-regional threatened species and threatening processes, and
- Providing direction for the Regional Threatened Species Coordinator and Regional Threatened Species Communicator.

Action 1.1 Workshop and seek comments on the development of a South Coast Threatened Species and Ecological Communities Regional Recovery Team

Action 1.2 Establish a South Coast Threatened Species and Ecological Communities Regional Recovery Team

Component Tasks
1. Establish membership of the Team.
2. Develop the Recovery Team objectives and areas of responsibility.
3. Determine frequency of meetings.

Action 1.3 Review this South Coast Threatened Species and Ecological Communities Strategic Management Plan after 5 years

Regional Threatened Species Coordinator

The appointment of a Regional Threatened Species Coordinator will be crucial in developing and implementing a regional approach to threatened species recovery and threat abatement. The regional coordinator will manage, facilitate and oversee recovery planning and the implementation of Recovery Plans and threatened species management across the Region in collaboration with current Recovery Teams. This role will increase the capacity of the Region to monitor and evaluate current threatened species programs, disseminate threatened species and threatening process data and implement priorities.

It is anticipated that the Regional Threatened Species Coordinator, under the direction of the Regional Recovery Team, would be responsible for, in the South Coast Region:

- The implementation of this Regional Plan,
- Coordinating the integration of recovery and threat abatement actions across the Region,
- Being the Regional representative for some single or multi-species Recovery Teams,
- Being the Regional contact for threatened species enquiries, both for those involved in threatened species recovery and the general public,
- Developing integrated management plans for Key Threatened Species Areas,
- Seeking funding opportunities for Regional recovery and threat abatement programs,
- Coordinating the management of Regional threatened species data and its provision to the DEC Species and Communities Branch,
- Coordinating any recommendations to DEC Species and Communities Branch for changes to the conservation status of any Regional threatened species, and
- Liaising with other groups/promoting threatened species recovery.

Action 1.4 Appoint a Regional Threatened Species Coordinator

Component Tasks
1. Define the role of Threatened Species Coordinator.
2. Further develop the key deliverables of this position.

Single and Multi-Species Recovery Teams

The recovery teams that are already established provide valuable guidance and direction for significant threatened species and communities recovery in the Region. It is important that these recovery teams continue to exist and be involved in threatened species recovery in the Region.

The established recovery teams will continue to be responsible for, and be encouraged to liaise with the Regional Threatened Species Coordinator regarding:

- The continued implementation of existing recovery plans,
- The implementation and monitoring of recovery actions, and
- Gauging success or failure through the performance criteria outlined in each of the recovery plans.

Action 1.5 Continue the implementation of existing recovery plans by single or multi-species recovery teams

Component Tasks

1. Continue the implementation of existing recovery plans in the Region.
2. Review the Regional membership of single and multi-species recovery teams.
3. Develop coordination between the existing recovery teams and the Regional Recovery Team (see Action 1.2)

Objective 2: Increase involvement of Natural Resource Management Officers (NRMOs) and community

Threatened species do not occur solely within conservation reserves and hence it is necessary to incorporate and include all stakeholders in the recovery planning process. Threatened species conservation could be improved on the Region's off-DEC-estate through increasing the capacity of the Region to provide stakeholders with information and guidance regarding threatened species and threatening processes.

Action 2.1 Increase NRMOs capacity for integrated threatened species management

Component Tasks

1. Develop training in threatened species management and threat identification and abatement for NRMOs.
2. Disseminate threatened species information to NRMOs.
3. Develop strategic approach to NRMOs threatened species and threatening process management integration.

Action 2.2 Develop a consultation process aimed at achieving threatened species management for mixed tenure priority areas

Component Tasks

1. Initiate consultation with all relevant stakeholders and dissemination of information through workshops.
2. Evaluate existing data on mixed tenure priority areas.
3. Develop complimentary management strategies with agreed priorities.

Objective 3: Increase understanding and awareness across the Region

Threatened species recovery is reliant on community support and therefore community education and awareness is an important factor in the recovery process. The appointment of a Regional Threatened Species Communicator would provide the South Coast Region with a greater capacity in this area.

Regional Threatened Species Communicator

The Regional Threatened Species Communicator is envisioned to be a semi-permanent position responsible for the promotion of threatened species in the Region in order to increase stakeholders understanding and awareness of threatened species by:

- Coordinating the development and implementation of a Regional Threatened Species Communication Strategy,
- Disseminating information on the current recovery process, roles and responsibilities of agencies, individuals and legislation relating to threatened species to the community groups, land holders, species "friends" groups, education institutions etc,
- Clarifying statutory roles and responsibilities of relevant organisations,
- Developing an information booklet/CD on the threatened species and priority species of the Region including details on distribution, biology, threats and management strategies,
- Further advancing and promoting the GIS tool developed in this Plan (Section 7), specifically for catchment scale work with catchment groups, and
- Carrying out threatened species workshops across the Region.

Action 3.1 Appoint a Regional Threatened Species Communicator

Component Tasks

1. Define the role of Threatened Species Communicator.
2. Further develop key deliverables for this role e.g. threatened species information booklet.

Action 3.2 Develop and implement a Regional Threatened Species Communication Strategy for threatened species management and threat abatement programs.

Component Tasks

1. Develop a Regional Threatened Species Communication Strategy.
2. Develop threatened species information booklet.
3. Develop adaptive database.
4. Carry out workshops on threatened species management.

Threatened species GIS tool

The Region lacks a centralised database containing information on threatened species and their response to threatening processes. This limits the capacity to strategically plan, adaptively manage and analyse change, a significant issue with the current climate change predictions.

As part of this regional planning process the concept and prototype for a Threatened Species GIS tool was developed, as described in Section 7. This tool allows the distribution of threatened species, and their susceptibility to primary threatening processes to be viewed spatially across the Region. The tool will be useful at multiple scales from landscape scale to individual properties.

This GIS tool requires further development, which will be coordinated by both the Threatened Species Coordinator and the Communicator. Once developed this tool will be available to land managers and NRMOs and will allow them to obtain information on specific species in a grid square, and their response to threatening processes and specific habitat requirements. This will further enable adaptive management of threatened species and threatening processes at a landscape scale.

Action 3.3 Further develop the threatened species GIS tool (Section 7)

Component Tasks
1. Continue input of threatened species and threatening process data into Regional Database.
2. Carry out Regional Threat Mapping.
3. Explore methods to spatially represent threats.
4. Input Priority species into GIS tool.
5. Integrate into Regional Communication Strategy.
6. Develop interactive spatial, biological and threatened species response data tool to be used by land managers.

Objective 4: Increase knowledge of threatened species

Knowledge Gaps

Effective threatened species recovery and threat abatement is reliant upon current and relevant information. This Regional Plan has highlighted broad scientific knowledge gaps in threatened species and threatening process that are currently reducing the capacity for recovery and threat abatement activities (Section 5.6). The key gaps in regional knowledge identified were:

- Incomplete knowledge of threatened species distribution and unequal survey effort for the east of the Region,
- Incomplete knowledge of threatened species response to key threats and the nature of the threatening processes,
- Lack of data on, and limited ability to spatially represent, threatening processes, and
- Incomplete taxonomic knowledge/attention to specific groups of threatened species i.e. invertebrates, fungus, lichens and aquatic species.

Action 4.1 Identify the key knowledge gaps in threatened species data

Component tasks
1. Continue to collate threatened species and threatening process information

Action 4.2 Where knowledge gaps identified, conduct survey and initiate research

Component tasks
1. Prioritize the implementation of surveys e.g. status of the species.
2. Prioritize the implementation of research e.g. threat response by threatened species.
3. Define critical habitat for all threatened species.

Action 4.3 Develop strategies to improve data sharing between agencies

Component Tasks
1. Identify all stakeholders involved in threatened species and NRM within the South Coast Region e.g. NRMOS, NGOs, government agencies.
2. Identify the type of data collection from stakeholders.
3. Identify repetition in data collection.
4. Identify potential routes of transfer for data sharing.

Objective 5: Integrate climate change responses into threatened species recovery

Climate Change

One of the aims of this regional planning process was to trial the incorporation of climate change considerations into regional recovery and threat abatement planning. It was found that many of the current recovery actions are already taking into account potential climate change impacts. The requirement of threatened species recovery is to build the resilience of the threatened species.

Action 5.1 Develop a strategy to increase the resilience of threatened species, landscapes and socio-ecological systems from climate change

Objective 6: Reduce the impact that climate change could have on threatened species and ameliorate its interaction with other primary threatening processes

Action 6.1 Establish long term monitoring and research projects relating to the impacts of climate change on threatened species

Component Tasks

1. Establish climate change monitoring priorities and protocols for threatened species and ecological communities based on key indicator species.
2. Develop projected scenarios and test on best available knowledge of dominant and keystone threatened species, vulnerability, resilience and habitat requirements to determine critical climate thresholds.
3. Develop management response options for species and threatened ecological communities at risk from climate change.

Action 6.2 Consider the potential interactions of climate change with other threatening processes in threat abatement programs

Component Tasks

1. Consider the exacerbated impact of feral predation and other threatening processes with climate change.
2. Conceptualise the interaction of the elements of fire regimes with other environmental stresses exacerbated by climate change.

Action 6.3 Build resilience of threatened species through reducing habitat fragmentation and allowing range shifting as a result of climate change

Component Tasks

1. Expand corridor system throughout highly fragmented landscapes.
2. Commence effective strategic planning to build linkages between tenures that buffer climate-forced distributional changes.

Action 6.4 Consider ex situ conservation for species threatened with extinction by climate change

Component Tasks
1. Continue the collection and storage of seeds of threatened species in the Threatened Flora Seed Centre.
2. Continue current captive breeding programs of animals for ex situ conservation.
3. Consider captive breeding programs for ex situ conservation of species that are considered will be particularly susceptible to extinction due to climate change impacts.

9.3 Prioritise Regional Recovery Actions

A key to improving the quality, efficiency and effectiveness of the management of threatened species and ecological communities across the Region was determined to be the prioritisation of threatened species and communities for recovery and threat abatement actions. This regional process developed the concept and prototype of a GIS tool to analysis the regional distribution of threatened species and threatening processes in order to identify management and research priorities, as discussed in Section 7. This prioritising was done at three levels:
- Single species
- Primary threatening processes
- Key geographic areas

9.3.1 Prioritising Single Species Recovery

Objective 7: Improve conservation status of threatened species and ecological communities in the Region

Action 7.1 Continue, and where appropriate integrate, the implementation of single species recovery plans

Component tasks
1. Where single species recovery actions overlap in geographic locations consider a collective management response (see Key Threatened Species Areas, Section 7).

Action 7.2 Collate all single species recovery plans, multi-species recovery plans, threat amelioration plans and area management plans in the Region

Component Tasks
1. Collate all data.
2. Consult with all relevant stakeholders e.g. scientists, landowners, recovery teams, government agencies.
3. Identify gaps in Recovery Plan implementation including knowledge gaps, implementation gaps, survey efforts and resources.
4. Identify constraints to implementing Recovery Actions e.g. funding, personnel, and expertise.

Action 7.3 Detail potential reintroduction programs for threatened species which are currently extinct from the Region

Component Tasks
1. Collate data of the historical distributions of threatened species across the Region, e.g. Abbott (2008).
2. Identify potential reintroduction sites.

Action 7.4 Determine the significance of populations of threatened species and communities to the survival of the species/community.

Component Tasks
1. Identify threatened species which are not endemic to the Region but have potentially important populations in the Region.
2. Research the importance of these populations to the survival of the threatened species.

Action 7.5 Identify and implement management of threats for threatened species not currently covered by recovery planning

Component Tasks
1. Identify the amelioration of threats needed from the threat matrix.
2. Ensure integration of 'non-covered species' into threat amelioration plans.
3. Continue monitoring programs for non-covered species.

Action 7.6 Continue to implement and further develop strategies and protocols for landowners to monitor threatened species.

Component Tasks
1. Determine threatened species that occur cross-tenure.
2. Develop strategies and protocols for landholders to assist the recovery of threatened species on their properties

9.3.2 Key Regional Threat Abatement Actions

A key to a regional scale approach to threatened species recovery is the integration of threat abatement actions across land tenures and into threatened species recovery actions.

Objective 8: Minimise the impact of inappropriate fire regimes on threatened species and ecological communities

Action 8.1 Document optimal fire regimes for the threatened species and ecological communities

Component Tasks
1. Identify and document optimal fire regimes (or data gaps where unknown) for all threatened species and ecological communities in the South Coast Region.
2. Support research into documenting optimal fire regimes for threatened species and ecological communities where these are unknown.

Action 8.2 Encourage the incorporation of knowledge of optimal fire regimes for the Region's threatened species and ecological communities into DEC fire management

Component Tasks
1. Develop and improve existing fire management protocols for the threatened species and ecological communities in the Region.
2. Make sure that fire management plans for prescription burning and wildfire response in the South Coast Region include consideration of threatened species and ecological communities.

Objective 9: Minimise the spread and impact of Phytophthora cinnamomi

Action 9.1 Continue best management practices to reduce the spread of *Phytophthora cinnamomi*

Component Tasks
1. Continue to restrict vehicle access of susceptible areas to dry soil conditions.
2. Continue and expand current Phosphite spraying program.

Action 9.2 Conduct research into *Phytophthora cinnamomi*

Component Tasks
1. Continue to support research into alternative mechanisms for controlling the impact and spread of *Phytophthora cinnamomi*.

Action 9.3 Promote community awareness of *Phytophthora cinnamomi*

Component Tasks
1. Promote community awareness of *Phytophthora* and the importance of reducing its spread.
2. Recognise and award community achievements in *Phytophthora* management.

Objective 10: Minimise the impact of fox and cat predation on the threatened fauna

Action 10.1 Continue and expand fox control

Component Tasks
1. Continue and expand Western Shield Program for fox control in all areas containing populations of sensitive fauna.

Action 10.2 Conduct research into fox and cat control

Component Tasks
1. Research non-target sensitivity to cat baits and conduct experimental baiting in areas containing highly sensitive threatened fauna.
2. Conduct research into mesopredator interactions in an area containing sensitive threatened fauna species.

Objective 11: Minimise the impact of salinisation and altered hydrology on the threatened species and ecological communities

Action 11.1 Identify threatened species at risk of salinisation

Component Tasks
1. Identify threatened species and ecological communities at risk from impacts of salinisation or altered hydrology over the next ten years, e.g. Utber and Newell (2008).
2. Consider ex situ conservation for any threatened species threatened with extinction due to the impacts of salinisation.

Action 11.2 Coordinate with NRMOs to mitigate salinisation across land tenures to reduce potential impacts on threatened species

Component Tasks
1. Provide NRMOs and landholders with information on the location and susceptibility of threatened species to salinisation.
2. Promote, recognise and award community achievements in salinisation mitigation.

Objective 12: Minimise the impact of habitat fragmentation on the threatened species and ecological communities

Action 12.1 Create corridors between habitat fragments which are important habitat for threatened species

Component Tasks
1. Continue and develop the Macro-corridor and Gondwana Link projects.
2. Identify any important habitat for threatened species that is particularly threatened by fragmentation and create habitat corridors to those fragments.

Objective 13: Minimise the impact of small population size on the threatened species and ecological communities

Action 13.1 Increase population size of threatened species which are particularly threatened by small population size

Component Tasks
1. Continue current translocations and captive breeding programs.
2. Develop translocation proposals and methods.
3. Continue genetic research.

Objective 14: Minimise the impact of invasive weeds on the threatened species and ecological communities

Action 14.1 Control invasive weeds where they are threatening threatened species and ecological communities

Component Tasks
1. Continue and develop weed strategy.
2. Promote, recognise and award community achievements in weed management.

Objective 15: Monitoring and evaluation of all threatening processes impact on threatened species/ communities across the Region

Action 15.1 Monitor and research the impacts of threatening process on threatened species

Component Tasks
1. Review and research the impacts of all threatening processes on the threatened species/communities of the South Coast Region.

9.3.3 Key Threatened Species Areas

The analyses of the threatened species and threatening process across the Region and the subsequent development of the GIS tool has located Key Threatened Species Areas for threatened species recovery and threatening process abatement programs. Integrated management of these areas would increase the efficiency and effectiveness of recovery and threat abatement actions in these areas.

The three Key Threatened Species Areas identified using the GIS tool are the Stirling Range Management Area, Fitzgerald Management Area and Albany Management Area (Section 7.3).

Objective 16: Integrate threatened species and threat abatement actions in the identified Key Threatened Species Areas

Action 16.1 Develop communication strategies for Key Threatened Species Areas containing mixed tenures

Component Tasks
1. Workshop with all stakeholders.
2. Develop area boundaries.
3. Disseminate information to landowners through the GIS Tool.

Action 16.2 Develop a process for data dissemination by mixed-tenure Key Threatened Species Areas for adaptive management

Component Tasks
1. Increase capacity of non-scientific community to monitor threatened species
2. Develop monitoring protocols and methods
3. Develop route for information transfer between stakeholders and Regional Database with confidentiality maintained

Action 16.3 Develop integrated management plans for the three Key Threatened Species Areas; Stirling Range Management Area, Fitzgerald Management Area and Albany Management Area

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APPENDIX 1: THREATENED SPECIES AND ECOLOGICAL COMMUNITIES OF THE SOUTH COAST REGION

D: Distribution Category
Recovery Plan and Team: SS – single species, MS – multi-species, * Commonwealth

Threatened Fauna

Scientific name	Common name	Status		Class	D	Recovery Plan	Recovery Team
		WA	AUS				
Diomedea amsterdamensis	Amsterdam Albatross	CR	EN	Marine Bird	5	MS	MS
Pezoporus wallicus flaviventris	Western Ground Parrot	CR	EN	Bird	1	SS	MS
Potorous gilberti	Gilbert's Potoroo	CR	CR	Mammal	1	SS	SS
Undescribed Rhytidid sp.(WAM#2295-69)	Stirling Range Rhytidid Snail	CR	NL	Invertebrate	1	MS	MS
Atrichornis clamosus	Noisy Scrub-bird	EN	VU	Bird	1	SS	MS
Balaenoptera musculus intermedia	Blue Whale ('true subspecies')	EN	EN	Marine Mammal	4	MS	?
Cacatua pastinator pastinator	Western (Muirs) Long-billed Corella	EN	VU	Bird	4	SS	SS
Calyptorhynchus baudini	Baudin's Black Cockatoo	EN	VU	Bird	3	MS	MS
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	EN	EN	Bird	3	SS	SS
Caretta caretta	Loggerhead Turtle	EN	EN	Marine Reptile	4	MS	*MS
Cynotelopus notabilis	WA Pill Millipede	EN	NL	Invertebrate	2		MS
Diomedea dabbenena	Tristan Albatross	EN	EN	Marine Bird	4	MS	*MS
Diomedea sanfordi	Northern Royal Albatross	EN	EN	Marine Bird	4	MS	*MS
Galaxias truttaceus hesperius	Western Trout Minnow	EN	CR	Fish	1	SS	
Macronectes giganteus	Southern Giant Petrel	EN	EN	Marine Bird	4	MS	*MS
Moggridgea sp. (B.Y.Main 1990/24, 25)	Stirling Range Moggridgea Spider	EN	NL	Invertebrate	1	MS	MS
Moggridgea tingle	Moggridgea tingle	EN	NL	Invertebrate	3		MS
Parantechinus apicalis	Dibbler	EN	EN	Mammal	3	SS	SS
Phascogale calura	Red-tailed Phascogale	EN	EN	Mammal	3	SS	
Psophodes nigrogularis nigrogularis	Western Whipbird (western heath subsp.)	EN	EN	Bird	1	MS	MS
Austrarchaea mainae	Western Archaeid Spider	VU	NL	Invertebrate	1		MS
Botaurus poicilptilus	Australasian Bittern	VU	NL	Bird	4		
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	NL	Bird	4	MS	MS
Carcharias taurus	Grey Nurse Shark	VU	VU	Marine Fish	4	*SS	*SS
Carcharodon carcharias	Great White Shark	VU	VU	Marine Fish	4	*SS	*SS
Cereopis novaehollandiae grisea	Recherche Cape Barren Goose	VU	VU	Bird	1		
Dasyornis longirostris	Western Bristlebird	VU	VU	Bird	1	MS	MS
Dasyurus geoffroii	Chuditch	VU	VU	Mammal	4	SS	SS
Dermochelys coriacea	Leatherback Turtle	VU	VU	Marine Reptile	4	*MS	*MS
Diomedea epomophora	Southern Royal Albatross	VU	VU	Marine Bird	4	*MS	*MS
Diomedea exulans	Wandering Albatross	VU	VU	Marine Bird	4	*MS	*MS
Diomedea gibsoni	Gibson's Albatross	VU	VU	Marine Bird	4	*MS	*MS
Engaewa walpolea	Walpole Burrowing Crayfish	VU	NL	Invertebrate	5	SS	SS
Eubaleana australis	Southern Right Whale	VU	EN	Marine Mammal	3	* SS	
Galaxiella munda	Mud Minnow	VU	NL	Fish	3		
Leipoa ocellata	Malleefowl	VU	VU	Bird	3	*SS	*SS
Megaptera novaeangliae	Humpback Whale	VU	VU	Marine Mammal	3	*SS	
Myrmecobius fasciatus	Numbat	VU	VU	Mammal	4	SS	SS
Nannatherina balstoni	Balston's Pygmy Perch	VU	VU	Fish	3		
Petrogale lateralis hacketti	Recherche Rock Wallaby	VU	VU	Mammal	1	MS	
Petrogale lateralis lateralis	Black-flanked Rock Wallaby	VU	VU	Mammal	3	SS	
Phascogale tapoatafa tapoatafa	Brush-tail Phascogale	VU	NL	Mammal	3		
Phoebetria fusca	Sooty Albatross	VU	VU	Marine Bird	4	MS	MS
Phoebetria palpebrata	Light-mantled Albatross	VU	LM	Marine Bird	4	MS	MS
Platycercus icterotis xanthogenys	Western Rosella (inland species)	VU	NL	Bird	4		
Procellaria aequinoctalis	White-chinned Petrel	VU	NL	Marine Bird	4		
Pseudochierus occidentalis	Western Ringtail Possum	VU	VU	Mammal	3	SS	SS
Pseudomys shortridgei	Heath Mouse	VU	VU	Mammal	3	SS	

Scientific name	Common name	Status		Class	D	Recovery Plan	Recovery Team
		WA	AUS				
Pseudonaja affinis tanneri	Recherche Dugite	VU	NL	Reptile	1		
Setonix brachyurus	Quokka	VU	VU	Mammal	4	SS	SS
Spicospina flammocaerulea	Sunset Frog	VU	EN	Amphibian	1	SS	SS
Thalassarche carteri	Indian Yellow-nosed Albatross	VU	VU	Marine Bird	4	MS	MS
Thalassarche cauta	Shy Albatross	VU	VU	Marine Bird	4	MS	MS
Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross	VU	LM	Marine Bird	4	MS	MS
Thalassarche chrysostoma	Grey-headed Albatross	VU	VU	Marine Bird	4	MS	MS
Thalassarche melanophrys	Black-browed Albatross	VU	VU	Marine Bird	4	MS	MS
Thalassarche salvini	Salvin's Albatross	VU	VU	Marine Bird	4	MS	MS

Threatened Flora (DRF)

Scientific name	Common name	Status		Class	D	Recovery Plan	Recovery Team
		WA	AUS				
Adenanthos pungens subsp. effusus	Sprawling Spiky Adenanthos	CR	EN	Shrub	4	SS	MS
Andersonia axilliflora	Giant Andersonia	CR	EN	Shrub	1	SS	MS
Banksia anatona	Cactus Banksia	CR	EN	Shrub	1	SS	MS
Banksia brownii	Feather-leaved Banksia	CR	EN	Shrub	1	SS	MS
Banksia ionthocarpa subsp. ionthocarpa	Kamballup Banksia	CR	NL	Shrub	1	SS	MS
Banksia montana	Stirling Range Banksia	CR	EN	Shrub	1	SS	MS
Banksia mucronulata subsp. retrorsa	Recurved-leaved Swordfish Banksia	CR	NL	Shrub	1	SS	MS
Brachyscias verecundus	Ironstone Brachyscias	CR	CR	Herb	5	SS	
Caladenia drakeoides	Hinged Dragon Orchid	CR	EN	Orchid	5	SS	MS
Calectasia cyanea	Cape Tinsel Lilly	CR	CR	Herb	1	SS	MS
Daviesia glossosema	Maroon-flowered Daviesia	CR	CR	Shrub	1	SS	MS
Daviesia pseudaphylla	Stirling Range Daviesia	CR	EN	Shrub	1	SS	MS
Drakaea confluens ms	Late Hammer Orchid	CR	EN	Orchid	3	SS	MS
Eremophila lactea	Milky Emu Bush	CR	EN	Shrub	1	SS	MS
Eremophila subteretifolia ms	Lake King Eremophila	CR	EN	Shrub	4	SS	MS
Eremophila verticillata	Whorled Eremophila	CR	EN	Shrub	5	SS	MS
Gastrolobium luteifolium	Yellow-leafed Nemcia	CR	NL	Shrub	1	SS	MS
Grevillea maxwellii	Maxwell's Grevillea	CR	EN	Shrub	1	SS	MS
Isopogon uncinatus	Albany Cone Bush	CR	EN	Shrub	1	SS	MS
Lambertia echinata subsp. echinata	Prickly Honeysuckle	CR	EN	Shrub	1	SS	MS
Lambertia fairallii	Fairall's Lambertia	CR	EN	Shrub	1	SS	MS
Lambertia orbifolia subsp. orbifolia ms	Round-leafed Honeysuckle	CR	EN	Shrub	1	SS	MS
Latrobea colophona		CR	NL	Shrub	1		
Leucopogon gnaphalioides	Stirling Range Beard Heath	CR	EN	Shrub	1	SS	MS
Marianthus sp. Bremer (N.Gibson & M.Lyons 1776)	Bremer Marianthus	CR	NL	Shrub	5		MS
Myoporum turbinatum	Salt Myoporum	CR	EN	Shrub	1	SS	MS
Persoonia micranthera	Small-flowered Persoonia	CR	EN	Shrub	1	SS	MS
Rhacocarpus webbianus	Webb's Moss	CR	NL	Moss	3	SS	MS
Rhizanthella gardneri	Underground Orchid	CR	EN	Orchid	3	SS	MS
Scaevola macrophylla	Large-flowered Scaevola	CR	NL	Herb	1	SS	MS
Verticordia apecta	Hay River Featherflower	CR	NL	Shrub	1	SS	MS
Acacia depressa	Echidna Wattle	EN	VU	Shrub	5		MS
Acacia rhamphophylla	Kundip Wattle	EN	EN	Shrub	1	SS	MS
Adenanthos velutinus	Velvet Woollybush	EN	EN	Shrub	1		MS
Apium prostratum subsp. phillipii	Fine-leaved Apium	EN	VU	Herb	1		MS
Banksia oligantha	Wagin Banksia	EN	EN	Shrub	5	SS	MS
Banksia pseudoplumosa		EN	NL	Shrub	1		MS
Boronia clavata	Bremer Boronia	EN	NL	Shrub	1		MS
Caladenia bryceana subsp. bryceana	Dwarf Spider Orchid	EN	EN	Orchid	2	SS	MS
Caladenia christineae	Christine's Spider Orchid	EN	VU	Orchid	4		MS
Caladenia dorrienii	Cossack Spider Orchid	EN	EN	Orichid	4		MS
Caladenia winfieldii	Majestic Spider Orchid	EN	EN	Orichid	5	SS	MS
Commersonia sp Mt Groper		EN	EN	Shrub	1		
Conostylis drummondii	Drummond's Conostylis	EN	NL	Shrub	5		MS
Coopernookia georgei	Mauve Coopernookia	EN	EN	Herb	1		MS
Darwinia collina	Yellow Mountain Bell	EN	EN	Shrub	1	SS	MS
Darwinia oxylepis	Scarlet Mountain Bell	EN	EN	Shrub	1	SS	MS

Scientific name	Common name	Status		Class	D	Recovery Plan	Recovery Team
		WA	AUS				
Darwinia sp. Stirling Range (GJ Keighery 5732)	Red Mountain Bell	EN	VU	Shrub	1		MS
Darwinia wittwerorum	Wittwer's Mountain Bell	EN	EN	Shrub	1	SS	MS
Daviesia megacalyx	Long-sepaled Daviesia	EN	EN	Shrub	1	SS	MS
Daviesia obovata	Paddle-leaf Daviesia	EN	NL	Shrub	1		MS
Drakaea micrantha ms	Dwarf Hammer Orchid	EN	VU	Orchid	4		MS
Eremophila denticulata subsp. trisulcata		EN	EN	Shrub	5	SS	
Eucalyptus burdettiana	Burdett Gum	EN	EN	Tree	1		MS
Eucalyptus coronata	Crowned Mallee	EN	VU	Tree	1		MS
Eucalyptus insularis	Twin Peak Island Mallee	EN	EN	Tree	1		MS
Goodenia integerrima	Gypsum Goodenia	EN	VU	Shrub	5	SS	MS
Grevillea involucrata	Lake Varley Grevillea	EN	EN	Shrub	5	SS	MS
Hibbertia priceana		EN	NL	Shrub	1		MS
Kunzea similis subsp. mediterranea		EN	NL	Shrub	1		
Leucopogan marginatus	Thick-margined Leucopogan	EN	EN	Shrub	2	SS	MS
Muehlenbeckia horrida subsp. abdita	Remote Thorny Lignum	EN	CR	Shrub	5	SS	MS
Myoporum cordifolium	Jerramungup Myoporum	EN	VU	Shrub	1		MS
Reedia spathacea		EN	NL	Sedge	5		
Sphenotoma drummondii	Mountain Paper Heath	EN	EN	Shrub	1	SS	MS
Stachystemon vinosus		EN	NL	Shrub	1	SS	
Verticordia densiflora var. pedunculata	Long-stalked Featherflower	EN	EN	Shrub	5		MS
Verticordia fimbrilepis subsp. australis	Southern Shy Featherflower	EN	VU	Shrub	1		MS
Verticordia pityrhops	Mt Barren Featherflower	EN	EN	Shrub	1		MS
Villarsia calthifolia	Mountain Villarsia	EN	EN	Herb	1	SS	MS
Xyris exilis	Stirling Range Xyris	EN	VU	Herb	1		MS
Acacia awestoniana	Stirling Range Wattle	VU	VU	Shrub	1		MS
Acacia brachypoda	Western Wheatbelt Wattle	VU	EN	Shrub	5		
Acacia leptalea	Chinocup Wattle	VU	EN	Shrub	5	SS	MS
Acacia trulliformis	Ongerup Wattle	VU	NL	Shrub	1		MS
Adenanthos dobagii	Fitzgerald Woollybush	VU	EN	Shrub	1		MS
Adenanthos ellipticus	Oval-leaf Adenanthos	VU	VU	Shrub	1		MS
Adenanthos pungens sub.sp pungens	Spiky Adenanthos	VU	VU	Shrub	4	SS	MS
Allocasuarina tortiramula	Twisted Sheoak	VU	VU	Tree	5		MS
Andersonia pinaster ms	Two Peoples Bay Andersonia	VU	VU	Shrub	1		MS
Anigozanthos bicolor subsp. minor	Small Two Colour Kangaroo Paw	VU	EN	Herb	1	SS	MS
Asplenium obtusatum subsp. northlandicum	Shore Spleenwort	VU	NL	Herb	3		MS
Banksia goodii	Good's Banksia	VU	VU	Shrub	1		MS
Banksia sphaerocarpa var. dolichostyla	Ironcap Banksia	VU	VU	Shrub	5		MS
Banksia verticillata	Granite Banksia	VU	VU	Shrub	2		MS
Beyeria sp Bandalup		VU	NL	Shrub	1		
Boronia revoluta	Ironcaps Boronia	VU	EN	Shrub	4		MS
Caladenia harringtoniae	Pink Spider Orchid	VU	VU	Orchid	4		MS
Calectasia pignattiana	Stilted Tinsel Lilly	VU	VU	Herb			MS
Chordifex abortivus	Manypeaks Rush	VU	EN	Sedge	1	SS	MS
Conostylis lepidospermoides	Sedge Conostylis	VU	EN	Herb	1		MS
Conostylis misera	Grass Conostylis	VU	EN	Herb	1	SS	MS
Cryptandra congesta		VU	NL	Shrub	2	SS	
Darwinia calothamnoides		VU	NL	Shrub	5		
Darwinia meeboldii	Cranbrook Bell	VU	VU	Shrub	1		MS
Darwinia squarrosa	Fringed Mountain Bell	VU	VU	Shrub	1		MS
Deyeuxia drummondii	Drummond's Grass	VU	EN	Grass	1	SS	MS
Diuris drummondii	Tall Donkey Orchid	VU	VU	Orchid	4		MS
Diuris micrantha	Dwarf Bee Orchid	VU	VU	Orchid	5		MS
Drummondita longifolia	Peak Charles Drummondita	VU	VU	Shrub	1		MS
Eleocharis keigheryi	Keighery's Eleocharis	VU	VU	Sedge	5		MS
Eremophila denticulata subsp. denticulata	Fitzgerald Eremophila	VU	VU	Shrub	1		MS
Eucalyptus merrickiae	Goblet Mallee	VU	VU	Tree	1		
Eucalyptus nutans	Red-flowered Moort	VU	NL	Tree	1		MS
Eucalyptus purpurata		VU	NL	Tree	1		
Gastrolobium lehmannii	Cranbrook Pea	VU	VU	Shrub	2		MS
Grevillea fuscolutea		VU	NL	Shrub	1	SS	
Grevillea infundibularis	Fan-leaf Grevillea	VU	EN	Shrub	1		MS
Kennedia glabrata	Northcliffe Kennedia	VU	VU	Herb	4		MS

Scientific name	Common name	Status		Class	D	Recovery Plan	Recovery Team
		WA	AUS				
Kunzea similis spp similis		VU	NL	Shrub	1		
Laxmannia grandiflora subsp. brendae		VU	NL	Shrub	1	SS	
Lepidium aschersonii	Spiny pepper-cress	VU	VU	Herb	1		MS
Marianthus mollis		VU	EN	Shrub	1	SS	
Meziella trifida	Three-lobed Meziella	VU	VU	Herb	5		MS
Microtis globula	Globular Mignonette Orchid	VU	VU	Orchid	1		MS
Orthrosanthus muelleri	South Stirling Morning Iris	VU	EN	Herb	1	SS	MS
Ricinocarpos trichophorus	Barrens Wedding Bush	VU	EN	Shrub	1		MS
Roycea pycnophylloides	Saltmat	VU	EN	Herb	5	SS	MS
Stylidium galioides	Yellow Fitzgerald Triggerplant	VU	VU	Herb	1		MS
Tetratheca aphylla subsp. megacarpa		VU	VU	Shrub	5		
Thelymitra psammophila	Sandplain Sun Orchid	VU	VU	Orchid	2		MS
Tribonanthes purpurea	Granite Pink	VU	VU	Herb	4		MS
Verticordia carinata	Stirling Range Featherflower	VU	VU	Shrub	2		MS
Verticordia crebra	Crowded Featherflower	VU	VU	Shrub	1		MS
Verticordia fimbrilepis subsp. fimbrilepis		VU	EN	Shrub	5	SS	
Verticordia helichrysantha	Coast Featherflower	VU	VU	Shrub	1		MS

Threatened Ecological Communities

Ecological Community	Status		D	Recovery Plan	Recovery Team
	WA	AUS			
Lake Bryde	CR	NL	5	SS	SS
Montane Thicket of the Eastern Stirling Range	CR	EN	1	SS	SS
Mt Lindesay – Little Lindesay Vegetation Complex	EN	NL	1	SS	
Russell Range Mixed Thicket Complex	VU	NL	1		
Eucalyptus acies mallee heath	VU	NL	1		
Herblands and Bunch Grasslands	VU	NL			

APPENDIX 2: DOCUMENTS RELEVANT TO SOUTH COAST THREATENED SPECIES AND THREAT ABATEMENT

This South Coast Threatened Species and Ecological Communities Strategic Management Plan is intended to operate in conjunction with current documents that relate to threatened species recovery and threat abatement in the Region. These documents are listed under the following headings:

Recovery Plans

The Recovery Plans for the threatened fauna, flora and ecological communities that occur in the South Coast Region (and species that occur in the buffer zone indicated by *) are listed below, including those endorsed under the EPBC Act (Commonwealth), those endorsed under State legislation (State), State Interim recovery plans (IRP) and draft recovery plans (Draft). This list also includes the DRF Wildlife Management Program documents.

Recovery Plan	Life of Plan	Endorsed?
FAUNA		
Blue, Fin and Sei Whale Recovery Plan	2005-2010	Commonwealth
Chuditch *(Dasyurus geoffroii)* Recovery Plan	1992-2001	Commonwealth
Dibbler (*Parantechinus apicalis)* Recovery Plan	2003-2013	Commonwealth
Gilbert's Potoroo (*Potorous gilberti*) Recovery Plan	2003-2008	Commonwealth
Humpback Whale Recovery Plan (*Megaptera novaeangliae*)	2005-2010	Commonwealth
National Recovery Plan for Malleefowl	2000	Commonwealth
Noisy Scrub-bird, *Atrichornis clamosus*, Recovery Plan	1993-2002	Commonwealth
Recovery Plan for Albatrosses and Giant-Petrels: Diomedeidae; Procellariidae	2001-2005	Commonwealth
Recovery Plan for Marine Turtles in Australia	2003-2007	Commonwealth
Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) in Australia	2002-2006	Commonwealth
Southern Right Whale (*Eubalaena australis*) Recovery Plan	2005-2010	Commonwealth
Sub-Antarctic Fur Seal and Southern Elephant Seal Recovery Plan	2004-2009	Commonwealth
White Shark (*Carcharodon carcharias*) Recovery Plan	2002-2006	Commonwealth
Recovery Plan for the Numbat (*Myrmecobius fasciatus*)	1997-1999	State
Sunset Frog Recovery Plan	1995-2005	State
Western Ground Parrot (*Pezoporus wallicus flaviventris*) Recovery Plan	1996-1998	IRP
Western Ringtail Possum (*Pseudocheirus occidentalis*) Interim Recovery Plan	2005-2010	IRP

Recovery Plan	Life of Plan	Endorsed?
Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan	2000-2009	Draft
Galaxias truttaceus hesperius (The Western Trout Minnow) Recovery Plan	2008-2012	Draft
National recovery Plan for the Heath Rat (*Pseudomys shortridgei*, Dayang)		Draft
Petrogale lateralis lateralis Recovery Plan		Draft
Recovery Plan for Baudins and Forest Red-tailed Black Cockatoo	2005-2015	Draft
Recovery Plan for the genus *Engaewa*		Draft
Red-tailed Phascogale Recovery Plan	2004-2009	Draft
South Coast Threatened Birds Recovery Plan	2004-2009	Draft
Western Australia Marine Turtle Management Plan	2000-2009	Draft
Western Long-Billed Corella (Southern Subspecies) or Muir's Corella (*Cacatua pastinator pastinator*) Recovery Plan		Draft
Wildlife Management Plan for the Threatened and Relictual Invertebrates of the Stirling Range National Park	2008-2012	Draft
FLORA		
Declared Rare and Poorly Known Flora in the Albany District	2005	Management Program No. 20
Declared Rare and Poorly Known Flora in the Esperance District	2001	Management Program No. 21
Declared Rare and Poorly Known Flora in the Katanning District	2000	Management Program No. 25
Albany Cone Bush, *Isopogon uncinatus*	2001-2003	Commonwealth, IRP
Dwarf Spider Orchid, *Caladenia bryceana* subsp. *bryceana* ms	1999-2002	Commonwealth, IRP
Fairall's Lambertia, *Lambertia fairallii*	2005-2010	Commonwealth, IRP
Feather-leaved Banksia, *Banksia brownii*	2005-2010	Commonwealth
Giant Andersonia, *Andersonia axilliflora*	2003-2008	Commonwealth, IRP
Gillham's Bell, *Darwinia oxylepis*	2001-2003	Commonwealth, IRP
Grass Conostylis, *Conostylis misera*	2005-2010	Commonwealth, IRP
Kundip Wattle, *Acacia rhamphophylla* Maslin ms	2005-2010	Commonwealth, IRP
Late Hammer Orchid, *Drakaea confluens* ms	2001-2003	Commonwealth, IRP
Long-sepaled Daviesia, *Daviesia megacalyx*	2005-2010	Commonwealth, IRP
Manypeaks Rush, *Chordifex abortivus* L.A.S Johnson & B.G. Briggs ms	2005-2010	Commonwealth, IRP
Milky Emu Bush, *Eremophila lactea*	1999-2002	Commonwealth, IRP

Recovery Plan	Life of Plan	Endorsed?
Mountain Villarsia, *Villarsia calthifolia*	2004-2009	Commonwealth, IRP
Salt Myoporum, *Myoporum turbinatum*	2000-2007	Commonwealth, IRP
Small-flowered Snottygobble, *Persoonia micranthera*	2003-2008	Commonwealth, IRP
Sprawling Spiky Adenanthos*, Adenanthos pungens* subsp. *effusus*	2006-2011	Commonwealth, IRP
Stirling Range Beard Heath, *Leucopogon gnaphalioides*	2001-2003	Commonwealth, IRP
Stirling Range Dryandra, *Dryandra montana*	2005-2010	Commonwealth, IRP
Whorled Eremophila, *Eremophila verticillat*a	2003-2008	Commonwealth, IRP
Wittwer's Mountain Bell, *Darwinia wittwerorum*	2005-2010	Commonwealth, IRP
Yellow Mountain Bell, *Darwinia collina*	2005-2010	Commonwealth, IRP
Adenanthos cunninghamii	2004-2009	IRP
Bennett's Mallee, *Eucalyptus bennettiae*	2004-2009	IRP
Cactus Dryandra, *Dryandra anatona*	2001-2004	IRP
Drummond's Grass, *Deyeuxia drummondii*	2001-2004	IRP
*Gypsum Goodenia, *Goodenia integerrima*	2003-2008	IRP
Hairy-fruited Marianthus, *Marianthus villosus*	2002-2004	IRP
*Hinged Dragon Orchid (Caladenia drakeoides)	2003-2008	IRP
*Ironstone Brachyscias, *Brachyscias verecundus*		IRP
Kamballup Dryandra, *Dryandra ionthocarpa* subsp. *ionthocarpa*	2004-2009	IRP
Lake King Eremophila, *Eremophila subteretifolia ms*	2002-2005	IRP
*Majestic Spider Orchid, *Caladenia winfieldii*	1996-1999	IRP
Maroon-flowered Daviesia, *Daviesia glossosema*	2001-2004	IRP
Matted Centrolepis, *Centrolepis caespitosa*	2004-2008	IRP
Maxwell's Grevillea, *Grevillea maxwellii*	2001-2004	IRP
Mountain Paper Heath, *Sphenotoma drummondii* (Summary of Actions)	1999-2002	IRP
Prickly Honeysuckle, *Lambertia echinata* subsp. *echinata*	2001-2004	IRP
Recurved-leaved Swordfish Dryandra, *Dryandra mucronulata* subsp. *retrorsa*	2003-2008	IRP
*Remote Thorny Lignum, *Muehlenbeckia horrida* subsp. *abdita*	2003-2008	IRP
Round-leafed Honeysuckle, *Lambertia* ssp. *orbifolia orbifolia* ms	2002-2007	IRP
*Saltmat, Roycea pycnophylloides	2006-2011	IRP
South Stirling Morning Iris, *Orthrosanthus muelleri*	2001-2004	IRP
Stirling Range Daviesia, *Daviesia pseudaphylla*	2001-2004	IRP

Recovery Plan	Life of Plan	Endorsed?
Large-flowered Scaevola, *Scaevola macrophylla*		Draft
Underground Orchid, *Rhizanthella gardneri*	2003-2008	Draft
ECOLOGICAL COMMUNITIES		
Montane Heath and Thicket of the South West Botanical Province, above approximately 900 m above sea level (Eastern Stirling Range Montane Heath and Thicket Community)	1999-2002	Commonwealth
Montane Mallee Thicket of the Stirling Range Mallee-thicket community on mid to upper slopes of the Stirling Range mountains and hills	2004-2009	IRP
Mt Lindesay – Little Lindesay Vegetation Complex Interim Recovery Plan	2008-2013	Draft

Management Plans

DEC Management Plans	Life of Plan
South Coast Region Regional Management Plan	1992-2002
Cape Arid National Park Interim Management Guidelines	2000
Cape Le Grande National Park Interim Management Guidelines	1992
Corackerup Nature Reserve and Unvested Peniup Reserve Interim Management Guidelines	2002-2007
Fitzgerald River National Park	1991-2001
Lake Magenta Nature Reserve Management Plan	1982
Lake Shaster Nature Reserve Interim Management Guidelines	1995
Torndirrup National Park Interim Management Guidelines	1996-2002
Two Peoples Bay Nature Reserve	1995-2005
Stirling Range and Porongurup National Parks	1999-2009
Stokes National Park Interim Guidelines	1998
Waychinicup National Park Interim Management Guidelines	
Wellstead Estuary Management Plan	2005
West Cape Howe National Park	1995-2005

City of Albany Management Plans	Life of Plan
Cheyne Bay Management Plan	1999
Cosy Corner Coastal Reserve Management Plan	2000
Lowlands Coastal Reserve Management Plan	2003
Mt Martin Regional Botanic Park Management Plan	1999
Nullakal Coastal Management Plan	
Sandpatch Coastal Management Plan	
Jerramungup Coastal Management Plan	

National Threat Abatement Plans

Threat Abatement Plans	Approval Date
Competition and land degradation by rabbits	2008
Competition and land degradation by unmanaged goats	2008
Dieback caused by the Root-rot fungus *Phytophthora cinnamomi*	2001
Predation by feral cats	2008
Predation by European red fox	2008
Predation, habitat degradation, competition and disease transmission by feral pigs	2005

APPENDIX 3: SOUTH COAST THREATENED SPECIES RECOVERY AND THREAT ABATEMENT KEY STAKEHOLDERS

Government

- Australian Government Department of the Environment, Water, Heritage and the Arts
- Western Australian Department of Environment and Conservation
- Land for Wildlife
- Western Australia Department of Agriculture
- Western Australia Department of Fisheries
- Western Australian Museum
- Western Australian Herbarium
- Local governments and councils

NRM Groups

- South Coast NRM Inc.

Non-Government Organisations

- Australian Bush Heritage
- Gondwana Link
- Greening Australia
- Wildflower Society of Western Australia
- WWF Australia

Community Groups

- Gilbert's Potoroo Action Group
- Friends of the Western Ground Parrot
- Malleefowl Preservation Group
- Project Numbat
- Wildflower Society
- Bushcarers Group

Others

- Tertiary institutions (research)
- Zoos and Wildlife Parks (captive breeding)
- Landowners

APPENDIX 4: SOUTH COAST THREATENED SPECIES RECOVERY TEAMS

Recovery Teams for threatened species and ecological communities of the South Coast Region:

- Albany District Threatened Flora Recovery Team
- Albatross and Giant Petrel Recovery Team
- Carnaby's Cockatoo Recovery Team
- Chuditch Recovery Team
- Dibbler Recovery Team
- Esperance District Threatened Flora Recovery team
- Forest Cockatoo Recovery Team (Baudins and Forest Red-tailed Black Cockatoos)
- Gilbert's Potoroo Recovery Team
- Great White Shark Recovery Team (part of the National Shark Recovery Team)
- Grey Nurse Shark Recovery Team (part of the National Shark Recovery Team)
- Katanning District Threatened Flora Recovery Team
- Lake Bryde Recovery Catchment Team
- Marine Turtle Recovery Team (part of the National Marine Turtle Recovery Team)
- Montane Heath and Thicket of the SW Botanical Province Recovery Team
- Muirs Corella Recovery Team
- National Malleefowl Recovery Team
- Numbat Recovery Team
- South Coast Threatened Birds Recovery Team
- South Coast Threatened Flora and Communities Recovery Team (including Montane Thicket TEC)
- South Coast Threatened Invertebrates Recovery Team
- Sunset Frog Recovery Team
- Warren Region Threatened Flora and TEC Recovery Team
- Western Ringtail Possum Recovery Team

APPENDIX 5: CURRENT SOUTH COAST THREATENED SPECIES RECOVERY AND THREAT ABATEMENT ACTIONS

Listed below are the main recovery and research actions for each of the threatened fauna, flora and ecological communities and threat abatement in the South Coast Region that are currently being implemented (as of 2008). These lists were completed by Janet Newell (Recovery Planner, DEC Albany) and Sarah Barrett (Threatened Flora Officer, DEC Albany), and may not be comprehensive. Species with no activities listed indicates that no species-specific recovery actions are currently being implemented for that species, although most are protected through the protection of habitat through reserves and programs such as the Western Shield fox baiting program.

Threatened Fauna

Note: Monitor refers to regular monitoring of known populations, survey refers to searching for more populations.

Scientific name	Knowledge	Organisations/ Funding	Activities
Atrichornis clamosus	Good	DEC, SCNRM, PhD	Monitor, survey, reintroduction, program, research, PhD, community education and awareness
Austrarchaea mainae	Poor	SCNRM, WA museum	Survey, research
Balaenoptera musculus intermedia			
Botaurus poicilptilus	Fair	Birds Australia	Monitor, survey
Cacatua pastinator pastinator			
Calyptorhynchus banksii naso	Good	SCNRM, Birds Australia	Monitor, survey
Calyptorhynchus baudini	Good	SCNRM, Birds Australia	Monitor, survey, nesting monitoring, community education and awareness
Calyptorhynchus latirostris	Good	SCNRM, Birds Australia	Monitor, survey, nesting monitoring, community education and awareness
Carcharias taurus			
Carcharodon carcharias			
Caretta caretta			
Cereopis novaehollandiae grisea			
Cynotelopus notabilis	Some	DEC, SCNRM, community groups	Monitor and survey during general invertebrate surveys
Dasyornis longirostris			
Dasyurus geoffroii	Fair	DEC	Survey, reintroductions?

Scientific name	Knowledge	Organisations/ Funding	Activities
Dermochelys coriacea			
Diomedea amsterdamensis			
Diomedea dabbenena			
Diomedea epomophora			
Diomedea exulans			
Diomedea gibsoni			
Diomedea sanfordi			
Engaewa walpolea		Dept of Fisheries, Dept of Water	
Eubaleana australis			
Galaxias truttaceus hesperius	Fair	Dept of Fisheries, Dept of Water, Murdoch Uni	Survey, fish way constructed to allow migration along Goodga River, maintenance of fish ladder, research
Galaxiella munda			
Leipoa ocellata	Good	MPG, SCNRM, community groups, university	Monitor, survey, research, PhD, community education, awareness and involvement
Macronectes giganteus			
Megaptera novaeangliae			
Moggridgea sp. (B.Y.Main 1990/24, 25)	Poor	DEC, WA museum, university	Survey, DNA research
Moggridgea tingle	Poor	DEC, WA museum, university	Survey, DNA research
Myrmecobius fasciatus	Good	DEC, SCNRM, community group	Monitor, reintroductions, captive breeding, research, community education and awareness
Nannatherina balstoni			
Parantechinus apicalis	Good	DEC, SCNRM	Monitor, survey, reintroductions, research
Petrogale lateralis hacketti			
Petrogale lateralis lateralis			

Scientific name	Knowledge	Organisations/ Funding	Activities
Pezoporus wallicus flaviventris	Some	DEC, SCNRM, community groups	Monitor, survey, research, research of cat control methods, community education and awareness
Phacogale tapoatafa tapotafa	Fair	DEC, SCNRM	Monitor, survey, research
Phascogale calura			
Phoebetria fusca			
Phoebetria palpebrata			
Platycercus icterotis xanthogenys	Fair	SCNRM	Survey, research
Potorous gilberti	Good	DEC, SCNRM, community groups	Monitor, captive breeding, translocation to Bald Island and fenced reserves, captive breeding, research, survey for further translocation sites, community education and awareness
Procellaria aequinoctalis			
Pseudochierus occidentalis			
Pseudomys shortridgei			
Pseudonaja affinis tanneri			
Psophodes nigrogularis nigrogularis	Good	DEC, SCNRM	Monitor, survey
Setonix brachyurus	Fair	DEC	Monitor through general fauna trapping programs (e.g. Western Shield Program)
Spicospina flammocaerulea		SCNRM	Monitor, research
Thalassarche carteri			
Thalassarche cauta			
Thalassarche chlororhynchos			
Thalassarche chrysostoma			
Thalassarche melanophrys			
Thalassarche salvini			
Undescribed Rhytidid sp.(WAM#2295-69)	Poor	DEC, SCNRM	Survey in 2008

Threatened Flora (DRF)

Note: Monitor refers to regular monitoring of known populations, survey refers to searching for more populations.

Scientific name	Knowledge	Organisations (* Funding)	Activities
Acacia awestoniana	Fair		Monitor, Pc testing, survey, seed collection
Acacia brachypoda			
Acacia depressa			
Acacia leptalea			
Acacia rhamphophylla	Fair		Monitor, survey, seed collection

Scientific name	Knowledge	Organisations (* Funding)	Activities
Acacia trulliformis	Fair	*DEC	Extensive survey 2008, salinity testing. Nominated for down listing to priority 4.
Adenanthos dobagii	Some	DEC	Monitor, survey 2008, rare flora markers
Adenanthos ellipticus	Fair		Monitor
Adenanthos pungens subsp. pungens	Some		Monitor, survey, Pc testing
Adenanthos pungens subsp. effusus			
Adenanthos velutinus			
Allocasuarina tortiramula			
Andersonia axilliflora	Good	DEC, SCNRM	Monitor, surveys, phosphite spraying, seed collection
Andersonia pinaster ms	Fair	DEC	Monitor, survey, phosphite spraying
Anigozanthos bicolor subsp. minor			
Apium prostratum subsp. phillipii	Good	DEC	Monitor, survey, weed control, seed collection
Asplenium obtusatum subsp. Northlandicum	Fair		Monitor
Banksia anatona	Good	DEC, *BCI	Monitor, protection from grazing, translocation x 2 2007, 2008, phosphite spraying, seed collection Pc testing
Banksia brownii	Good	DEC, *BCI	Monitor, protection from grazing, translocation x 3 2007, 2008, phosphite spraying, seed collection Pc testing
Banksia goodii	Good		Monitor, survey, phosphite spraying, research on demography
Banksia ionthocarpa subsp. ionthocarpa	Good	DEC, *NHT	Monitor, translocation 1998, seed collection, survey, Pc testing, research into disturbance, reproduction, etc
Banksia montana	Good	DEC, *NHT	Monitor, translocation 2005, phosphite spraying, seed collection, protection from grazing, Pc testing, research into demography etc
Banksia mucronulata subsp. retrorsa			
Banksia oligantha			
Banksia pseudoplumosa	Fair	DEC	Monitor, survey, seed collection, Pc testing
Banksia sphaerocarpa var. dolichostyla	Fair		
Banksia verticillata	Good	DEC	Monitor, survey, seed collection, Pc and canker sampling
Beyeria sp Bandalup	Good	DEC, PhD	Monitor, survey, seed collection, research of demography etc
Boronia clavata	Fair		Monitor, survey
Boronia revoluta			
Brachyscias verecundus			
Caladenia bryceana subsp. bryceana	Fair		Monitor, survey
Caladenia christineae	Fair		Monitor, survey
Caladenia dorrienii			
Caladenia drakeoides			
Caladenia harringtoniae	Poor		
Caladenia winfieldii			

Scientific name	Knowledge	Organisations (* Funding)	Activities
Calectasia cyanea	Good		Monitor, survey, seed and cuttings collection, protection from grazing, research of demography
Calectasia pignattiana			
Chordifex abortivus	Fair		Monitor, survey
Commersonia sp Mt Groper	Fair		Monitor, survey, seed collection
Conostylis drummondii			
Conostylis lepidospermoides			
Conostylis misera	Fair		Monitor, survey, seed collection
Coopernookia georgei	Fair		Monitor, survey
Cryptandra congesta			
Darwinia calothamnoides			
Darwinia collina	Good	DEC	Monitor, survey, phosphite spraying, seed collection, Pc testing, research of fire ecology
Darwinia meeboldii	Good	DEC	Monitor, survey, seed collection
Darwinia oxylepis	Good	DEC	Monitor, survey, seed collection, phosphite spraying
Darwinia sp. Stirling Range (GJ Keighery 5732)	Fair	DEC, SCNRM	Monitor, survey, seed collection, phosphite spraying
Darwinia squarrosa	Good	DEC, SCNRM	Monitor, survey, seed collection, phosphite spraying, Pc testing
Darwinia wittwerorum	Good	DEC	Monitor, survey, seed collection, Pc testing
Daviesia glossosema	Good	DEC, SCNRM	Monitor, survey, seed collection, phosphite spraying, Pc testing
Daviesia megacalyx	Good		Monitor, survey, seed collection
Daviesia obovata	Good	DEC, SCNRM	Monitor, survey, seed collection, phosphite spraying, Pc testing
Daviesia pseudaphylla	Good	DEC, SCNRM	Monitor, survey, seed collection, phosphite spraying, Pc testing
Deyeuxia drummondii	Good		Monitor, survey, seed collection, Pc testing
Diuris drummondii			
Diuris micrantha			
Drakaea confluens ms	Fair	DEC, SCNRM, community group	Monitor, survey, seed collection, phosphite spraying and injecting
Drakaea micrantha ms	Poor		Survey
Drummondita longifolia			
Eleocharis keigheryi			
Eremophila denticulata subsp. denticulata	Fair		Monitor, survey
Eremophila denticulata subsp. trisulcata			
Eremophila lactea		DEC, *NHT	Translocation 2009
Eremophila subteretifolia ms	Poor		Monitor
Eremophila verticillata		DEC	Translocation 2002
Eucalyptus burdettiana	Fair		Monitor, seed collection, rare flora markers

Scientific name	Knowledge	Organisations (* Funding)	Activities
Eucalyptus coronata	Fair		Monitor, seed collection, rare flora markers
Eucalyptus insularis			
Eucalyptus merrickiae			
Eucalyptus nutans	Fair		Monitor, survey, seed collection, rare flora markers
Eucalyptus purpurata	Fair		Monitor, seed collection
Gastrolobium lehmannii			
Gastrolobium luteifolium	Fair	DEC, *SCNRM	Survey, seed collection, translocation 2009, Pc testing, phosphite spraying, research
Goodenia integerrima			
Grevillea fuscolutea			
Grevillea infundibularis	Fair		Monitor, survey
Grevillea involucrata			
Grevillea maxwellii	Good		Monitor, survey, seed collection, protection from grazing, Pc testing, research of disturbance and demography
Hibbertia priceana	Fair		Monitor, survey, rare flora markers
Isopogon uncinatus	Good		Monitor, survey, phosphite spraying, seed collection, Pc testing, research of demography
Kennedia glabrata			
Kunzea similis spp similis	Fair		Monitor, survey, seed collection
Kunzea similis ssp mediterranea	Fair		Monitor, survey, seed collection, survey for translocation site
Lambertia echinata subsp. echinata	Good	DEC	Monitor, survey, seed collection, translocation 2006 (x 2 seed orchards), phosphite spraying
Lambertia fairallii	Good	DEC, *BCI	Monitor, survey, seed and cutting collection, translocation 2007, phosphite spraying
Lambertia orbifolia subsp. orbifolia ms	Good	DEC, *SCNRM	Monitor, survey, seed and cutting collection, translocation 1998 (still ongoing), phosphite spraying, research of reproduction, genetics and demography
Latrobea colophona	Fair	DEC, SCNRM	Monitor, phosphite spraying, Pc testing, cuttings collection
Laxmannia grandiflora subsp. Brendae			
Lepidium aschersonii			
Leucopogan marginatus			
Leucopogon gnaphalioides	Good	DEC, SCNRM	Monitor, survey, cuttings collection, translocation 2005, phosphite spraying, protection from grazing, Pc testing
Marianthus mollis	Good	DEC	Monitor, survey, seed collection, rare flora markers
*Marianthus sp.*Bremer (N.Gibson & M.Lyons 1776)			
Meziella trifida			
Microtis globula			
Muehlenbeckia horrida subsp. abdita			
Myoporum cordifolium	Good		Monitor, survey, rare flora markers
Myoporum turbinatum		DEC, *SCRNM	Translocation 2009
Orthrosanthus muelleri	Good		Monitor, survey, rare flora markers, salinity testing

Scientific name	Knowledge	Organisations (* Funding)	Activities
Persoonia micranthera	Good	DEC, *SCNRM	Monitor, survey, translocation 2005, seed collection, phosphite spraying, Pc and other disease testing, protection from grazing, research of demography/reproduction
Reedia spathacea			
Rhacocarpus webbianus			
Rhizanthella gardneri			
Ricinocarpos trichophorus	Poor		Monitor, survey
Roycea pycnophylloides			
Scaevola macrophylla	Poor		Not relocated since 1990's
Sphenotoma drummondii	Good	DEC, SCNRM	Monitor, survey, Pc sampling, phosphite spraying
Stachystemon vinosus	Good	DEC, PhD	Monitor, survey, seed collection, research, *is now a P4*
Stylidium galioides	Poor		Monitor, survey
Tetratheca aphylla subsp. Megacarpa			
Thelymitra psammophila	Fair		Monitor, survey
Tribonanthes purpurea	Poor		Monitor, survey
Verticordia apecta			
Verticordia carinata	Fair		Monitor
Verticordia crebra	Fair		Monitor, survey, rare flora markers
Verticordia densiflora var. pedunculata			
Verticordia fimbrilepis subsp. australis			
Verticordia fimbrilepis subsp. fimbrilepis			Translocation 1998
Verticordia helichrysantha	Fair		Monitor, survey, rare flora markers, seed collection
Verticordia pityrhops	Good		Monitor, survey, rare flora markers, seed collection
Villarsia calthifolia	Good		Monitor, survey, rare flora markers, seed collection, weed control
Xyris exilis	Fair		Monitor, survey, rare flora markers, seed collection

Threatened Ecological Communities (TEC)

Ecological Community	Knowledge	Organisations/ Funding	Activities
Lake Bryde			
Eucalyptus acies mallee heath			
Herblands and Bunch Grasslands			
Montane Thicket of the Eastern Stirling Range	Good	DEC, SCNRM	Extensive surveys of whole community, geology and soil, phosphite spraying
Mt Lindesay – Little Lindesay Vegetation Complex	Some	DEC, SCNRM	Phosphite spraying
Russell Range Mixed Thicket Complex			

Primary Threatening Processes

Primary Threatening Processes	Organisations	Activities
Inappropriate fire regime	DEC, FESA	Wildfire suppression and prescribed burning.
Phytophthora cinnamomi infestation	DEC, SCNRM, Project Dieback	Spraying of Phosphite on particularly threatened/susceptible flora species. Research into the susceptibility of particular species to *Phytophthora*. Seed collection, seed orchards and translocations of particularly threatened flora species. Mapping of the extent of dieback across the Region. Restricting vehicle movements to dry soil conditions, boot cleaning stations on walking trails. Community education/awareness through show displays, talks to community groups, stickers, brochures, information boards at National Parks etc.
Introduced predators (cats and foxes)	DEC	Western Shield Fauna Recovery Program involving regular fox baiting (1080) of over one million ha of reserves and UCL quarterly, and monitoring of fauna recovery related to the program. Trials of cat baits.
Environmental weed invasion	DEC, SCNRM, Ag Dept, community groups, CSIRO	Weed control using various techniques including physical removal, herbicides and release of biological control agents. Research into the effectiveness of various control methods.
Fragmentation of habitat	Gondwana Link, community groups	Restoring connections between habitat fragments through purchasing properties and revegetation.
Small population size	DEC	Seed collection and translocation of threatened flora species. Captive breeding e.g. Gilbert's Potoroo and Numbat. Translocation to increase number of populations, e.g. Gilbert's Potoroo and Noisy Scrub birds to Bald Island.
Salinisation or altered hydrology	Ag Dept, SCNRM, DEC, CSIRO	Research of extent of salinisation and control measures. Mapping of current and predicted extent of salinisation . Community education/awareness of control measures.
Climate change	DEC, SCNRM	Seed collection, seed orchards and translocation of threatened flora species.

Acronyms

DEC	Western Australia Department of Environment and Conservation
FESA	Fire and Emergency Services Authority
Project Dieback	NRM Dieback group
MPG	Malleefowl Preservation Group
SCNRM	South Coast NRM Inc.
Ag Dept	Western Australia Department of Agriculture and Food
CSIRO	Australian Commonwealth Scientific and Research Organisation

APPENDIX 6: THREAT MATRIX

In the Threat Matrix each species or community are placed in categories of threat based on ONE OR MORE of the following criteria:

- their biological response (of the species or component species or its habitat) to the threat (if a taxon or community is known to be highly susceptible in terms of biological response to a threat it must be placed in at least the HIGH category, even if no sub-populations or occurrences are currently impacted);
- the distribution, size and number of sub-populations across the landscape;
- the degree of current impact of the threat; and
- the risk of occurrence of the threat.

For species whose distribution goes beyond the South Coast Region the assessment is based on the degree of impact of the threat within the Region only (except for "Small Population Size", which is assessed on the size of the total population of the species).

The threatening processes that are included in the Threat Matrix are:

- *Phytophthora cinnamomi*;
- Inappropriate fire regime;
- Introduced predators (cats and foxes);
- Salinisation or altered hydrology;
- Fragmentation of habitat;
- Small population size;
- Weed invasion;
- Climate change.

Criteria for each Threatening Process

Each threatening processes is unique and our degree of knowledge of each differs, therefore a different number of the above criteria were used for each threatening process. These criteria are listed in the below table:

Threatening Processes	Criteria for Threat Matrix Categories			
	Extreme	**High**	**Low**	**No known impact or not susceptible**
Phytophthora cinnamomi				
Fauna	dependent on highly susceptible plant species or communities	associated with habitat dominated by susceptible plant species	associated with habitat with few susceptible plant species	not associated with habitat containing susceptible plants or communities
Flora	highly susceptible to Pc infection (see table for definitions of susceptibility)	susceptible or moderately susceptible to Pc infection (see table for definitions of susceptibility)	moderately resistant to Pc infection (see table for definitions of susceptibility)	resistant to Pc infection (see table for definition of resistance)
Ecological Community	dominated by species highly susceptible to Pc infection (see table for definitions of susceptibility)	dominated by species susceptible or moderately susceptible to Pc infection (see table for definitions of susceptibility)	dominated by species moderately resistant to Pc infection (see table for definitions of susceptibility)	dominated by species resistant to Pc infection (see table for definition of resistance)
Inappropriate Fire Regime				
Fauna and Flora	highly vulnerable to fire AND all sub-populations could be impacted by a single fire event	highly vulnerable to fire BUT occurs in several disjunct sub-populations, all which would not be impacted by a single fire event OR low vulnerability to fire but all sub-populations could be impacted by a single fire event	low vulnerability to fire AND occurs in several disjunct sub-populations, not all of which would be impacted by a single fire event	not fire sensitive
Ecological Community	dominated by species highly vulnerable to fire	dominated by species moderately vulnerable to fire	dominated by species with low vulnerability to fire	dominated by species which are not fire sensitive
Introduced Predators (Cats and Foxes)				
Fauna (not assessed for flora or ecological communities)	presumed or known to be highly vulnerable to fox or cat predation AND restricted to a single small sub-population	presumed or known to be highly vulnerable to fox or cat predation BUT occurs in several disjunct sub-populations	presumed or known to have low vulnerability to fox or cat predation	presumed or known to be not vulnerable to fox or cat predation
Salinisation or Altered Hydrology				

Threatening Processes	Criteria for Threat Matrix Categories			
	Extreme	**High**	**Low**	**No known impact or not susceptible**
Fauna	restricted to areas which are already affected by, or are predicted to be at high risk from salinity or altered hydrology by 2020 (based on NLWRA 2000 data and other information)	> 50 % of distribution records in areas which are predicted to be at high risk from salinity or altered hydrology by 2020 OR by 2050 (based on NLWRA 2000 data and other information)	1- 50% distribution records in areas which are predicted to be at high risk from salinity or altered hydrology by 2020 OR > 50% by 2050 (based on NLWRA 2000 data and other information)	all distribution records in areas which are predicted NOT to be at risk from salinity or altered hydrology (based on NLWRA 2000 data and other information)
Flora	occurs only in habitat which is already affected by, or predicted to be at high risk from, salinisation or altered hydrology by 2020 (based on NLWRA 2000 data and other information)	most sub-populations occurring in habitat which is predicted to be at high risk from salinisation or altered hydrology by 2020 OR 2050 (based on NLWRA 2000 data and other information)	some sub-populations occurring in habitat which is predicted to be at high risk from salinisation or altered hydrology by 2050 (based on NLWRA 2000 data and other information)	occurring in habitat which is predicted not to be at risk from salinisation or altered hydrology (based on NLWRA 2000 data and other information)
Ecological Community	dominated by plants intolerant to salinity or altered hydrology AND occurs only in habitat which is already affected by, or predicted to be at high risk from, salinity or altered hydrology by 2020 (based on NLWRA 2000 data and other information)	dominated by plants intolerant to salinity or altered hydrology AND most occurrences occurring in habitat which is predicted to be at high risk from salinity or altered hydrology by 2020 OR 2050 (based on NLWRA 2000 data and other information)	dominated by plants with some tolerance to salinity or altered hydrology AND some sub-populations occurring in habitat which is predicted to be at high risk from salinity or altered hydrology by 2050 (based on NLWRA 2000 data and other information)	dominated by plants tolerant to salinity or altered hydrology OR occurring in habitat which is not at risk from salinity or altered hydrology (based on NLWRA 2000 data)
Habitat Fragmentation				
Fauna	inability to disperse across unsuitable/cleared habitat AND occurring in small, isolated remnant(s)	inability to disperse across unsuitable/cleared habitat BUT occurring in large, isolated remnant(s)	limited ability to disperse across unsuitable/cleared habitat AND/OR occurring in large remnant(s) with some connectivity	ability to disperse across unsuitable/cleared habitat
Flora (not assessed for ecological communities)	occurring only in small, isolated remnant(s)	occurring in large, isolated remnant(s)	occurring in large remnant(s) with some connectivity	not impacted by current fragmentation
Small Population Size				

Threatening Processes	Criteria for Threat Matrix Categories			
	Extreme	**High**	**Low**	**No known impact or not susceptible**
Fauna and Flora (not assessed for ecological communities)	Number of individuals < 250	Number of individuals > 250 or < or equal to 2500	Number of individuals > 2500 or < or equal to 10,000	Number of individuals >10,000
Weed Invasion				
Fauna	dependent on habitat that weeds are rendering unsuitable in all sub-populations	dependent on habitat that weeds are rendering unsuitable in some sub-populations	weeds are present and altering habitat in some sub-populations but habitat currently remains suitable	weeds not present OR not known to be altering habitat
Flora	weeds competing with taxon in all sub-populations	weeds competing with taxon in most sub-populations	weeds are present and altering habitat in some sub-populations but habitat currently remains suitable	weeds not present OR not known to be altering habitat
Ecological Community	weeds altering community in all occurrences	weeds altering community in most occurrences	weeds altering community in some occurrences	weeds not present OR not altering community
Climate Change				
Fauna and Flora	3 or more criteria	1-2 criteria	No criteria	not considered vulnerable to climate change
Ecological Community	dominated by species considered EXTREMELY vulnerable to climate change	dominated by species considered HIGHLY vulnerable to climate change	dominated by species considered to have LOW vulnerability to climate change	dominated by species considered not to be vulnerable to climate change

APPENDIX 7: THREATENED SPECIES DENSITY GRID MAPS

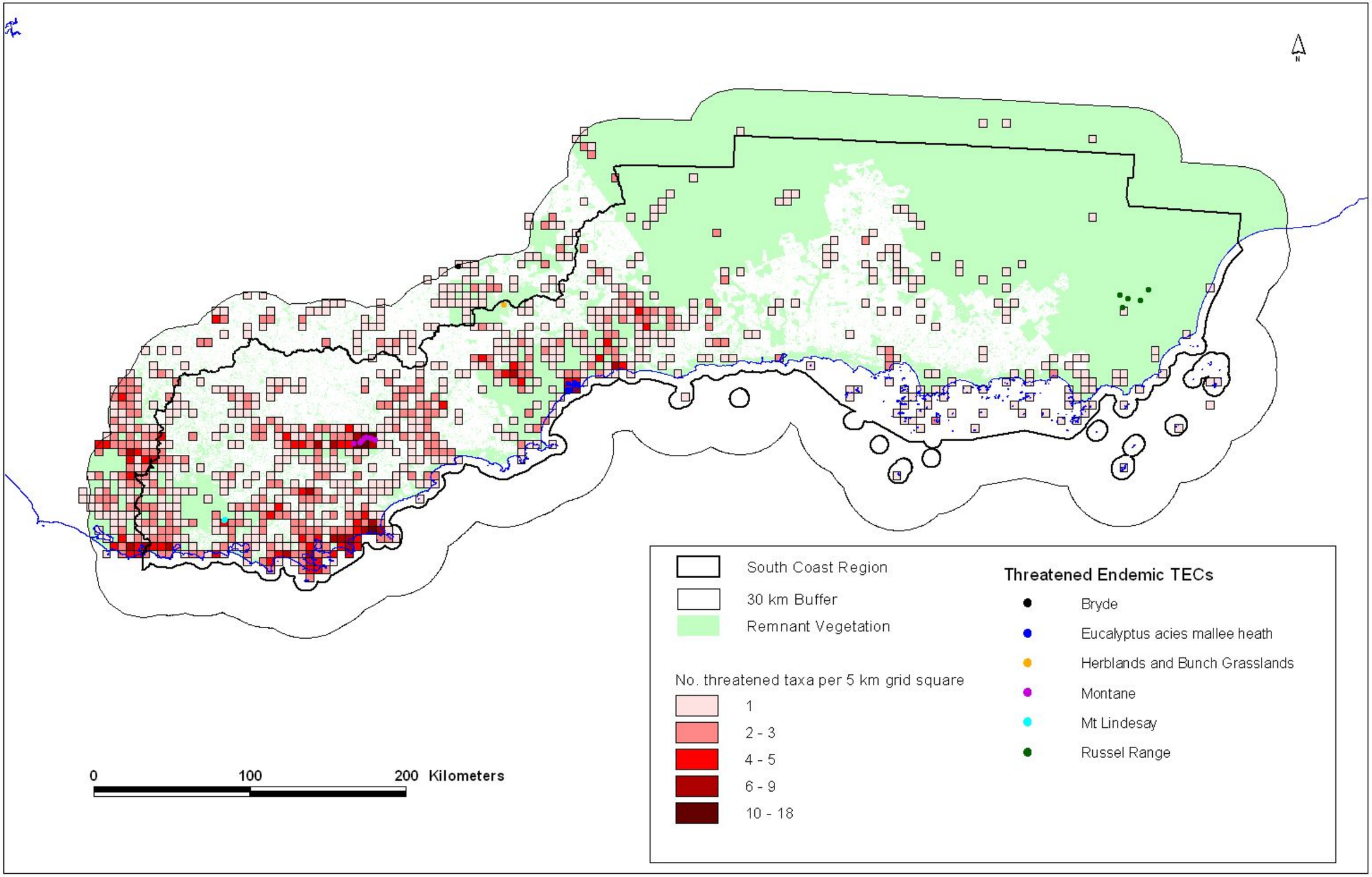

Figure1: The Threatened Species Density Grid showing the density of all threatened species across the South Coast Region in a 5km grid. The locations of Threatened Ecological Communities (TECs) are also indicated.

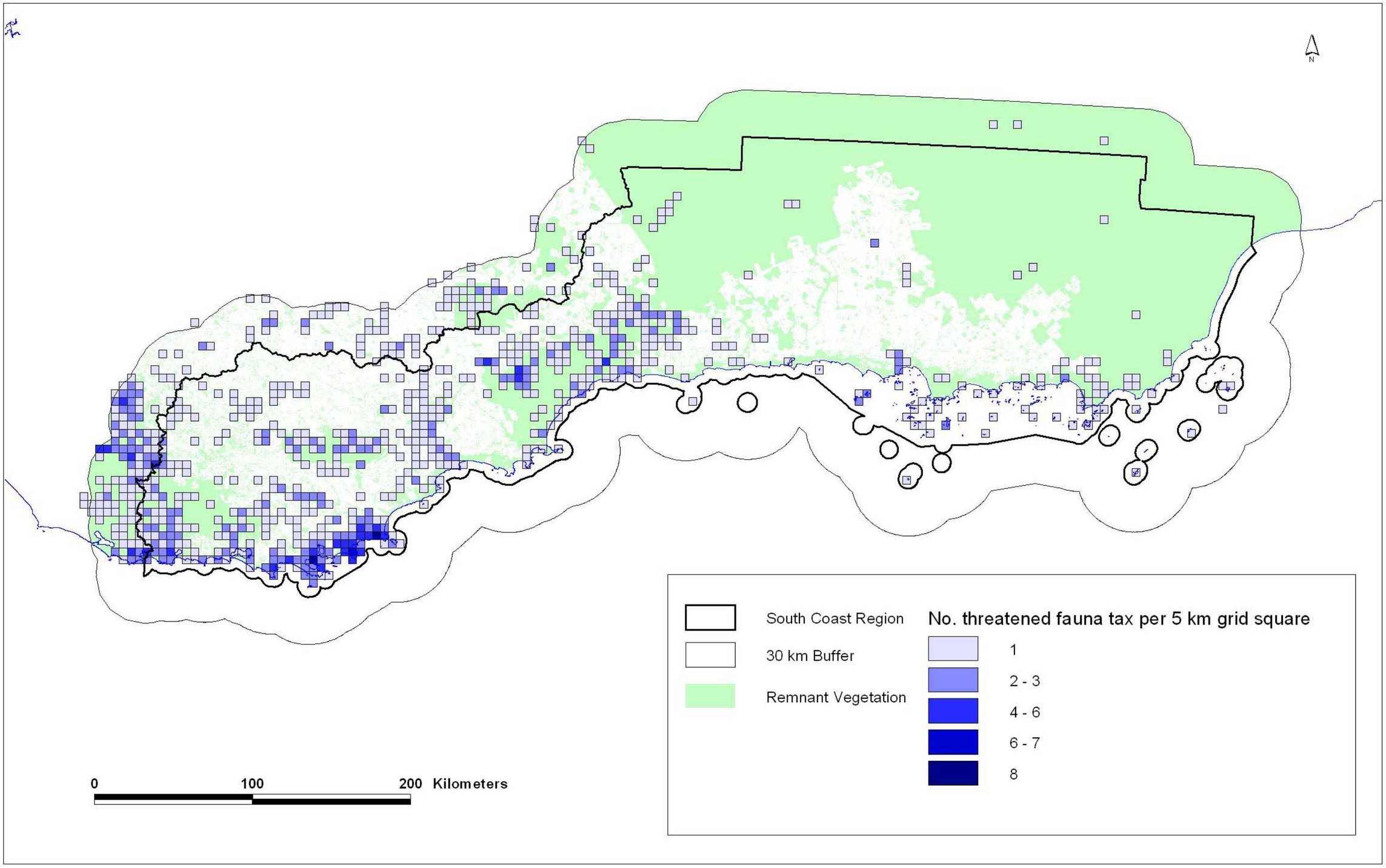

Figure 2: The Threatened Species Density Grid showing the density of all FAUNA threatened species across the South Coast Region in a 5km grid. The locations of Threatened Ecological Communities (TECs) are also indicated

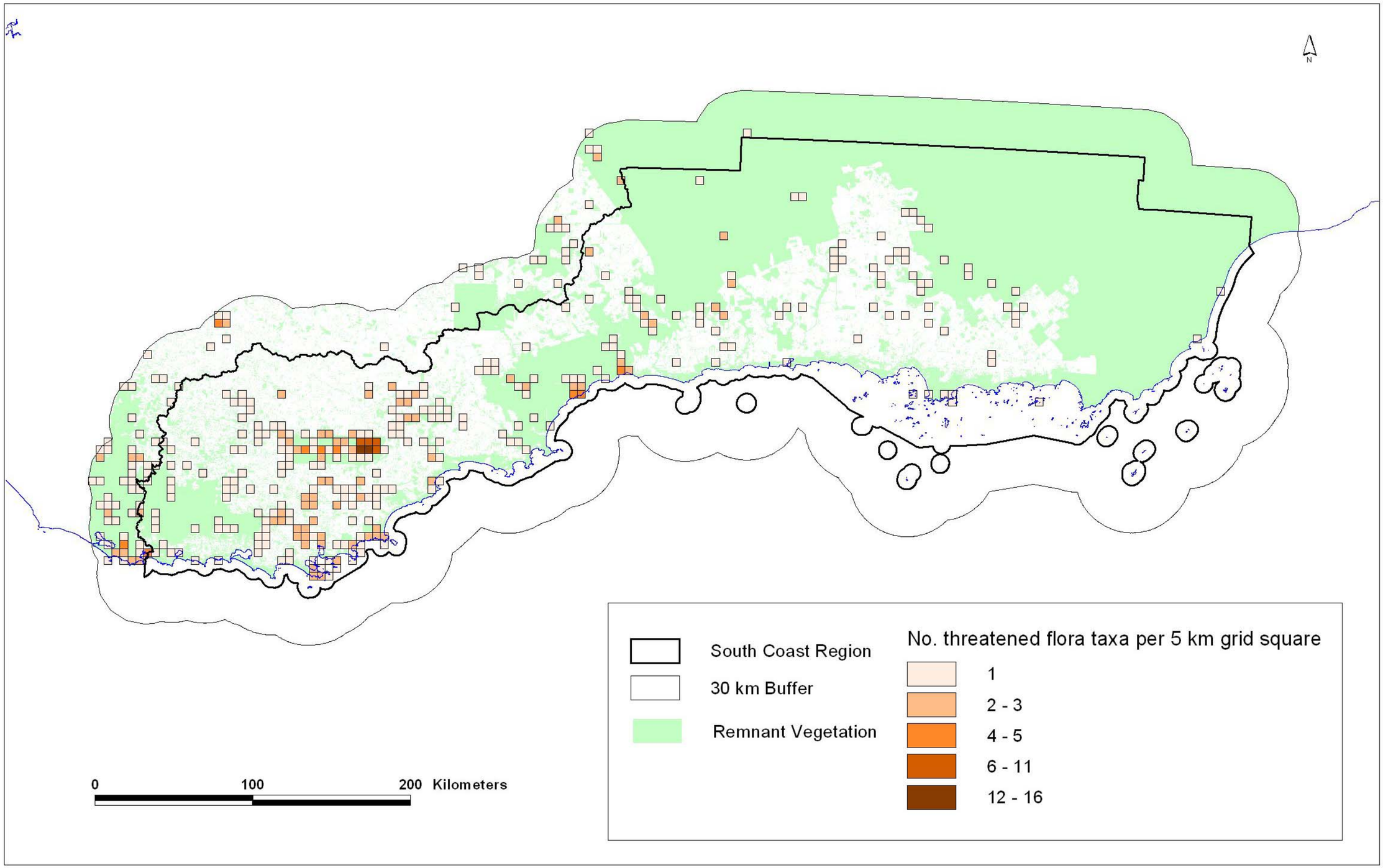

Figure 3: The Threatened Species Density Grid showing the density of all FLORA threatened species across the South Coast Region in a 5km grid. The locations of Threatened Ecological Communities (TECs) are also indicated.

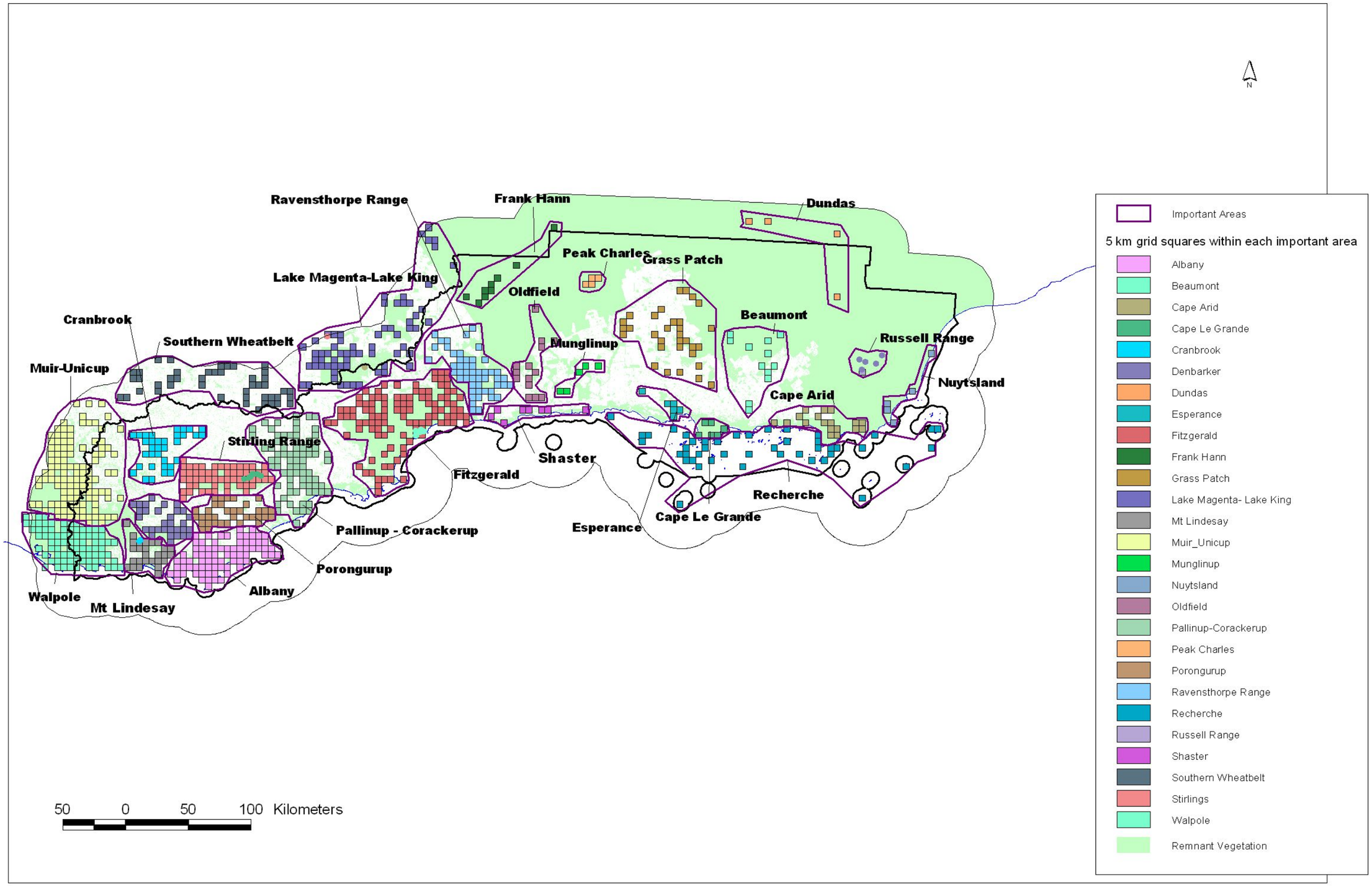

Figure 4: The Regional Areas in the South Coast Region for threatened species recovery based on the distribution of threatened species. These areas were identified using the Threatened Species Density Grid tool. The Stirling Range, Albany and Fitzgerald were identified as the key Regional Areas.