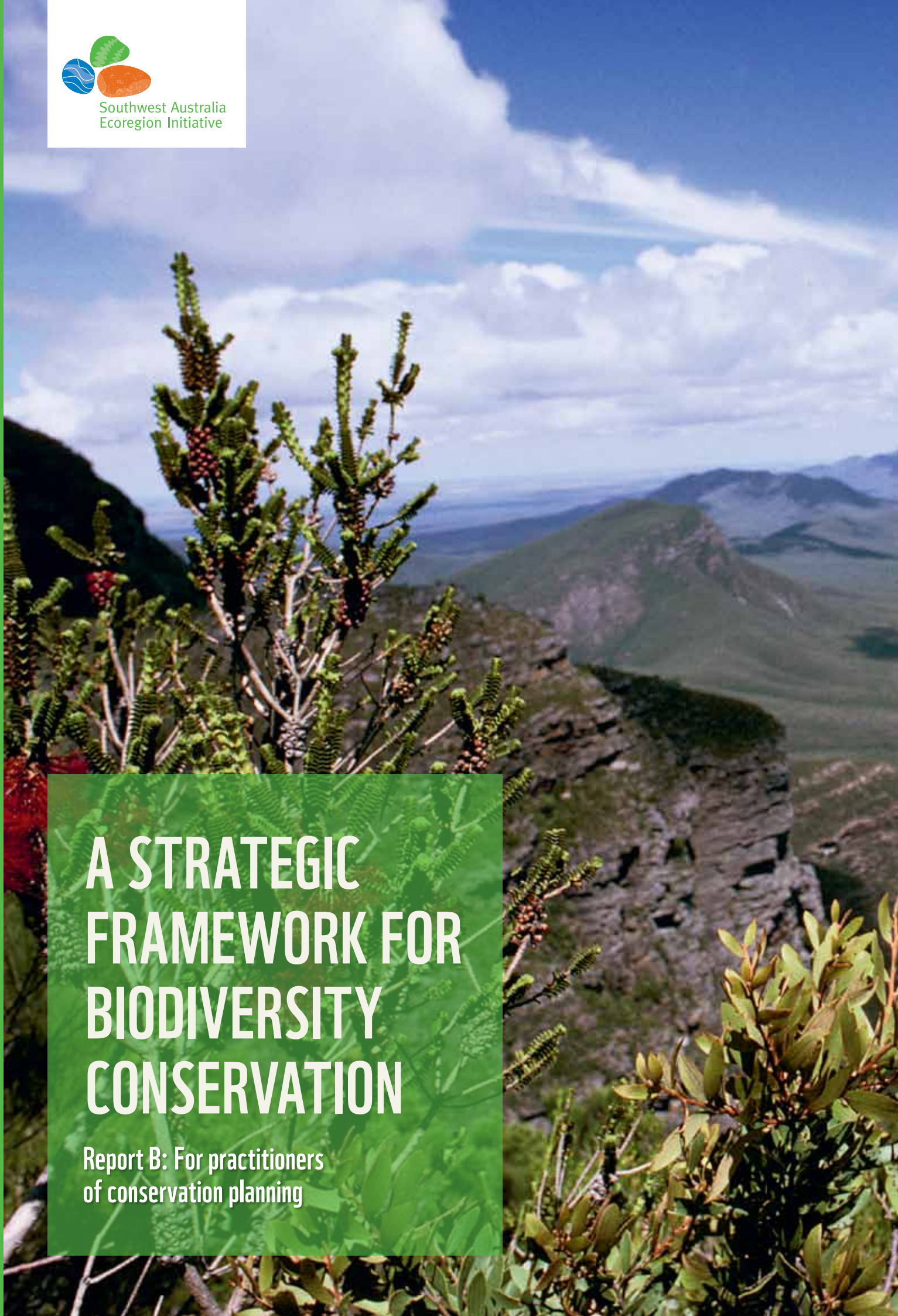
Southwest Australia
Ecoregion Initiative



A STRATEGIC FRAMEWORK FOR BIODIVERSITY CONSERVATION

Report B: For practitioners of conservation planning

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EXECUTIVE SUMMARY

The Southwest Australia Ecoregion (SWAE) is an internationally recognised biodiversity hotspot that covers nearly 700,000 square kilometres. It is high in biodiversity values and endemism but many of these natural values are highly threatened. Species and ecological communities are at risk from current and historical land-use, Phytophthora dieback, salinity, feral animal predation and weed invasion. Over the past 30 years, a range of federal, state and local government, and community initiatives have sought to address such threats, yet biodiversity loss continues.

The Southwest Australia Ecoregion Initiative (SWAEI) is a consortium of representatives from local, state and federal governments, environmental non-government organisations and natural resource management (NRM) groups concerned about the ad hoc nature of biodiversity planning and management initiatives. The consortium has undertaken an extensive systematic conservation planning project that aims to identify highly prioritised areas, or Zones for Conservation Action (ZCA). This project delivers a coordinated, strategic planning framework for the conservation of biodiversity in the south-west of Australia. It is based on scientific principles, informed by experts, and has been developed using methods that are widely used and easy to interpret.

Technical Report B: For practitioners of conservation planning represents the culmination of this two-year project and is a supplementary report to *A Strategic Framework for Biodiversity Conservation Report A: For decision-makers and practitioners*. This report describes the systematic conservation planning process and provides guidance on how to interpret and implement the results.

Systematic conservation planning is a complex process. Decisions and trade-offs are made to balance veracity with timely delivery. As such, the role of *Technical Report B: For practitioners of conservation planning* is to guide those choosing to undertake a systematic conservation planning process.

Dermot O'Gorman
CEO WWF-Australia

ACKNOWLEDGEMENTS

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SETTING THE CONTEXT

THE SOUTHWEST AUSTRALIA ECOREGION INITIATIVE

Although the SWAE is internationally recognised for its biodiversity values, there has not been a coordinated and integrated approach to addressing the threats it faces. A consortium of concerned conservation experts met informally in 2001, with the aim of developing a cooperative approach to biodiversity conservation in the region. This subsequently led to the establishment of the SWAEI.

The SWAEI was formalised in 2002 with the inception of a Stakeholder Reference Group (SRG). The SRG has been jointly chaired by the Department of Environment and Conservation (DEC) and WWF-Australia and includes representatives from NRM regional groups, Australian and State government agencies, research and tertiary institutions and the community. A smaller Working Group (also jointly chaired by the DEC and WWF-Australia) met more frequently to progress SWAEI objectives and to report to the SRG.

The SWAEI has relied upon the DEC and WWF-Australia to drive a number of activities, including the Conservation Planning Symposium. This event brought together over 260 participants, including internationally renowned conservation planning experts, NRM professionals and community representatives. Attendees participated in discussions and workshops that helped to formulate the planning approach used here for the SWAE.

In 2008 and 2010, funding was received from the Australian Government's Caring for Our Country initiative to undertake a systematic conservation planning project for the ecoregion. WWF-Australia led the first two phases of this project on behalf of the SWAEI consortium. The first phase was completed in 2009 and used information from the Conservation Planning Symposium and subsequent consultation with experts to develop a draft spatial plan and process for prioritisation. The second phase commenced in 2010 to finalise the systematic conservation planning process and to demonstrate a means of on-ground implementation.

Aims and objectives of the SWAEI

The SWAEI aims to deliver a coordinated, strategic planning framework for the conservation of biodiversity in the south-west of Australia. This is founded on a biodiversity assessment and prioritisation process. Using this approach, the SWAEI consortium aims to act as a catalyst for addressing key threats to the values of the ecoregion by raising its profile locally, nationally and internationally. It also seeks to provide guidance to decision-makers charged with land-use planning and on-ground implementation.

Vision for the SWAE

The SWAEI identified a set of guiding principles to protect, enhance and connect natural areas, which are underpinned by a landscape ecology approach to biodiversity conservation. These principles recognise the anthropogenic interaction within the ecoregion, as articulated by the following vision:

"A diverse and continuous mosaic of natural landscape features distributed across the landscape, interspersed with a diversity of socially and economically productive land uses, which support the natural diversity and natural functioning of that landscape".

Aims of the SWAEI's systematic conservation planning project

The aim of the SWAEI's systematic conservation planning project is to identify a set of prioritised areas, or Zones and Areas for Conservation Action (ZVA/ACA) and taxonomic imperatives within the ecoregion. The results of this systematic conservation project will help to:

- Inform targeted investment for on-ground action at the local, state, national and international scale;
- Inform local and state government planning decisions;
- Guide decision-making through community initiatives;
- Drive a range of strategies and actions that deliver the vision for the ecoregion; and
- Engage the community and key stakeholders in the building, strengthening and integration of partnerships and resources necessary to protect and conserve the values of the SWAE.

The ZCA represent areas that are highly prioritised for conservation action, whether for on-ground implementation or statutory protection. As this systematic conservation planning project aimed to be transparent, engage experts and to adopt a defensible decision-making process, these objectives were met by:

1. Summarising what is known about the biodiversity, in conjunction with experts and stakeholders, for use in a systematic spatial prioritisation problem;
2. Using systematic conservation planning software to conduct an analysis of the available data and information to identify a high priority set of areas that will deliver higher returns on conservation investment; and
3. Documenting the process of identifying the priority areas so that inputs and assumptions are clear, and further projects can build on this work or use specific aspects for more detailed analysis.

The results of the analysis connect spatial and taxonomic priorities to the existing interests and capacity of the government agencies, community groups and environmental non-government organisations (NGOs) who currently deliver a diverse array of on-ground conservation works. This prioritisation guides and coordinates decision-making and investment to enhance the conservation return on resource investment.

Rationale for this report

This report aims to synthesise the experience of a two-year project that has been delivered by WWF-Australia, on behalf of the SWAEI and the Australian Government. It describes the methodology and processes followed, including stakeholder engagement and the manipulation of data to produce a suite of prioritised areas.

This report is written specifically for a technical audience. It is intended to:

1. Demonstrate an open and transparent process;
2. Describe the methodology that was used;
3. Guide systematic conservation planning practitioners undertaking a similar process; and
4. Document the systematic conservation planning used, to allow this process to be repeated in the ecoregion in the future.

This report is the second of two reports produced for the systematic conservation planning project. For information and guidance on how to implement the outputs of this project, please refer to *Regional Framework for the Conservation of Biodiversity in the Southwest Australia Ecoregion, Report A: For decision-makers and practitioners.*

WT Eagle Chick

SUMMARY OF THE PROJECT METHODOLOGY

Ecoregion conservation has two over-arching components. The first is the strategic partnerships and relationships between stakeholders in the region, as described in step one. An effective process that engages stakeholders is the difference between an excellent plan that is never used and one that has sufficient cross-sector support to be implemented (WWF, 2004). The second component is a rigorous, science-based analysis of the biodiversity values and how these are represented spatially, or systematic conservation planning, as described in steps 2 to 10.

EXPERT ENGAGEMENT AND PARTNERSHIPS

Over the course of the systematic conservation planning project, which commenced officially in 2009, a series of workshops and one-on-one engagement occurred. Over 130 scientists and other experts contributed to the process, providing advice on the analysis, selection of relevant conservation features, target-setting parameters, land classification, threats, data access and interpretation, the interpretation of results and how to translate those results in to on-ground action.

As the lead organisation, WWF-Australia has worked collaboratively with a range of key stakeholders through its Working Group, which coordinated and directed the project, the Stakeholder Reference Group, which advised on stakeholder engagement and future community engagement, the CPT, and through one-on-one engagement. This project could not have been possible without the support, investment and contributions of the Australian Government, Western Australian Government, NRM regions, environmental NGOs, Western Australian Local Government Association, tertiary institutions and other interest groups.

What is systematic conservation planning?

Systematic conservation planning is a process that involves the collection of data applicable to an area, setting target objectives for the biodiversity features of the area for which there is available data, and then using software to objectively analyse the data to meet objectives. In the SWAE, systematic conservation planning is a means of analysing biodiversity information about the region to objectively identify those areas where the most efficient and effective conservation activities can be implemented.

Systematic conservation planning has two characteristics. The first is the use of explicit and quantifiable objectives. This means that planners and managers must be clear about what they intend to achieve and be accountable for decisions that should make progress towards the achievement of their objectives. The second characteristic is the use of the principle of complementarity, whereby the methods identify conservation areas that are complementary to one another in terms of collectively achieving objectives. Areas identified in this way will contain different species or complementary portions of different habitat types (ANZECC, 1997; Pressey and Bottrill, 2008).

Furthermore, systematic conservation planning involves working through a structured, transparent and defensible process of decision-making. One of the key outcomes is an integrated system of conservation areas (or, as referred to in this report, Zones for Conservation Action). This differs from traditional conservation planning, which results in a non-integrated collection of conservation areas produced by a series of ad hoc decisions that have often been made in isolation. The integrated system resulting from systematic conservation planning is much more effective at achieving objectives for the persistence of biodiversity and other natural values because it provides both a spatial and taxonomic focus for the investment of often limited conservation resources (Pressey and Bottrill, 2008).

Systematic conservation planning process

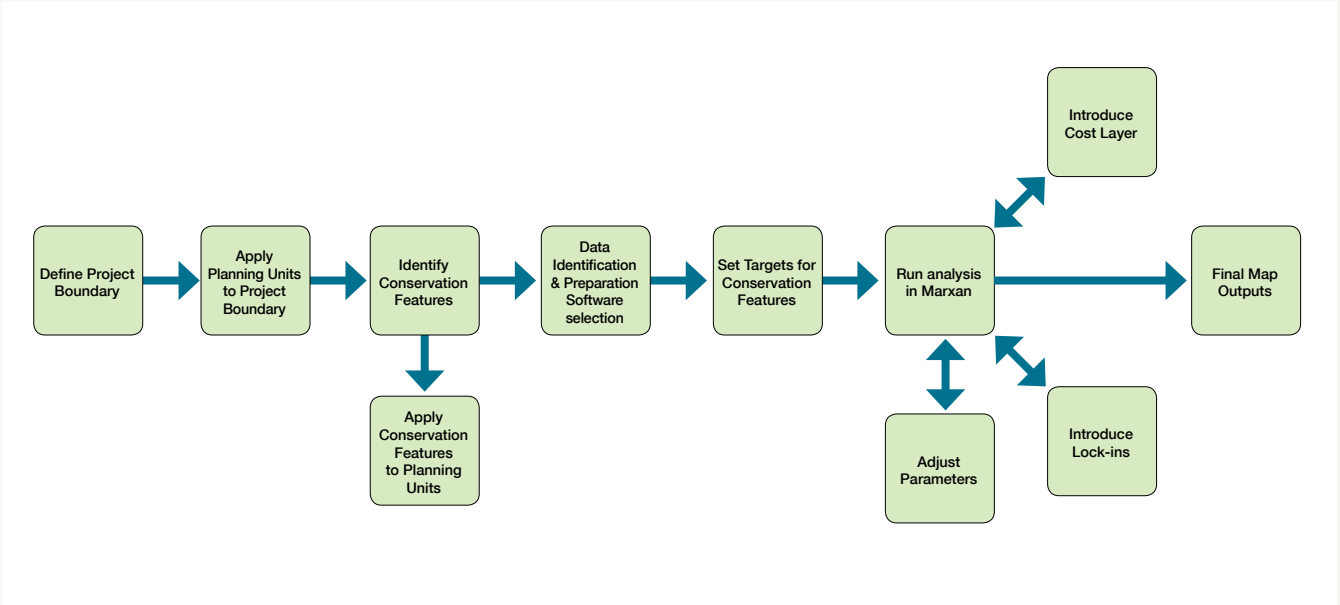
Systematic conservation planning is a complex process that can extend over many years. Resource constraints (financial and time) were considered and trade-offs made to ensure a rigorous and defensible result that stakeholders could find useful.

The logical progression of data preparation and analysis upon which systematic conservation planning relies is outlined in Figure 1. Each box entails a considerable amount of decision-making around complex issues, time processing, trials, reviewing outcomes and re-adjustment. This flow chart outlines the final method used in this project, but does not detail all the intermediate steps taken. The key steps included:

- Defining the project boundary;
- Choosing the planning units to be applied across the project area;
- Identifying the conservation features to be used in the analysis and applying them to planning units;
- Identifying and collecting available data;
- Setting targets for each conservation feature;
- Running the analysis;
- Defining the cost layer and choosing the threats to be represented in the analysis;
- Identifying areas to be "locked-in" to the final solution; and
- Re-running the analysis (and adjusting parameters as required).

Everlastings

Figure 1. Summary of analysis workflow for systematic conservation planning



STEP 1. IDENTIFYING RELEVANT STAKEHOLDERS AND CLARIFYING ROLES

The SWAEI consists of a Working Group (WG), co-chaired by the DEC and WWF-Australia. The group also includes representatives of the Department of Sustainability, Environment, Water, Population and Communities; the departments of Environment and Conservation, Planning and Agriculture and Food WA; NRM groups, the WA Local Government Association and Greening Australia. The working group's role was to provide strategic advice and guidance for the delivery of the conservation planning project.

The Stakeholder Reference Group (SRG) met on a quarterly basis and increased to approximately 60 representatives from community groups, Aboriginal Land and Sea Councils, NRM regional groups, state agencies, universities, research organisations, local government, environmental NGOs, technical consultants and the Chamber of Minerals and Energy. The purpose of the SRG was to engage with a broader audience and inform the progress of the project. Its meetings were also used to garner feedback and identify issues that were relevant to these stakeholders. This platform was also used to provide representatives with information to feed back into their own organisations, and resulted in additional meetings and presentations to raise awareness.

The Conservation Planning Team (CPT), which oversaw the decision-making, analysis and interpretation of the data, consisted of world-renowned experts such as Professor Bob Pressey FAA; Dr. Trevor Ward; DEC's Regional Ecologist Dr. Geoff Barrett and Project Manager Ms. Danielle Witham. The team met on an "as needs basis", which ranged from weekly to bi-monthly meetings. This group presided over the technical decision-making process relating to this complex systematic conservation planning project and gave advice on how to deal with particular issues.

The Technical Team consisted of representatives from Gaia Resources, who undertook the data cleaning and management, creation of data sets and GIS layers, and map production.

WWF-Australia, as the recipient of the funding, managed the day-to-day elements of the systematic conservation planning project and its delivery. This included contract management, resourcing, meeting financial and reporting requirements, overseeing communications and relationship management, providing executive support and chairing all SWAEI-related meetings. Raising awareness of the project also involved giving presentations, conducting meetings, preparing newsletters and media releases, and maintaining a website.

The Australian Government played an important role, not only with representation on the WG and SRG, but also by participating in workshops and reviewing reports. It made a significant investment through its Caring for Our Country program, without which the project could not have been delivered.

EXPERT ENGAGEMENT

Many of the decisions made during the course of this project were informed by key experts with expertise in on-ground implementation, biological science, hydrology, geology, ecology, taxonomy, land-use planning, GIS, threats to biodiversity and conservation planning. This advice was an essential and ongoing component of the decision-making process.

A variety of experts were identified during Phase 1, building upon previous work undertaken by the SWAEI. These experts provided guidance and advice in the selection of conservation features, the target-setting process, data provision and interpretation, how to address conflicting or challenging problems, the interpretation of results and methodology design.

The same experts were engaged as much as possible throughout this process to ensure continuity and consistency. Discussion, rationales, underlying theorems and issues raised at the workshops and during subsequent engagement were documented and distributed. While the workshops constituted a major research activity, experts continued to discuss ideas and to clarify questions throughout the duration of the project. In total, over 130 experts from federal, state and local government agencies, consultancy businesses, tertiary institutions and the environmental non-government sector contributed to this phase of the project.

Identification of conservation features and target-setting workshop

Over 65 experts contributed to the question of how best to represent the region's biodiversity. Eight workshops were held over a three-day period in 2009 (Phase 1). Sessions were based on the following classes and an additional workshop was held to identify threats to biodiversity across the ecoregion:

- Birds;
- Vegetation;
- Flora;
- Inland water bodies;
- Inland water species;
- Mammals, reptiles and amphibians;
- Invertebrates; and
- Key regional threats.

The aim of engaging experts in these workshops was to inform:

- The conservation features that should be considered for inclusion in the analysis in each of the asset classes;
- The ecological scale (e.g. species versus subspecies);
- The criteria to develop quantitative conservation targets;
- The characteristics of different conservation features that would influence the targets set. For example, the extent of previous distribution, natural rarity versus anthropogenic rarity, endemism, declines, extent of exposure to threats, life history characteristics, restrictions to the SWAE, periodic concentrations, vulnerability to further loss, abiotic/ biotic heterogeneity, functional importance, dependence on variable resources, phylogeny and similarities to other species; and
- The limitations and applications of the available data in developing conservation targets.

Experts were given guidance on defining a conservation target for the purposes of software analysis, general principles for setting targets, general considerations for target-setting, limitations of target-setting and previous target-setting work.

The CPT was then able to design a suite of target-setting formulae that was applied to all conservation features, based on the relative importance that experts placed on particular conservation features. To avoid the concern of setting numerical targets, bias and the variation in subjectivity across the asset classes, the experts were not responsible for setting specific numerical values.

Expert review workshop

An expert review workshop involved 20 participants undertaking a preliminary review of the Phase 1 results. This workshop sought to:

- Confirm the conservation features used in the Phase 1 analysis;
- Confirm the formulae that underpinned the targets set for the conservation features; and
- Confirm that the data sources used were the most appropriate for the analysis.

Further one-on-one engagement occurred over a five-month period to capture any additional information.

Land classification workshop

More than 30 experts attended a workshop on land-tenure classification. This workshop aimed to get expert advice on how to classify different land tenures and parcels to be included in the cost layer. Specifically, the workshop sought to:

- Determine how to apply different land tenures to the systematic conservation planning process;
- Determine how to recognise the activities of stakeholders in the systematic conservation planning process;
- List management approaches and tenures with key characteristics;
- List appropriate data and agreement to access/use in the SWAEI process;
- Determine a common language to be used by statutory planning authorities; and
- Continue discussions about mainstreaming the systematic conservation planning outputs with stakeholders.

Zones for Conservation Action workshop / Areas for Conservation Action

A workshop held in 2011 brought together more than 20 experts to help interpret the results and assist in the development of a methodology to guide those people implementing broad-scale conservation planning on the ground. (For more information refer to the *Regional Framework for the Conservation of Biodiversity in the Southwest Australia Ecoregion Report A: For decision-makers and practitioners.)* This workshop aimed to:

- Develop a methodology to prioritise ZCAs;
- Identify four to five ZCA that are likely to be regional priorities and represent spatial variety of different issues (e.g. peri-urban, wheatbelt, woodlands, etc);
- Develop a methodology that describes the transition from regional-scale planning to local-scale;
- Develop a methodology that transitions prioritised areas to actual management prescriptions;
- Prioritise conservation features;
- Make recommendations on the management actions required for restoration, management and protection; and
- Identify additional delivery mechanisms by which recommendations can be made within the defined ZCA (e.g. land-use planning, off-sets, regulation, market-based instruments and incentives).

In subsequent workshops Areas of Conservation Action (ACA) were defined using sub-IBRA regional boundaries and/or the amalgamation of two sub-IBRA boundaries for an inclusive approach that recognised the potential for the development of corridors and connectivity in the landscape. The ten (10) ACA are features on the Priority 1 for Action Map, and ZCA are shown on Figure 33. Best Solution Map.'

An ACA may be the total area within an IBRA Sub-regional boundary or a selected area within a ZCA – the principle applied is to adopt an inclusive, rather than an exclusive approach, and consider connectivity and corridors.

STEP 2. DEFINING PROJECT BOUNDARY

A biological landscape defines the size and distribution of land and habitat areas required for the conservation of key biodiversity assets (or conservation features). The landscape should be large enough to represent a variety of biodiversity assets of interest, as well as their spatial requirements to remain viable.

The boundary area for the SWAEI's systematic conservation planning project was refined, based on the spatial needs of key conservation features. The boundary was identified by including both intact and potentially restorable habitat and human-dominated landscapes, such as the Swan Coastal Plain, and included areas that were critical to the survival of key species or underlying processes.

Both terrestrial and critical aquatic habitats, including coastal and estuarine habitats, were included within the boundary and scope of the project. Initially, it was agreed that islands greater than 20 hectares would be included, given their similarity to terrestrial areas. However, based on expert advice, all islands were finally excluded because they have quite distinct values that need to be evaluated using different criteria.

Planning at the ecoregion scale is important for a variety of reasons. Firstly, it provides a broad spatial context for decision-making by different spheres of government, NRM bodies and other organisations involved with the delivery of on-ground conservation. Secondly, it provides decision-makers with an appreciation of regional variation in vegetation types and species occurrence, thereby contributing to a more comprehensive assessment of the ecoregion's biodiversity.

THE BOUNDARY OF THE SOUTHWEST AUSTRALIA ECOREGION

The SWAE (Figure 2.) comprises the Southwest Australian Floristic Region (SWAFR, sensu Hopper and Gioia, 2004), plus the adjacent semi-arid region (Transitional Zone). After extensive consultation, it was also agreed to include a 100-kilometre buffer outside the Transitional Zone to provide spatial context for conservation planning, particularly to identify threats, conservation features and processes just outside the SWAE boundary that might influence decisions within its borders. The project area (summarised in Box 2.) contains all or part of the following 14 (of 85) bioregions set out by the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995):

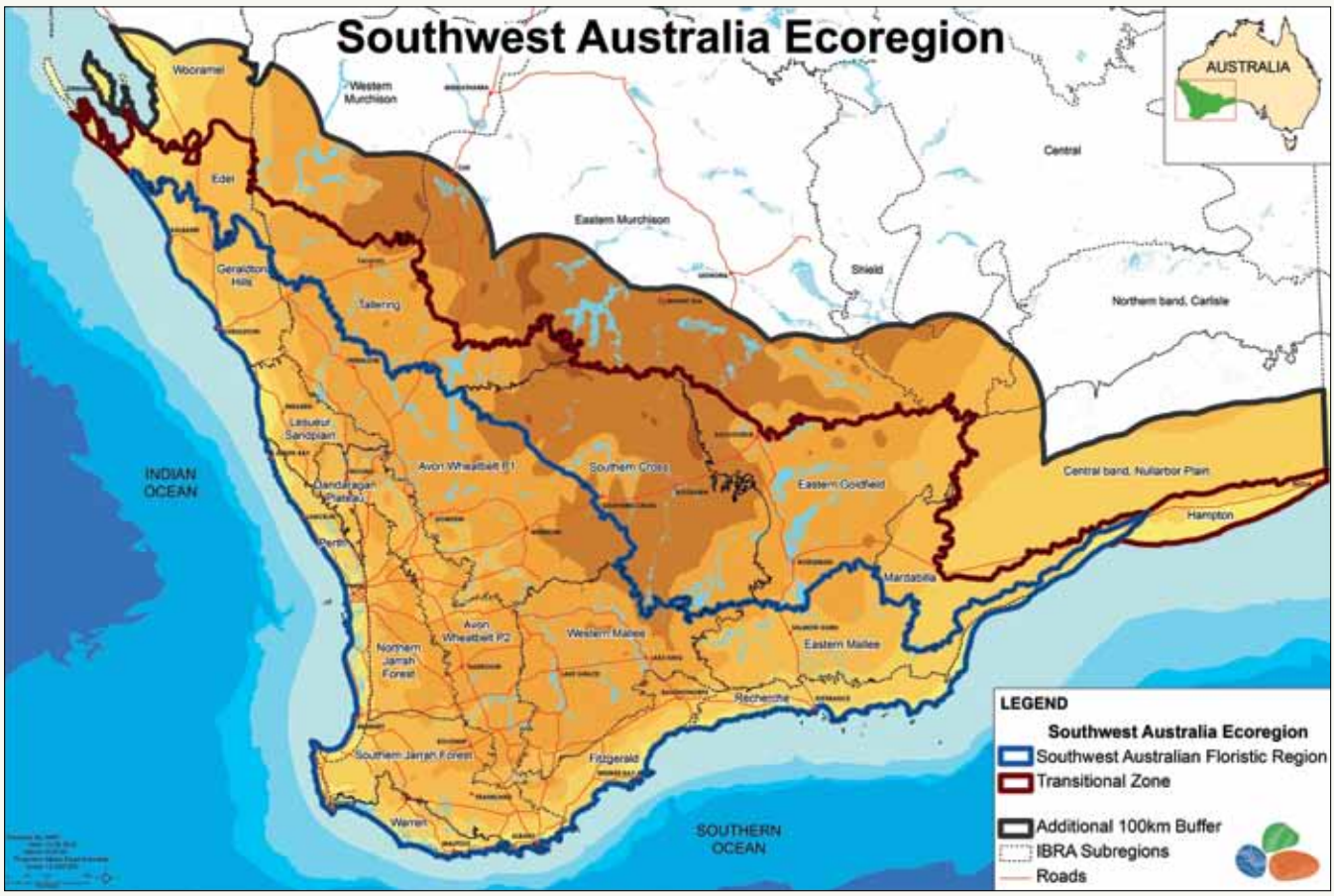
- Avon Wheatbelt
- Coolgardie
- Geraldton Sandplains
- Hampton
- Mallee
- Nullarbor*
- Warren
- Carnarvon*
- Esperance Plains
- Great Victoria Desert*
- Jarrah Forest
- Murchison*
- Swan Coastal Plain
- Yalgoo

*part of the 100 km buffer zone

Box 1. IBRA Bioregions

Title:	Interim Biogeographic Regionalisation for Australia Boundaries (IBRA) version 6.1
Custodian:	Department of Sustainability, Environment, Water, Population and Communities
Scale:	1:250,000
Coverage:	Australia-wide
Ending date:	December 2004
Abstract:	A landscape-based approach to classifying the land surface of Australia. Nominal attributes that make up IBRA are: climate, lithology/geology, landform, vegetation, flora and fauna, and land-use. For more information, go to: http://www.environment.gov.au/metadataexplorer/explorer.jsp

Figure 2. Southwest Australia Ecoregion



Box 2. Summary of project parameters

Project area:	A total of 686,871 km², including: • 27% of the total area of Western Australia; • 9% of the total area of Australia; and • All or part of 14 of the 85 Australian Bioregions (IBRA).
Planning units:	A total of 266,570 two-kilometre-wide hexagonal grid cells
Conservation features:	A total of 1,391 conservation features, including: • 100 bird species; • 31 mammal species; • 35 reptile species; • seven amphibian species; • 49 inland water species; • 43 invertebrate species; • 82 water bodies; • 137 flora species; • 45 other types; and • 862 vegetation complexes.
Endemic:	Of the 402 flora and fauna species used in the analysis, 295 are endemic to the SWAE (73%).
Data:	Over 70 different datasets were used in the final analysis. Over 30 organisations were contacted regarding data availability or usage clarification throughout the project. Over 400 GB of data and 127,000 files were used in the project.

STEP 3. APPLYING PLANNING UNITS TO PROJECT AREA

Planning units are the uniform spatial unit of analysis used in most approaches to systematic conservation planning and are the building blocks of an expanded system of conservation areas. Planning units are cells that form a continuous grid over the project area. They are the units of assessment and comparison and, as an overlay, divide the project area into square grids, circles or hexagons. They must capture all the areas that should be selected as part of the reserve system and their size should be at a scale appropriate for both the ecological features and the size of the protected areas likely to be implemented (Margules and Pressey, 2000; Mairono, *et al.*, 2008). For the purposes of systematic conservation planning, the smallest spatial entity for modelling and analysis is usually selected. However, there are options available for determining the size and shape, which are influenced by processing time. Put simply, the more planning units there are, the longer the processing time will be for the analysis component of this project.

Planning units need to adhere to the following rules:

- They must c*over the whole of the project area;*
- *There must not* be any gaps or overlaps; and
- Each cell must have a unique identifier.

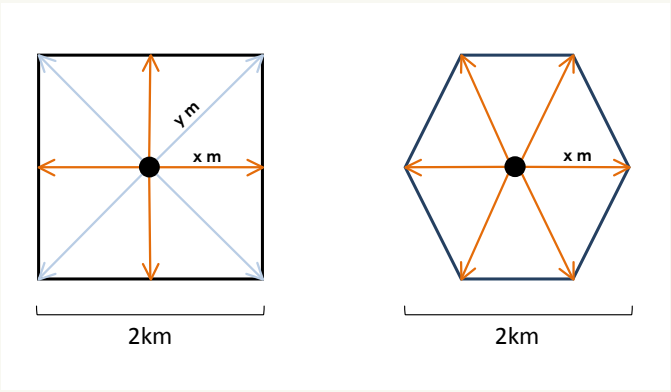
Planning unit shape

Planning units can either be regular or irregular in shape. Regular-shaped planning units (such as squares or hexagons) tend to be favoured scientifically as they produce areas of equal size for comparison. Irregular-shaped planning units, such as cadastral boundaries, can also be used and produce outputs that can be utilised constructively for on-ground conservation (Ardron, *et al.*, 2010). However, irregular boundaries must be selected with caution. Larger parcels of land tend to contain more conservation features and be viewed more favourably within a Marxan process, potentially producing outputs biased towards size rather than biodiversity richness.

Irregular planning units based on cadastre were initially considered as the potential grid for the SWAE, which contained more than a million cadastre parcels. However, due to the data needing extensive cleaning (due to numerous gaps and anomalies), the large number of parcels and potential selection favourability (of larger areas being favoured over smaller), a regular grid was deemed more suitable.

Square cells are a common grid shape to use for spatial analysis as they are easy to produce, manipulate with spatial software, and to interpret. However, as a shape, they do not necessarily best represent the spatial distribution of environmental or biological attributes (unless they are very small cells, entailing a very large amount of computational analysis). Hexagons (Figure 3.) are structurally more compact and the central point is equidistant to its sides. This means that there is less risk of distortion in the representation of conservation features (Jurasinski and Beierkuhnlein, 2006).

Figure 3. Comparison between square and hexagonal planning units



Planning unit size

A planning unit determines how each data attribute is compared, so its size and shape needs to be selected with care. If planning unit cells are too small, computational time can be excessively long or there may be insufficient contrast between cells, especially if each contains only one or two conservation features. If cells are too large, output areas may be either too big to analyse or too difficult to distinguish. Based on the project size, data accuracy and the potential outcomes required, a cell diameter of 2km was used for this systematic conservation planning project.

The hexagonal grids used in this analysis were produced using the Repeating Shapes tool from Jenness Enterprises. Details of the Repeating Shapes processing included:

- **Grid type:** Hexagon
- **Coverage:** SWAE project boundary
- **Diameter:** 2 km
- **Orientation**: Horizontal
- **Area**: 2.598 sq km

The resulting grid layer produced just over 266,000 planning unit cells that were clipped to the project area boundary. An example of the planning units is shown in Figure 4. and Box 3. contains a short description of the planning unit dataset.

Figure 4. Example of planning units (near Albany, Western Australia)

Box 3. Dataset for planning units used in the analysis

Title:	Planning units
Custodian:	SWAEI
Scale:	N/A
Coverage:	Covers the entire SWAEI project area
Ending date:	May 2011
Abstract:	This dataset was created specifically for the SWAEI project as a base dataset to be used for further analysis. Each planning unit is uniquely identified, and additional conservation features and other data is attributed to the planning units in subsequent processing. Due to licensing, only the planning unit identifier can be provided with this dataset.
URL link:	N/A

STEP 4. PREPARING AND CHOOSING SOFTWARE

Systematic conservation planning requires information on the spatial distribution of biodiversity. Data was included in this analysis only if it could be mapped and was already in an electronic format. This is a key concept. Without the ability to spatially define a particular conservation feature, or a threat, it was not possible to attribute it to the planning units and to use it in the analysis.

Data identification and preparation was a time-consuming and resource-intensive element of the project. In Phase 1, 253 GB of data (over 69,000 files) was included. An additional 149 GB of data, including over 58,000 files, was created during Phase 2. In total, over 400 GB and 127,000 files were prepared over a two-year period.

DATA IDENTIFICATION

Data identification was informed by engaging with experts, the WG, SRG or the CPT. The biodiversity data and knowledge was not pre-constrained as all identifiable elements were considered as plausible inputs. This means that taxonomic bias would not prevail unless that was a natural result of the available knowledge base. The data was sourced (see Appendix 3.) through existing on-line data providers (e.g. the Shared Land Information Platform accessed through https://www2.landgate.wa.gov.au/web/guest) or by contacting data custodians directly. Licensing agreements were entered into at the requirement of the data custodian. For example, the South Coast Natural Resource Management Phytophthora dieback datasets required data to be deleted at the end of the licence term and the DEC requested that any taxa listed under the West Australian *Wildlife Conservation Act 1950* could only be displayed on maps with a scale of 1:25,000 or greater. In most cases, licensing agreements specified the use of the source data for this project only and prohibited data being made available to other stakeholders.

Preparing data

Once data was identified and access negotiated with custodians, metadata was requested, though not always supplied. As metadata was limited, new lists were created for the purposes of this project. Once sourced, the data was reviewed and cleaned using various processes. These processes can be broadly categorised as:

- Formatting – converting the datasets to the common spatial data format of ESRI shape files (e.g. when point-based occurrence records are supplied in Microsoft Excel format);
- Coordinating Systems – ensuring that all data was converted to the same projection, namely the Albers Equal Area Conic projection (to ensure that area calculations were correct);
- Topological – fixing a range of issues with datasets, such as ensuring polygons were complete, (e.g. closing the mouths of estuaries to create polygons), and that polygon boundaries did not overlap;
- Attribution – checking that the attributes for a d ataset were as described in the metadata and were completed in the dataset;
- Removal of any records with spatial inaccuracies (e.g. accuracy estimates of "1 degree");
- Removal of any records with attribute inaccuracies (e.g. missing species names);
- Removal of any data that was recorded prior to 1970 as it is considered inaccurate due to GPS limitations and data currency issues;
- Taxonomic – a specific form of attribution checking to ensure that all names used the same nomenclature (using the taxonomic nomenclature standard from the WA Museum and WA Herbarium); and
- Outlier errors – checking that coordinates in the data were not incorrectly set (e.g. missing negative signs on Southern Hemisphere data) and were not wrongly shown as outside the study area.

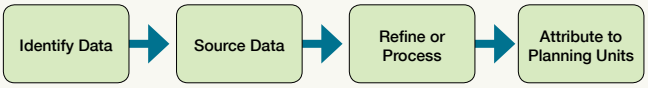
All decisions regarding the cleaning process were recorded for each dataset, leading to a large number of highly technical documents, which are not included in this report.

Generally, data was identified, sourced, refined or processed, and then attributed to the planning units for the SWAEI area, as outlined in Figure 5.

While the data processing or refinement was specific to each dataset, the data projection of Australia Albers Equal Area Conical was used to provide the best preservation of the spatial area of the datasets. Each dataset was reprojected using ArcGIS to ensure standardisation across the project area. Other refinements, such as stitching together datasets, or creating surrogates, were also undertaken in this step. Attribution to the planning units was undertaken through simple spatial intersections. These are further discussed in the sections that detail project tasks and techniques.

Appendix 2. contains a full list of all datasets used in this project.

Figure 5. General data preparation



CONSERVATION PLANNING SOFTWARE

While several conservation planning software tools are readily available, members of the CPT had considerable expertise in using the Marxan software.

Marxan is a widely used and freely available decision support tool for planning marine and terrestrial reserve systems. It identifies areas that efficiently conserve an adequate amount of a variety of conservation features for a minimal cost. Marxan has been used to:

- Help design new reserve systems;
- Report on the performance of existing reserve systems; and
- Develop multiple-use zoning plans for NRM (University of Queensland, 2011).

To use Marxan, a range of conservation features are attributed across a series of planning units. Marxan uses simulated annealing as the optimisation algorithm to find numerous "good solutions", which are generated through multiple iterations or "runs", with planning units either included or excluded in the reserve solution (Game and Grantham, 2008). This is dependent on whether part of the solution is already contained within the reserve network (complementarity), what the gaps in the network may be and whether solutions can be found away from threats.

Standard outputs – best solution and selection frequency

Marxan produces two standard outputs. The "best solution" file identifies, out of the specified number of runs, which one produced the solution with the lowest cost according to Marxan's objective function. However, Game and Grantham (2008) recommend exercising caution as the lowest-cost solution, in reality, does not make it the best reserve system. Similarly, the best solution may be only marginally better than other solutions. Thus, "best" has a very narrow definition and should not be communicated to stakeholders or decision-makers as the ideal solution. Rather, it should be seen as a very good solution within a continuum of options.

The second output summarises the selection frequency for each planning unit across all the good solutions generated. How frequently a planning unit is selected is a measure of how often that planning unit is required to achieve the planning objectives for that specific scenario. The frequency of planning unit selection has no intrinsic value outside the specific arrangement of the decision parameters represented in each scenario. The selection frequency value of a planning unit in one scenario is therefore not necessarily transferable to another scenario. Planning units are selected less often when there is a range of equally good alternatives and hence more units are considered replaceable. However, even some of the units of low selection frequency must be included in any plan of conservation action or the conservation targets will not be met. Planning units that become "irreplaceable" appear in every solution and must be included to achieve the planning objectives. It is important to note that a selection frequency map does not represent a solution; rather it shows the relative irreplaceability of specific planning units in achieving the conservation targets.

However, it is important to acknowledge that the solutions produced by Marxan reflect a "black and white" view of the world – either an area of land or sea is in or out of the reserve; there are no shades of grey. Furthermore, Marxan is used to guarantee biological constraints are met in reserves, but it could not be used to ensure a certain area is retained for a specific human use.

A simple illustration of how Marxan works is provided in Figure 6., which shows sample conservation features being attributed across the planning units. In this example, Marxan has been run through a set number of runs, using the same conservation features, targets and parameters. The image on the right illustrates the selection frequency of the planning units used in this example.

Other software used

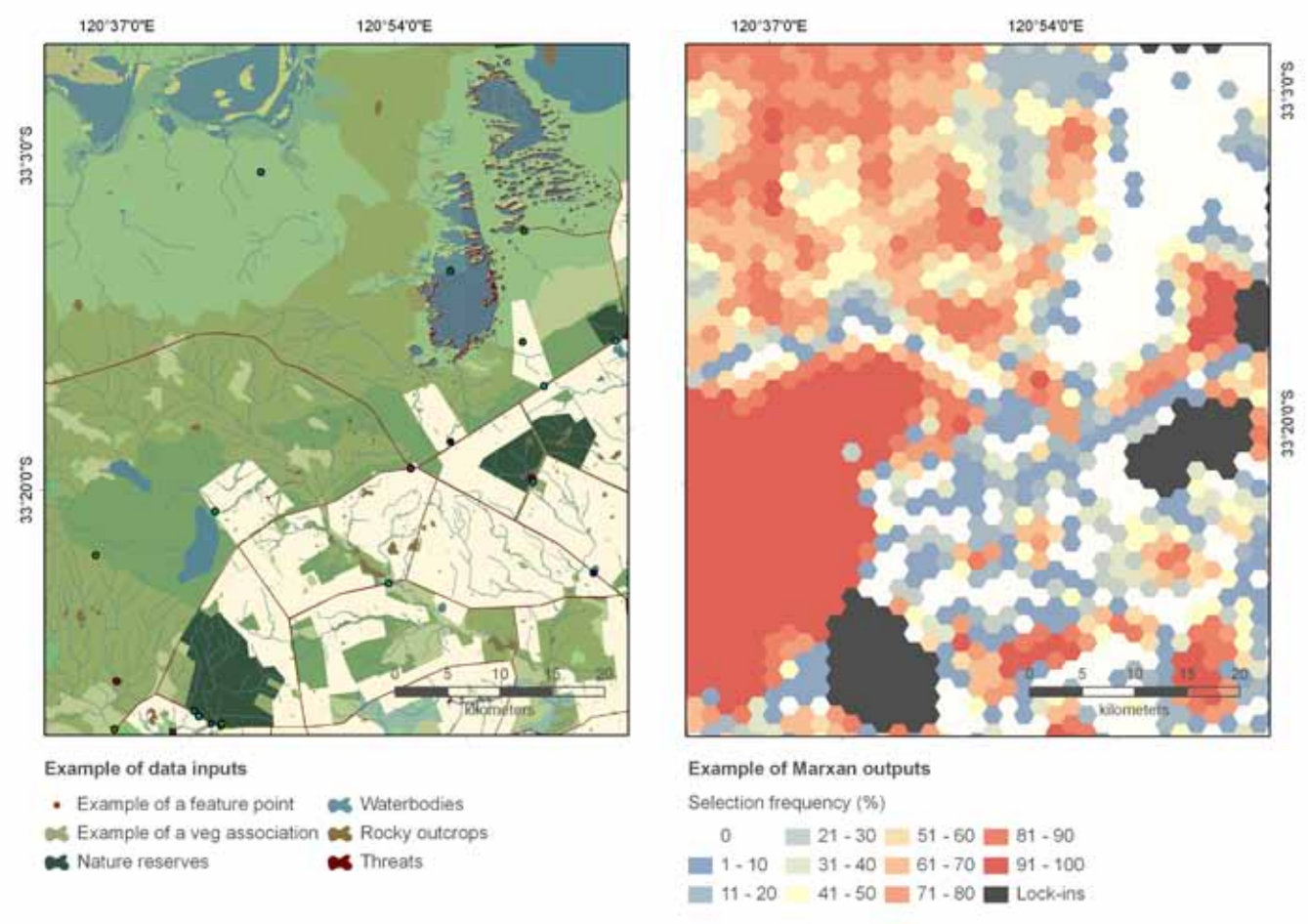
Rather than use Marxan in its native form, this project used Zonae Cogito (version 1.21), which features an interface to Marxan software and an integrated open source Geographical Information System (GIS) platform embedded within. This allows results to be mapped, and is considered a simple and robust way to run Marxan analyses and to view the results. Both Marxan and Zonae Cogito (ZC) can be freely downloaded from http://www.uq.edu.au/marxan. Training manuals available from the website guide users through general exercises.

Other software programs used during the project included:

- Microsoft Excel: a commercial spreadsheet program;
- ArcGIS 9.3: commercial GIS software used for spatial data manipulation and for results display and map production;
- Joint Nature Conservation Committee (JNCC) tool: an ArcGIS extension applied to calculate boundaries for Bound.dat file. Downloadable from http://www.uq.edu.au/marxan/index.html?page=83126 (requires ArcGIS to run);
- Jenness Repeating Shapes tool: a freely available ArcGIS extension used for producing hexagon-shaped grids, used in the creation of planning units. Downloadable from http://www.jennessent.com/arcgis/arcgis_extensions.htm (requires ArcGIS to run); and
- Notepad++: a freely downloadable text editor used for the manipulation of a number of the Marxan source tables, where required (note: any text file editor is sufficient). Downloadable from http://notepad-plus-plus.org/.

As noted above, it would be possible to substitute freely available software for each of these software packages chosen above. However, the plug-ins for ArcGIS (the JNCC and Jenness tools) would need to be rewritten for use in other software. In addition to these readily available tools, the technical team developed a script for use in ArcGIS (written in Python) that undertakes connectivity processing for the planning units. This script is available from WWF on request.

Figure 6. Marxan selection frequency example



STEP 5. IDENTIFYING CONSERVATION FEATURES

Identifying conservation features refers to the process of identifying the suite of characteristics that not only make, but also represent the important biological values of the SWAE. Conservation features can be as diverse as (but not limited to) an individual species, an ecosystem, or a range of other biological or biophysical occurrences. This includes focal species (e.g. Carnaby's black cockatoo), focal habitat (e.g. rare habitat types, such as Threatened Ecological Communities; surrogate habitat types, such as granite outcrops or wetlands; or vegetation communities) and focal processes (e.g. migratory pathways or roosting and feeding sites).

Conservation features are the core driver for the Marxan analysis and consist of any part of the environment, ecosystem or biodiversity that is to be included in the data analysis. Generally, the three types of conservation features used in this project were individual features, surrogates or wallpaper.

Individual features

Individual features are specific features that are considered important to conserve, for which there is available data, such as:

- A specific flora or fauna species (e.g. Carnaby's black cockatoo) or subspecies (Muir's corella);
- A class of area (e.g. Threatened Ecological Community);
- An ecosystem type (e.g. kwongan heath); or
- Topographic features (e.g. waterholes).

Surrogates

Surrogates use one type of feature to indicate other features that are more difficult to show spatially or to represent ecologically, for example:

- Granite outcrops (known as areas of high diversity, rarity, endemism and refugia);
- Surrogate species (e.g. the presence of water milfoil indicates fresh water); or
- Surrogate modelling (e.g. southern slopes indicating ideal invertebrate habitat).

Wallpaper

Wallpaper is a dataset that covers the whole of the project area (for example, vegetation types were used as a base dataset to give input consistency over the whole project area). This means that even where there may be planning units that have no attributes assigned from the conservation feature datasets, Marxan will still have a biological basis upon which to select a planning unit.

CHOOSING CONSERVATION FEATURES

Focal species, habitats and ecological processes were investigated to identify which conservation features were to be used for the project. Analysis of endemism and the presence of species, based on WA Herbarium and WA Museum datasets was undertaken, as well as a review of species listed for protection under both the Western Australian *Wildlife Conservation Act 1950* and the Federal *Federal Environment Protection and Biodiversity Conservation Act 1999*. Ten asset classes were chosen to be included within the decision problem:

- Amphibians;
- Birds;
- Invertebrates;
- Mammals;
- Reptiles;
- Flora;
- Inland water bodies;
- Inland water species;
- Vegetation types; and
- Other (e.g. surrogates for biodiversity, such as granite outcrops).

As an example of its biological complexity, the SWAE project area contains over 16,000 known taxa (around 3,500 fauna and 13,500 flora species and subspecies, including introduced species). However, data and spatial distribution on most of these species is limited, and due to computational and time constraints, the species level information had to be aggregated and devolved to the use of surrogates to be able to represent many of the species in the Marxan analysis. This problem principally (but not only) applies to both the common/abundant species and the small/cryptic species, which have not been the subject of detailed distributional research.

A summary of the total numbers of conservation features for each asset class is listed in Table 1. A full list is provided in Appendix 4.

FAUNA CONSERVATION FEATURES

A total of 216 fauna conservation features (amphibians, birds, invertebrates, mammals and reptiles) were chosen for inclusion in the project analysis. Data came from a variety of sources (see Box 4.). An intensive data cleaning process ensured that all data points were in the same format.

Table 1. Conservation features by asset class

Asset class	No. of individual conservation features used in the analysis	No. of surrogates used to represent conservation features used in the analysis
Birds	100	2
Mammals	31	0
Reptiles	35	0
Amphibians	7	0
Inland water species	49	13
Invertebrates	43	1
Inland water bodies	82	0
Flora	137	0
Other	45	14
Vegetation	862	0
Total	**1391**	**30**

Box 4. Fauna datasets used in the analysis

Title:	Atlas of Australian Birds (2)
Custodian:	Birds Australia
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	Atlas data forms the basis for research such as The State of Australia's Birds Report. Since 1998, a dedicated band of over 7,000 atlassers have amassed over 420,000 surveys, comprising over 7.1 million bird records.
URL link:	http://www.birdsaustralia.com.au/our-projects/atlas-birdata.html
Title:	Hooded Plover Nesting Sites
Custodian:	Birds Australia
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	A database monitoring nesting sites and chick counts for the hooded plover.
URL link:	http://www.birdsaustralia.com.au/our-projects/beach-nesting-birds.html

Box 4. Fauna datasets used in the analysis (Cont.)

Title:	Threatened and Priority Fauna
Custodian:	Department of Environment and Conservation
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	A database of ongoing surveying work detailing rare and priority fauna points over Western Australia.
URL link:	http://www.dec.wa.gov.au/content/view/5379/2231/
Title:	Carnaby's Black Cockatoo Roosting Sites
Custodian:	Department of Environment and Conservation
Scale:	GPS points
Coverage:	South-west Australia
Ending date:	Ongoing
Abstract:	A confidential database detailing known roosting sites throughout the south-west of Australia.
URL link:	http://www.dec.wa.gov.au/content/view/6333/2361/
Title:	Carnaby's Black Cockatoo Breeding Sites
Custodian:	Department of Environment and Conservation
Scale:	GPS points
Coverage:	South-west Australia
Ending date:	Ongoing
Abstract:	A confidential database detailing known breeding sites throughout the south-west of Australia.
URL link:	http://www.dec.wa.gov.au/content/view/6333/2361/
Title:	Carnaby's Black Cockatoo Feeding Sites
Custodian:	Department of Environment and Conservation
Scale:	1:250,000 (vegetation surrogate-based)
Coverage:	South-west Australia
Ending date:	June 2009
Abstract:	Broadly defined feeding sites, based on a variety of vegetation data surrogates. Data used includes pre-European vegetation, tuart woodlands, vegetation complexes and System 6 data (Heddle vegetation complexes) with data being clipped to a remnant vegetation and outputs cleaned to consider areas that have been lost to degradation, clearing, development and changing climatic conditions from the potential food sources.
URL link:	http://www.dec.wa.gov.au/content/view/6333/2361/
Title:	Collections Database (various)
Custodian:	Western Australian Museum
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	An ongoing database collection for a wide variety of fauna for Western Australia.
URL link:	http://www.museum.wa.gov.au/

Box 4. Fauna datasets used in the analysis (Cont.)

Title:	Western Swamp Tortoise Boundaries
Custodian:	Environmental Protection Authority
Scale:	GPS points
Coverage:	South-west Australia
Ending date:	Ongoing
Abstract:	Boundaries showing the location of western swamp tortoise habitats in Western Australia.
URL link:	http://tinyurl.com/6beeapq

Fauna subspecies

Most individual conservation features were processed at the species level. However, in some cases it was considered important to include in the analysis the distinction between subspecies. This applied where subspecies were considered geographically distinct and it was important to capture the full range of representation or where a subspecies was listed under the Western Australian *Wildlife Conservation Act 1950* and/or the Federal *Environment Protection and Biodiversity Conservation Act 1999* and, subsequently, a different target formula applied (refer to the section on setting targets for more information).

Where it was determined that a subspecies needed to be distinguished from the species level, the following rules applied:

- Subspecies needed to be identifiable within the datasets;
- All subspecies points were included in the layer; and
- If data for both subspecies and species levels was available then it was treated as individual subspecies but stratified using distributional information and expert advice.

The stratification of conservation features into subspecies occurred for six fauna taxa in this analysis (listed in Table 2.). Box 5. contains a working example for the western rosella.

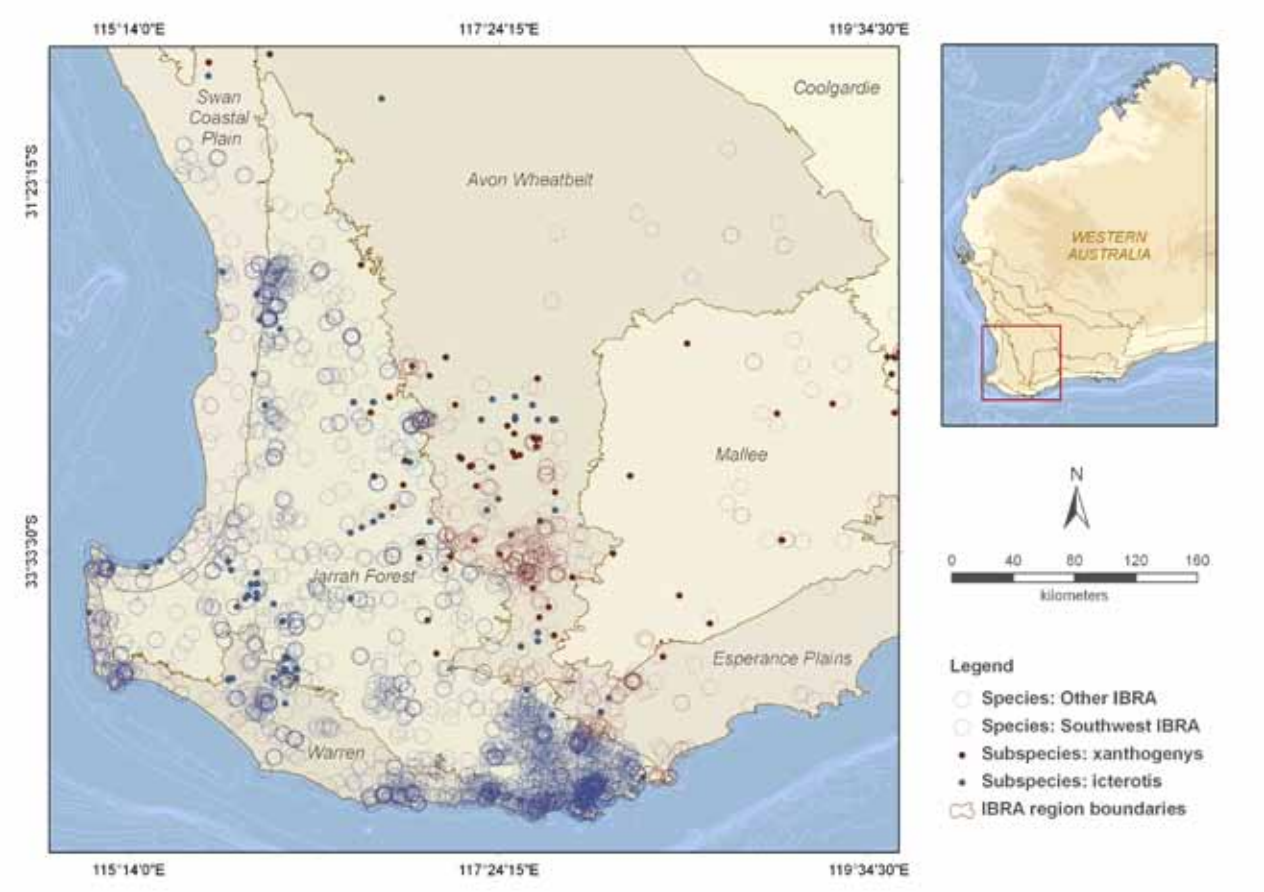
Table 2. Stratified subspecies fauna taxa

Scientific name	Subspecies	Common name	Stratification details
Cacatua pastinator	*C. p. pastinator* *C. p. butleri (derbyi)*	Muir's corella	Easily stratified data as subspecies was spatially separated
Psophodes nigrogularis	*P. n. oberon* *P. n. nigrogularis*	Western whipbird	Easily stratified data. Used Reference Book to determine boundary
Platycercus icterotis	*P. i. icterotis* *P. i. xanthogenys*	Western rosella	Stratified species via IBRA regions (see Box 5. for more details)
Ctenotus gemmula	SCP population All others	Jewelled sandplain skink	Easily stratified data as subspecies was spatially separated
Egernia stokesii	*E. s. badia* *E. s. stokesii*	Spiny tailed skink	Easily stratified data as subspecies was spatially separated
Mormopterus planiceps	Inland subspecies South-western subspecies	South-western free-tailed bat	Easily stratified data as subspecies was spatially separated

Box 5. Example of subspecies stratification for the western rosella

Scientific name:	*Platycercus icterotis*
Common name:	Western rosella
Potential issues:	There are two subspecies of western rosella in the project area (P. i. xanthogenys and P. i. icterotis) that reside within close proximity of one another. The subspecies P. i. xanthogenys resides in the mallee (and is listed under the WA *Wildlife Conservation Act 1950* and the Federal *Environment Protection and Biodiversity Conservation Act 1999*). Subspecies P. i. icterotis resides in the forests of the deep south but is not listed under the *WA Wildlife Conservation Act 1950* or the Federal *Environment Protection and Biodiversity Conservation Act 1999*. Experts consider it resource-limited, which was reflected in the target formula. The two subspecies are also known to interbreed (DEC, 2009).
Stratification:	Based on the above information, the data was stratified as follows: 1. Any data that included subspecies details (no matter where the location) was extracted out into its own subspecies layer; 2. Data showing only species level was stratified via IBRA regions: Subspecies *P. i. icterotis* came under the Jarrah, South Coast Plains and Warren IBRA regions Subspecies *P. i. xanthogenys* came under all other IBRA regions (mainly the Mallee IBRA region); and 3. Data from 1. and 2. was then combined to create sub-specific data as its own conservation feature dataset.

This example demonstrates the complexity of achieving subspecies representation where distribution of the subspecies is close or overlaps. With expert advice, we determined that any data records found within the Mallee area were defined as being *P. i. xanthogenys* and any data records found in the southern areas were defined as *P. i. icterotis* subspecies.



FLORA CONSERVATION FEATURES

Flora conservation features (see Box 6.) were processed similarly to the fauna conservation features. As a direct result of the cleaning process, points from the Orchid Atlas were not included in this project, as they were recorded prior to the 1970 cut-off date. No flora conservation features were stratified in this project. Box 6. Flora datasets used in the analysis

Box 6. Flora datasets used in the analysis

Title:	Collections database
Custodian:	WA Herbarium
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	The WA Herbarium and associated regional herbaria form a unique, dynamic, state-wide team that gathers, manages, researches and communicates information on the geography, systematics and biology of our unique and precious flora on behalf of the Western Australian community.
URL link:	http://www.dec.wa.gov.au/content/category/41/831/1821/50/0/lang,en/
Title:	Banksia Atlas
Custodian:	WA Herbarium
Scale:	GPS points
Coverage:	Western Australia
Ending date:	December 1990
Abstract:	A dataset comprised a volunteer surveying effort between 1984 and 1986. Level of detail included distribution, growth form, habitat and other biological details.
URL link:	http://florabase.dec.wa.gov.au/
Title:	Declared Rare and Priority Flora List
Custodian:	Department of Environment and Conservation
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	A database of ongoing surveying work detailing rare and priority flora points over Western Australia.
URL link:	http://www.dec.wa.gov.au/content/view/5379/2231/

INLAND WATER BODY CONSERVATION FEATURES

Eighty-two inland water bodies were included in the analysis, based on a range of considerations, including geomorphology or significant international, national or regional classifications. Inland water bodies included:

- Channels;
- Minor rivers;
- Other caves;
- Wetlands; and
- Major rivers;
- Estuaries;
- Other water bodies;
- Wild rivers.

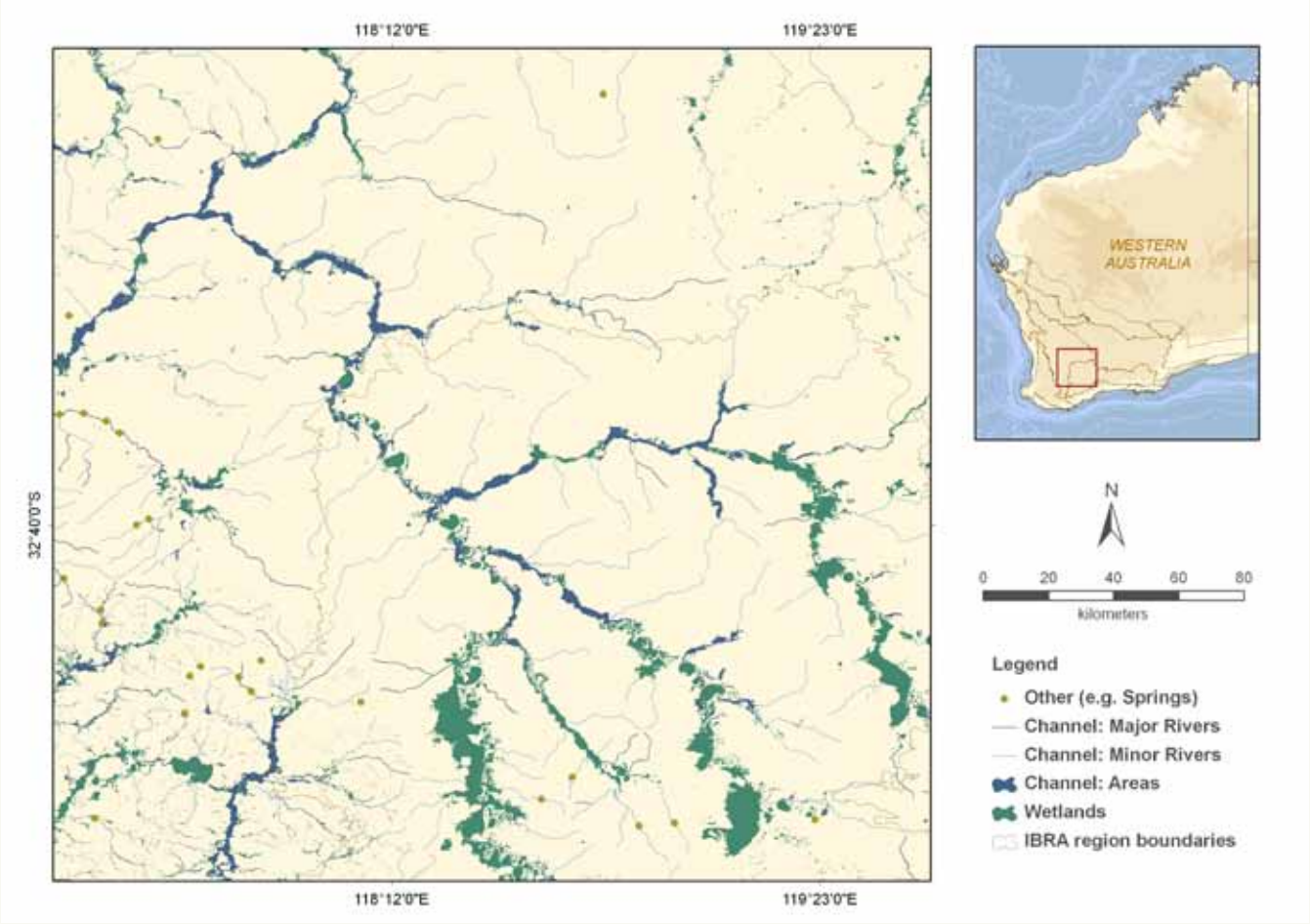
A range of datasets were used to create amalgamated datasets for each of these categories and are listed in Box 7. In amalgamating these datasets, higher resolution data took precedence over lower resolution data. As a result, no water body categories overlap (except for "other water bodies"). This exception was made for springs, waterholes and other water points, which were considered absolute entities and were not excluded if they overlapped with a water body category. Figure 7. contains an example of the final datasets.

In determining how to create conservation features from the categories of water bodies, a range of protected area lists that cover water bodies in the SWAE were investigated. These included:

- Ramsar Wetlands;
- Wetlands of National Significance: A Directory of Important Wetlands in Australia;
- Environmental Protection Policies (EPP): Swan Coastal Plains Lakes; and
- Conservation Category Wetlands.

For each of these lists, the wetlands listed were identified and extracted from the core datasets to create specific conservation features consisting of a subset of that type of water body. Box 8. contains a full listing of the resources used to identify listed wetlands. In addition to these resources, the High Conservation Value Aquatic Ecosystems (HCVAE) listing was initially considered. However, this listing amalgamates areas in other datasets, so was not included in the final process of setting conservation features.

Figure 7. Water bodies dataset example



Box 7. Water bodies datasets used in the analysis

Title:	Geomorphic Wetlands from Darkan to Duranillin
Custodian:	Department of Environment and Conservation
Scale:	1:25,000
Coverage:	Darkan to Duranillin
Ending date:	9 March 2010
Abstract:	The dataset displays the location, boundary and geomorphic classification of wetlands from Darkan to Duranillin. Wetlands in this dataset have been classified into types, according to the geomorphic wetland classification system.
URL link:	http://www.dec.wa.gov.au/content/view/5868/1610/
Title:	Geomorphic Wetlands from Augusta to Walpole
Custodian:	Department of Environment and Conservation
Scale:	1:25,000
Coverage:	Augusta to Walpole
Ending date:	18 June 2008
Abstract:	The dataset displays the location, boundary and geomorphic classification (wetland type) of wetlands from Augusta to Walpole.
URL link:	http://www.dec.wa.gov.au/content/view/5315/1610/
Title:	Geomorphic Wetlands of the Swan Coastal Plains
Custodian:	Department of Environment and Conservation
Scale:	1:25,000
Coverage:	Swan Coastal Plain
Ending date:	Continuing
Abstract:	The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.
URL link:	http://www.dec.wa.gov.au/content/view/5317/1610/
Title:	Wetlands of the Wheatbelt
Custodian:	Department of Environment and Conservation
Scale:	1:100,000
Coverage:	Avon Wheatbelt
Ending date:	30 October 2008
Abstract:	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as small areas of the Rangelands to the east and the Darling Scarp to the west.
URL link:	http://www.dec.wa.gov.au/content/view/5311/2213/
Title:	Rivers
Custodian:	Department of Water
Scale:	1:100,000–250,000
Coverage:	Western Australia
Ending date:	5 November 2007
Abstract:	Major streamlines of Western Australia, coded with hierarchy and names.
URL link:	http://www.water.wa.gov.au/

Title:	Wild Rivers
Custodian:	Department of Water
Scale:	Various
Coverage:	Western Australia
Ending date:	August 2008
Abstract:	The Waters and Rivers Commission and the Australian Heritage Commission identified catchments in Western Australia that have not been significantly altered by humans.
URL link:	http://www.water.wa.gov.au/PublicationStore/first/83725.pdf
Title:	Springs, Lakes, Water Points, Water Holes, Caves
Custodian:	Geoscience Australia
Scale:	1:250,000
Coverage:	Australia
Ending date:	9 June 2006
Abstract:	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia. Springs are a place where water issues from the ground naturally. Lakes are naturally occurring bodies of mainly static water surrounded by land. Water points are a combination of gnamma holes, native wells, pools, rock holes and soaks. Water holes are a natural depression that holds perennial water, within a non-perennial watercourse or a non-perennial lake. Caves are a naturally formed, subterranean open area or chamber.
URL link:	http://www.ga.gov.au/meta/ANZCW0703008969.html

Box 8. Listed water bodies datasets used in the analysis

Title:	Ramsar Wetlands
Custodian:	Department of Sustainability, Environment, Water, Population and Communities
Scale:	1:25,000
Coverage:	Australia
Ending date:	March 2007
Progress:	Complete
Protected by:	The *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Abstract:	Ramsar Wetlands are representative, rare or unique wetlands, or those considered important for conserving biological diversity. They are included on the List of Wetlands of International Importance developed under the Ramsar Convention.
URL link:	http://www.environment.gov.au/cgi-bin/wetlands/alphablist.pl
Title:	Wetlands of National Significance: Directory of Important Wetlands in Australia
Custodian:	Department of Sustainability, Environment, Water, Population and Communities
Scale:	1:250,000 (largely derived from GA Topo 250K Water Bodies data)
Coverage:	Australia
Ending date:	October 2008
Protected by:	The *Environment Protection and Biodiversity Conservation Act 1999*
Abstract:	The directory not only identifies nationally important wetlands, it defines wetlands, their variety, and the many flora and fauna species that depend upon them.
URL link:	http://www.environment.gov.au/water/topics/wetlands/database/diwa

Title:	Environmental Protection (Swan Coastal Plain Lakes) Policy 1992
Custodian:	Environmental Protection Authority
Scale:	1:50,000
Coverage:	Swan Coastal Plain
Ending date:	December 1992
Progress:	Complete
Protected by:	The *Western Australian Environmental Protection Act 1986*
Details:	www.epa.wa.gov.au
Abstract:	The policy includes boundaries showing lake areas of environmental value on the Swan Coastal Plain. The policy made the filling, draining, excavating, polluting and/or clearing of these lakes an offence unless authorised by the EPA.
URL link:	http://tinyurl.com/3wlf3n9
Title:	Geomorphic Wetlands Swan Coastal Plain
Custodian:	Department of Environment and Conservation
Scale:	1:25,000
Coverage:	Swan Coastal Plain
Ending date:	December 2009
Progress:	Complete
Protected by:	Conservation category wetlands are "critical assets" and represent the most important environmental assets for protection and conservation in the State (EPA, 2005).
Abstract:	The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain. It includes Conservation Category Wetlands definitions in attributes.
URL link:	http://www.dec.wa.gov.au/content/view/5317/1610/
Title:	Wetlands of the Wheatbelt
Custodian:	Department of Environment and Conservation
Scale:	1:100,000
Coverage:	Avon Wheatbelt
Ending date:	30 October 2008
Abstract:	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as a small area of the Rangelands to the east and the Darling Scarp to the west. It includes Conservation Category Wetlands definitions in attributes.
URL link:	http://www.dec.wa.gov.au/content/view/5311/2213/

As a result, the conservation features selected for inclusion in the analysis consisted of a range of water bodies. These included:

- Channels (listed);
- Major rivers (listed);
- Minor rivers (listed);
- Estuaries (listed);
- Other caves;
- Wetlands (listed);
- Wild rivers.
- Channels (non-listed);
- Major rivers (non-listed);
- Minor rivers (non-listed);
- Estuaries (non-listed);
- Other water bodies;
- Wetlands (non-listed); and

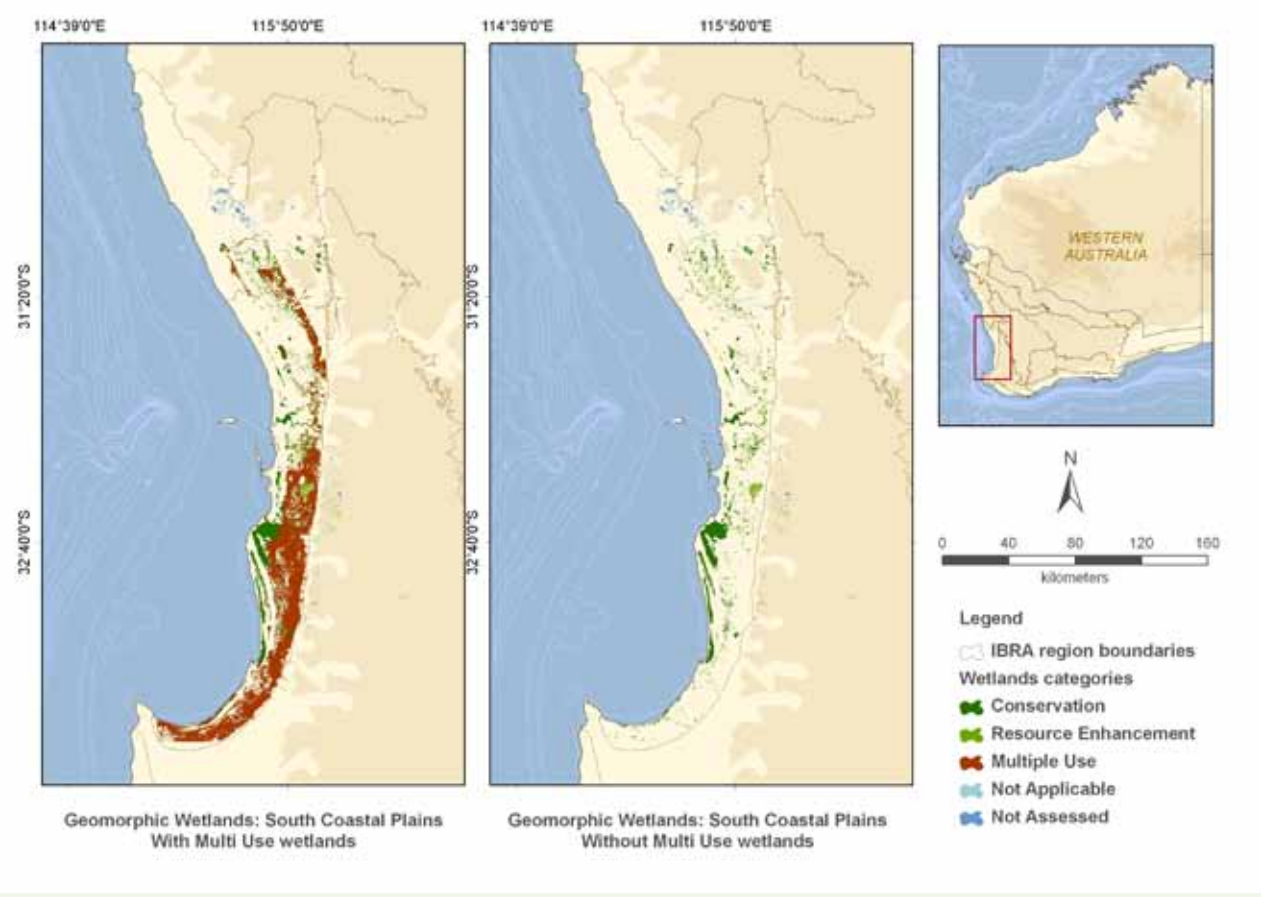
All non-listed categories, or categories without listed examples (e.g. wild rivers), were then stratified by IBRA regions. Box 9. uses the Swan Coastal Plain dataset as a working example and shows the entire process for this set of water body features.

Box 9. Working example of wetlands data on the Swan Coastal Plain

The Swan Coastal Plain IBRA region has the highest human population in the SWAE. Subsequently, the wetlands data is reasonably well known and accurate, being captured at a scale of 1:25,000. However, the dataset does not indicate the condition of the wetlands. It is estimated that over 70% of wetlands on the Swan Coastal Plain have been lost or degraded (EPA, 2007). The data was filtered to ensure that only those wetlands suitable for conservation were included in the analysis.

The Swan Coastal Plain geomorphic wetland data was processed in the following way:

Category	Details	Data inclusion
Conservation Category	The highest level of wetland considered healthy wetlands.	Included as "Listed Wetlands".
Resource Enhancement	Wetlands with a possibility to restore to former health.	Included as "Non Listed Wetlands".
Multi-use	Used for multiple reasons.	Not included due to possible degradation.
Not Assessed / Not Applicable	No data.	Not included.



INLAND WATER SPECIES CONSERVATION FEATURES

Forty-eight species associated with inland water bodies were included as conservation features, such as flora, crustaceans and fish (see Appendix 4.). These conservation features were processed in the same manner as the fauna and flora conservation features.

OTHER CONSERVATION FEATURES

A range of other conservation features were dealt with in specific ways to include them in the analysis. Here we provide details of the conservation feature creation and attribution for:

- Granite outcrops;
- South-facing slopes (a surrogate used for invertebrate diversity); and
- Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs).

Granite outcrops

Granite outcrops were raised several times by experts as an important surrogate for biodiversity as they provide a variety of microhabitats for plants and seasonal resources and refuge for a range of animals. These areas have rich biodiversity and many endemic species are restricted to individual outcrops. Furthermore, they are significant locations that tie in with Aboriginal and European cultural heritage (Bayly, 1999; Granite Outcrops Symposium, 1997).

Several available datasets within the project area show the location of granite outcrops. However, this data either covered the whole of the project area at a low resolution, or was highly accurate in just one area only. Granite outcrops could also be extracted from satellite imagery, but this type of processing could not be completed within the project resource constraints.

Consequently, the CPT decided to amalgamate the existing datasets to create a full dataset for the ecoregion. This was done in the same manner as for the inland water body conservation features, with the most accurate dataset taking precedence over data of lesser accuracy. The various datasets used (see Box 10.) were cut and "stitched" together to form one seamless "blanket" of data that does not overlap.

Moaning Frog / Heleioporus eyrei

Box 10. Granite outcrop datasets used in the analysis

Title:	Wetlands of the Wheatbelt
Custodian:	Department of Environment and Conservation
Scale:	1:100,000
Coverage:	Avon Wheatbelt
Ending date:	October 2008
Abstract:	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as in a small area of the Rangelands to the east and the Darling Scarp to the west
URL link:	http://www.dec.wa.gov.au/content/view/5311/2213/
Title:	Western Australia Granite Outcrop Locations
Custodian:	Wikipedia
Data origins:	1996 Gazetteer of Australia
Scale:	GPS points
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	The dataset includes all gazetted rocks, boulders, pinnacles, crags, needles, pillars, rock formations and tors in Western Australia, both inland and offshore. It does not include monoliths gazetted as mounts or hills, such as Mount Augustus.
URL link:	http://en.wikipedia.org/wiki/Granite_outcrops_of_Western_Australia
Title:	Pre-European Vegetation Dataset
Custodian:	Department of Agriculture and Food, Western Australia
Scale:	1:250,000
Coverage:	Western Australia
Ending date:	February 2005
Abstract:	Comprehensive vegetation dataset based on J.S. Beard, with mapping of the south-west corner compiled by A.J.M. Hopkins from various sources.
URL link:	http://www.agric.wa.gov.au
Title:	Deformation Areas
Custodian:	Geoscience Australia
Scale:	1:250,000
Coverage:	Australia-wide
Ending date:	Current
Abstract:	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia. Deformation areas are a combination of distorted surfaces and outcrops.
URL link:	http://www.ga.gov.au/meta/ANZCW0703008969.html

Apart from the Wetlands in the Wheatbelt dataset (with a scale of 1:100,000 but a coverage of only the Avon Wheatbelt), all other datasets that contain granite outcrop locations were of the same scale (1:250,000) and of the same coverage (Western Australia). Reviewing each dataset against Google Earth gave an indication of their relevant accuracy with regards to location. Each of these datasets were clipped and stitched based on assessment by the technical team.

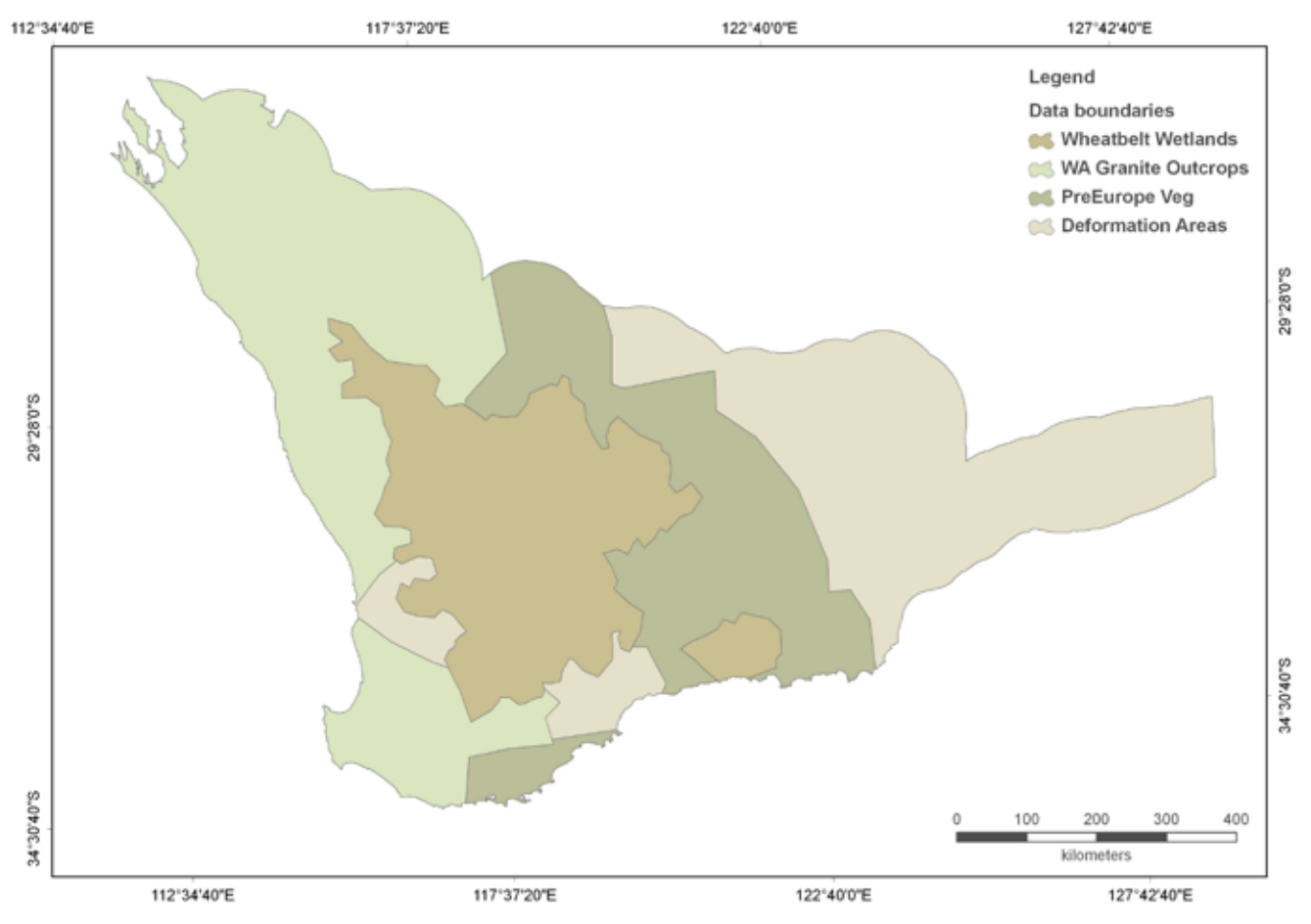
The resulting layer was combined using the hierarchy shown in Table 3., with a graphical representation shown in Figure 8.

In order to capture the unique flora and fauna present within different granite outcrops in different IBRA regions, this dataset was then stratified by IBRA region to create a number of conservation features from the amalgamated dataset.

Table 3. Data hierarchy for granite outcrops

Data title	Spatial area of greatest accuracy	Scale	Hierarchy	Data attributes
Wetlands of the Wheatbelt	Avon Wheatbelt	1:100,000	1	Granite outcrop attributes Included all confidence types (low, medium and high)
WA Granite Outcrop locations	North, North-West	1:250,000	2	All locations included
Pre-European Vegetation	South, South-east	1:250,000	3	Rock outcrop vegetation association attribute used
Deformation Areas	All other areas	1:250,000	4	Outcrop attributes used

Figure 8. Data hierarchy for granite outcrops



South-facing slopes

Very little data existed on individual invertebrate species across the SWAE and the limited number of species-level datasets could not represent the distribution of this diverse group of organisms. Invertebrate experts suggested microclimate or topographic surrogates as a way of identifying ecosystems that could represent diversity and distribution of invertebrate species. These surrogates included deep gullies and south-facing slopes as they tend to contain more spiders and millipedes, while ridges and hills can indicate diversity of snails and millipedes. Unfortunately, data on gullies, hills or ridges covering the ecoregion was inadequate and it was decided to use south-facing slopes only. South-facing slopes were extracted using gradient and aspect details found in readily available digital elevation models (DEM).

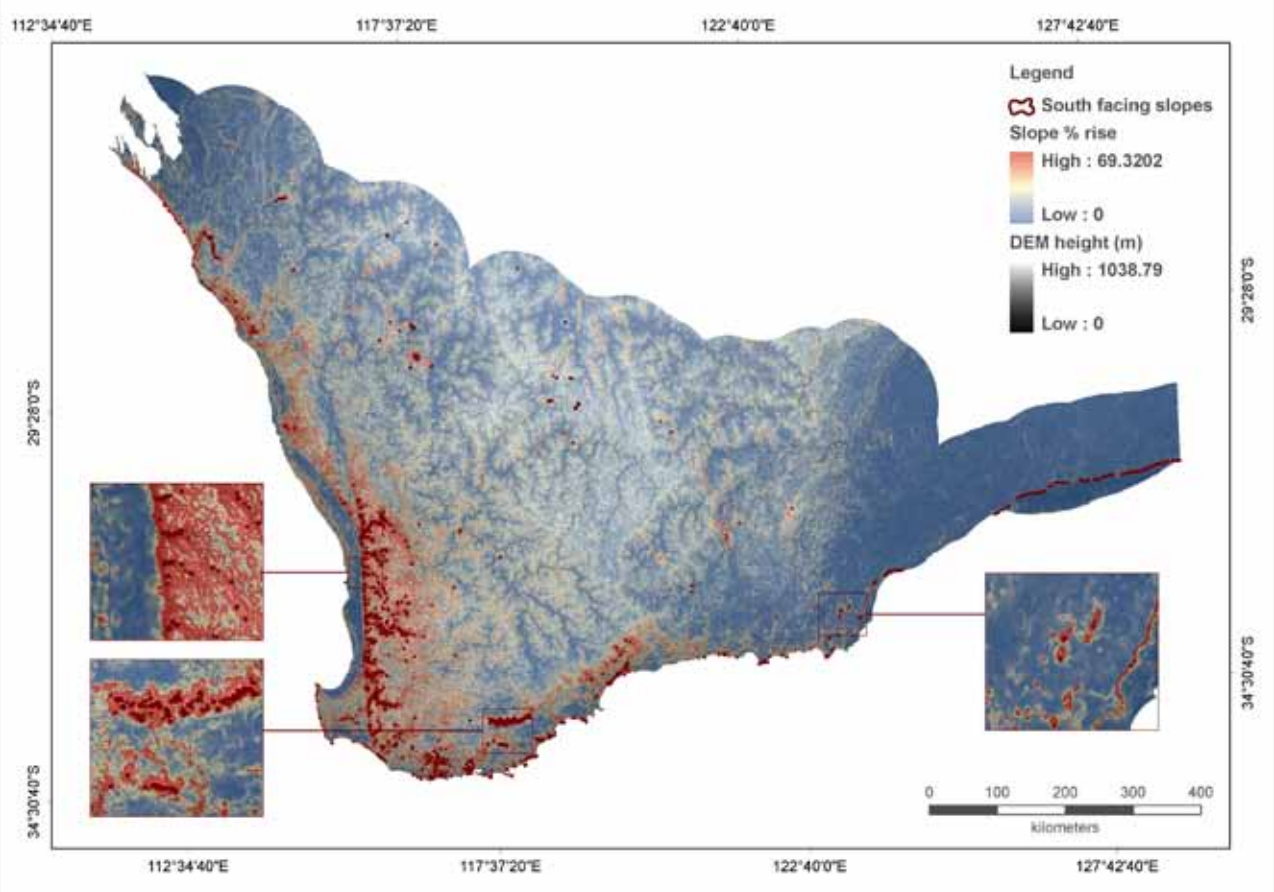
Geoscience Australia has the only DEM dataset that covers the whole of the project area. It is a nine second (250-metre cell wide) model with an elevation accuracy error up to 200 m and an elevation range of 0 1,028 m. Box 11. contains details of this dataset.

South-facing slopes were determined by identifying areas in the nine-second DEM that had a gradient of 10% or more, and had a slope bearing of between 135 and 225 degrees. These areas are shown in Figure 9. The south-facing slopes data was entered into Marxan as a "presence" in a planning unit.

Box 11. GeoData dataset used in the analysis

Title:	GEODATA Nine Second DEM (DEM-9S) Version 3
Custodian:	Geoscience Australia
Scale:	1:250,000
Coverage:	Australia
Ending date:	June 2008
Abstract:	A gridded digital elevation model computed, using the ANUDEM elevation gridding program Version 5.2.2, from continent-wide topographic data, including point elevations, streamlines, water body boundaries and cliff lines. The grid spacing is 9 seconds in longitude and latitude (approximately 250 m).
URL link:	http://www.ga.gov.au/meta/ANZCW0703011541.html

Figure 9. South-facing slopes and the nine-second DEM



THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES (TECs AND PECs)

An ecological community is a naturally occurring biological assemblage or group of plants and/or animals (or other living things, such as microbes) that occurs in a particular type of habitat. Ecological communities form ecosystems within their habitat. A Threatened Ecological Community (TEC) is subject to processes that threaten to destroy or significantly modify it across much of its range, whereas Priority Ecological Communities (PEC) are potentially threatened ecological communities that do not meet survey criteria or that are not adequately defined (DEC, 2007).

TECs and PECs are referred and assessed by a panel of experts on the WA Threatened Ecological Communities Scientific Committee (WATECSC) and, when listed, are indirectly protected by the Environmental Protection Act 1986 and Environmental Protection Regulations 2004 (DEC, 2007). Table 4. describes the categories and Box 12. shows the single dataset that exists for the TEC and PEC data.

Table 4. Categories of TECs and PECs

Type of community	Categories
Threatened Ecological Community	Presumed totally destroyed; Critically endangered; Endangered; or Vulnerable
Priority Ecological Community	Priority 1 – Poorly known ecological communities; Priority 2 – Poorly known ecological communities; Priority 3 – Poorly known ecological communities; Priority 4 – Ecological communities that are adequately known, rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring; or Priority 5 – Conservation-dependent ecological communities

Box 12. TEC and PEC dataset used in the analysis

Title:	Threatened and Priority Ecological Community Sites
Custodian:	Department of Environment and Conservation
Scale:	GPS point location within 100 m accuracy. Polygons manually determined.
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	Ecological communities throughout WA that are presumed totally destroyed, critically endangered, endangered, vulnerable, priority 1-5, lower risk and/or not evaluated. Communities are based on various lifeforms, including plants, invertebrates and micro-organisms.
URL link:	http://www.dec.wa.gov.au/content/view/849/2017/

The data contained within the TEC and PEC dataset is provided in either point or polygon data.

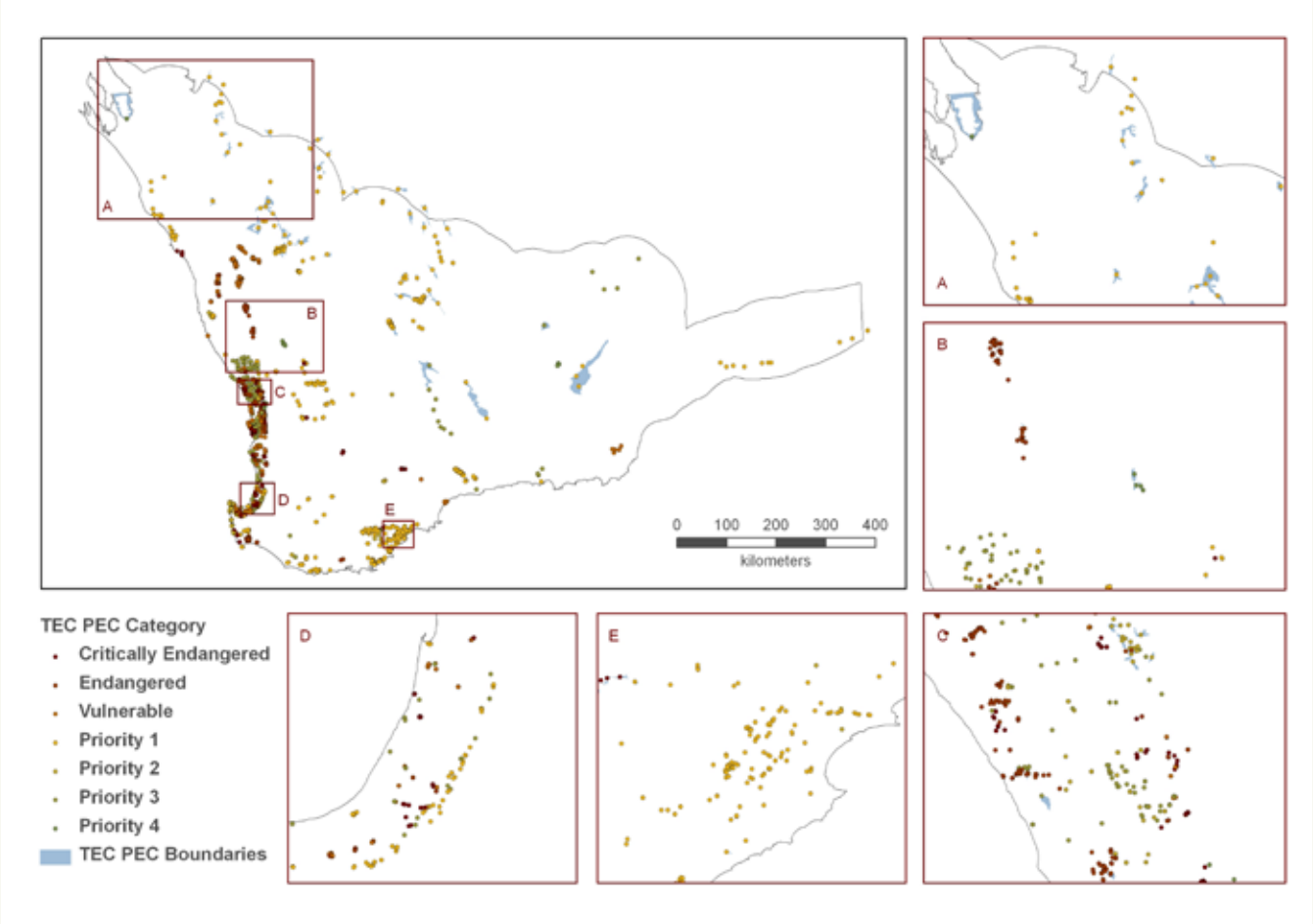
Point data includes locations of both TECs and PECs, captured at GPS accuracy. It contains information pertaining to the site, its category and a suggested buffer value that encompasses the site. If a site is groundwater or surface water dependant, these areas will also be included in the buffer radius.

Polygon data includes buffers created around selected TEC points that encompass the site with a more accurate boundary.

There were 2,401 points and 1,172 polygons within the TEC and PEC dataset, as shown in Figure 10.

Of the 2,401 points, 1,759 can be located within a polygon (each polygon has at least one point allocated), leaving a total of 642 points with no polygon buffer. Of these, the buffer value ranges from 30-45,000 m. Including the point buffer values was considered important even though they may not necessarily represent the site area accurately. As a result, the Conservation Planning Team decided to use a standardised buffer size of 1 km for all points that did not coincide with a TEC or PEC polygon boundary. This buffer was considered a way to determine the presence of a TEC or PEC in the area, although not necessarily its extent.

Figure 10. All TEC and PEC data for the Southwest Australia Ecoregion



VEGETATION CONSERVATION FEATURES

It was considered important to include different vegetation types and their extent as conservation features in this analysis. This is because they represent different habitat types, for example jarrah-karri forests and shrublands, banksia and eucalypt woodlands, heathlands, mallee and the arid savannah. Different vegetation types and extent can demonstrate areas that support viable populations of species and habitat connectivity. They can also act as a surrogate for ecological processes, represent different habitat types and be rare or unique habitats in their own right (for example kwongan heath, see Box 14.). In order to include vegetation conservation features in Marxan, a conservation feature of the connectivity of the vegetation was created and the following two datasets sought:

- Vegetation type (describing the vegetation communities); and
- Vegetation extent.

While there are many vegetation type datasets applicable to the SWAE, only the pre-European vegetation dataset (available from the Department of Agriculture and Food WA) covered the project area completely. Although integrating more accurate vegetation datasets was considered (such as the System 6 or the Regional Forest Agreement datasets from the Department of Environment and Conservation), expert advice suggested there would be too much bias towards the highly localised, more accurate datasets. To address this problem, the vegetation dataset that covered the whole project area was used. This dataset was then stratified by IBRA region.

The pre-European vegetation dataset used satellite imagery and has been improved using aerial photography where possible. This was the latest dataset available to show the vegetation extent for the project area.

Box 13 lists both datasets.

Box 13. Vegetation datasets used in the analysis

Title:	Pre-European Vegetation Dataset
Custodian:	Department of Agriculture and Food, Western Australia
Scale:	1:250,000
Coverage:	Western Australia
Ending date:	February 2005
Abstract:	Comprehensive vegetation dataset based on J.S. Beard, with mapping of the south-western corner compiled by A.J.M. Hopkins from various sources.
URL link:	http://www.agric.wa.gov.au
Title:	Vegetation Extent Baseline Dataset (remnant vegetation)
Custodian:	Department of Agriculture and Food, Western Australia
Scale:	Various
Coverage:	South-west Australia
Ending date:	August 2008
Abstract:	A dataset containing vegetation extent polygons from the mapping of remnant vegetation in Western Australia.
URL link:	http://www.agric.wa.gov.au

The pre-European vegetation dataset contains a total of 490 different vegetation types throughout the project area. This dataset was then clipped to the vegetation extent baseline dataset to indicate current vegetation extents. According to this simple processing, 26% (176,625.8 km^2) of remnant vegetation in the project area (686,871 km^2) has been cleared (Figure 11.).

The following three vegetation types in the pre-European vegetation dataset were not included as they were already represented as other conservation features:

- Salt lakes;
- Freshwater lakes; and
- Granite outcrops.

As the pre-European vegetation dataset was broad and it is important to get representation across the ecoregion, the conservation planning team stratified the vegetation data per IBRA region. Table 5. contains a breakdown of the remnant vegetation by IBRA region.

In order to stratify the vegetation types to the various bioregions, the data was clipped and cleaned. Considerable attention was paid to the vegetation types that were found on the edges of bioregions, to ensure that sliver polygons did not bias the selection of areas in Marxan.

This stratification of remnant vegetation resulted in 862 new vegetation data types. This can be separated into IBRA regions as shown in Table 6.

Figure 11. Remnant vegetation in the Southwest Australia Ecoregion

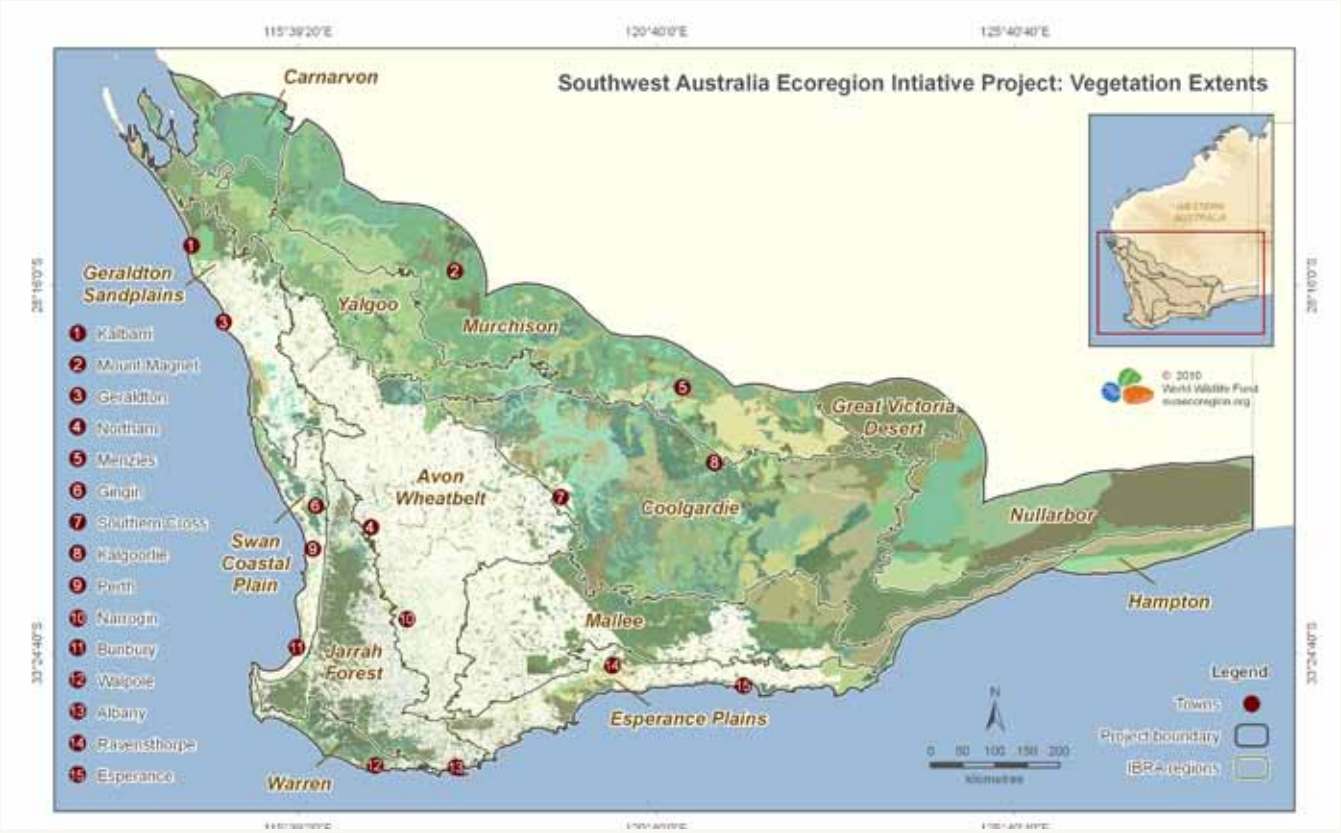


Table 5. Breakdown of remnant vegetation by IBRA region

IBRA region name	Area of IBRA region (km²)	Area of remnant vegetation in IBRA region (km²)	Area cleared (km²)	Percentage cleared (%)
Avon Wheatbelt	95,163.86	17,304.56	77,859.3	82
Carnarvon	17,940.96	17,913.82	27.14	0
Coolgardie	129,170.47	126,893.14	2,277.33	2
Esperance Plains	29,133.32	14,834.29	14,299.03	49
Geraldton Sandplains	31,453.02	14,123.67	17,329.35	55
Great Victorian Desert	16,746.77	16,746.77	0	0
Hampton	10,412.89	10,380.08	32.81	0
Jarrah Forest	45,085.03	25,324.13	19,760.9	44
Mallee	73,955.07	40,902.81	33,052.26	45
Murchison	100,859.50	100,730.40	129.1	0
Nullarbor	62,990.37	62,990.37	0	0
Swan Coastal Plain	15,307.48	5,795.76	9,511.72	62
Warren	8,495.54	6,758.76	1,736.78	20
Yalgoo	50,156.90	49,546.68	610.22	1

Table 6. Breakdown of vegetation types by IBRA region

IBRA region name	Number of vegetation types
Avon Wheatbelt	141
Carnarvon*	36
Coolgardie	89
Esperance Plains	46
Esperance Fitzgerald	6
Esperance Recherche	6
Geraldton Sandplains	73
Great Victoria Desert*	9
Hampton	5
Jarrah Forest	74
Mallee	73
Mallee Eastern	7
Mallee Western	7
Murchison*	94
Nullarbor*	10
Swan Coastal Plain	55
Warren	49
Yalgoo	81
No data	1
Total	**862**

*part of the 100 km buffer zone

Kwongan heath and mallee vegetation types

Changes in species composition is an important process in many ecosystems but rarely considered in systematic reserve site selection (Felinks *et al.*, 2010). Expert advice was provided on the spatial turnover of kwongan heath and mallee vegetation types associated, particularly, with the Esperance Plains and Mallee IBRA subregions (Griffin *et al.* 1983; Burgman, 1988; Brown, 1989; Keighery, G., 2010, pers. comm). Additional processing is outlined in Box 14.

Box 14. Stratification of kwongan heath and mallee vegetation complexes

Kwongan heath and mallee of the northern and southern sandplains comprises floristically-rich heath with dense thickets of sclerophyllous shrubs and isolated small trees. It is one of the most botanically diverse vegetation types world-wide. Kwongan heath is characterised by nutrient-poor sandy soils, frequent wildfire, a very high level of endemism, spectacular displays of wildflowers in spring, and a Mediterranean climate with winter rainfall and hot, dry summers (Pate *et al.*, 1984).

Trying to capture a 15 km wide species turn-over within the project area would result in an unnecessarily complex stratification system. The process used is detailed below.

1. Data extraction

A vegetation type could be associated with either kwongan or mallee but not both.

Kwongan heath

Kwongan heath complexes were extracted from the pre-European vegetation dataset if they contained:

- Both “mallee” and “shrubland” in their description; or
- Only “scrub heath” in their description.

These datasets were then combined into a single kwongan dataset.

Mallee

Mallee complexes were extracted from the pre-European vegetation dataset if they contained “mallee” in their description and data was only selected if it had not already been defined as a kwongan complex. A single mallee dataset was then created.

2. Stratification

The kwongan heath and mallee datasets created in step 1 were then stratified to create separate remnant kwongan and mallee datasets for each of the following IBRA regions:

- Geraldton Sandplains;
- Swan Coastal Plain;
- Avon Wheatbelt;
- Coolgardie;
- Esperance Plains; and
- Mallee.

VEGETATION CONNECTIVITY

Spatial patterns of vegetation at the regional scale are important because the proximity and arrangements of patches of vegetation influences the persistence of animal species that have different minimum habitat requirements and vary in their ability to move across open ground. In addition, vegetation proximity can influence the genetic flow between flora and fauna species (Tews *et al.*, 2004; Johnson *et al.*, 2007).

Further to the remnant vegetation type and extent dataset processing above, a dataset that could be used to determine the connectedness of remnant vegetation was developed for this analysis. No readily available dataset captured the connectivity of remnant vegetation throughout the project area, although the underlying data required already exists – namely the vegetation extent baseline dataset, which was used to model this dataset. The model was developed based on a relatively simple premise of adjacency: that connectivity could be calculated based on the amount of remnant vegetation found within a planning unit and that of its neighbouring planning units.

A connectivity value was calculated for each planning unit using the following six-step process.

Step one

Select any planning unit, which temporarily becomes the "central" planning unit for this process. When this process is repeated, the subsequent planning unit then becomes the "central" planning unit.

Step two

Select all planning units that immediately surround and are contiguous with the central planning unit (named Tier 1).

Find the vegetation average in Tier 1 by:

- Adding the total amount of vegetation area found in those planning units; and
- Dividing by the number of planning units selected (six in total).

Weight this amount by three.

Step three

Select all the other (not Tier 1) planning units that surround and are contiguous with the Tier 1 planning units (named Tier 2).

Find the vegetation average in Tier 2 by:

- Adding the total amount of vegetation area found in those planning units; and
- Dividing by the number of planning units selected (12 in total).

Weight this amount by two.

Step four

Select all the other (not Tier 1 or Tier 2) planning units that surround and are contiguous with the Tier 2 planning units (named Tier 3).

Find the vegetation average in Tier 3 by:

- Adding the total amount of vegetation area found in those planning units; and
- Dividing by the number of planning units selected (18 in total).

Step five

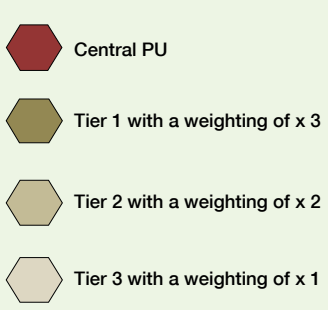
Add all values for Tier 1, Tier 2 and Tier 3.

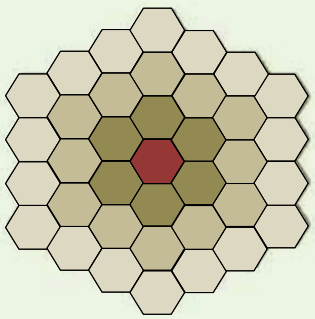
Step six

Place this value in the central planning unit cell, as an estimate of connectivity.

Figure 12. illustrates the calculation for this process.
Box 15. contains a working example.

Figure 12. Vegetation connectivity model





Connectivity in central planning unit =
((A)/6) x 3) + ((B)/12) x 2) + (C)/18 = Y

Where:

A: total area of remnant vegetation per km² per planning unit within Tier 1

B: total area of remnant vegetation per km² per planning unit within Tier 2

C: total area of remnant vegetation per km² per planning unit within Tier 3

Box 15. Example of determining vegetation connectivity

If the maximum amount of vegetation in one planning unit is 2.5 km², then:

A: Tier 1 total veg cover = 9.0
(1.5 + 2.0 + 2.0 + 2.0 + 1.5 + 0.0)
A total of six planning units

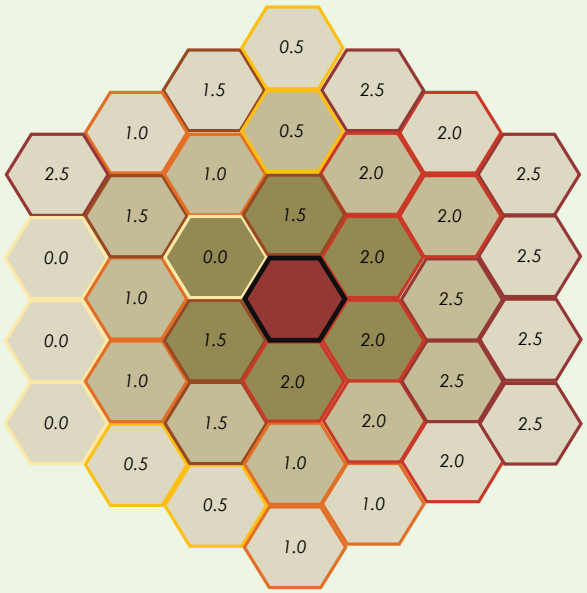
B: Tier 2 total veg cover = 18.5
(0.5 + 2.0 + 2.0 + 2.5 + 2.5 + 2.0 + 1.0 + 1.5 + 1.0 + 1.0 + 1.5 + 1.0)
A total of 12 planning units

C: Tier 3 total veg cover = 25
(0.5 + 2.5 + 2.0 + 2.5 + 2.5 + 2.5 + 2.5 + 2.0 + 1.0 + 1.0 + 0.5 + 0.5 + 0.0 + 0.0 + 0.0 + 2.5 + 1.0 + 1.5)
A total of 18 planning units

Calculations:

Using the connectivity formula:
((A)/6) x 3) + ((B)/12) x 2) + (C)/18
((9)/6) x 3) + ((18.5)/12) x 2) + (25)/18
4.5 + 3.08 + 1.38

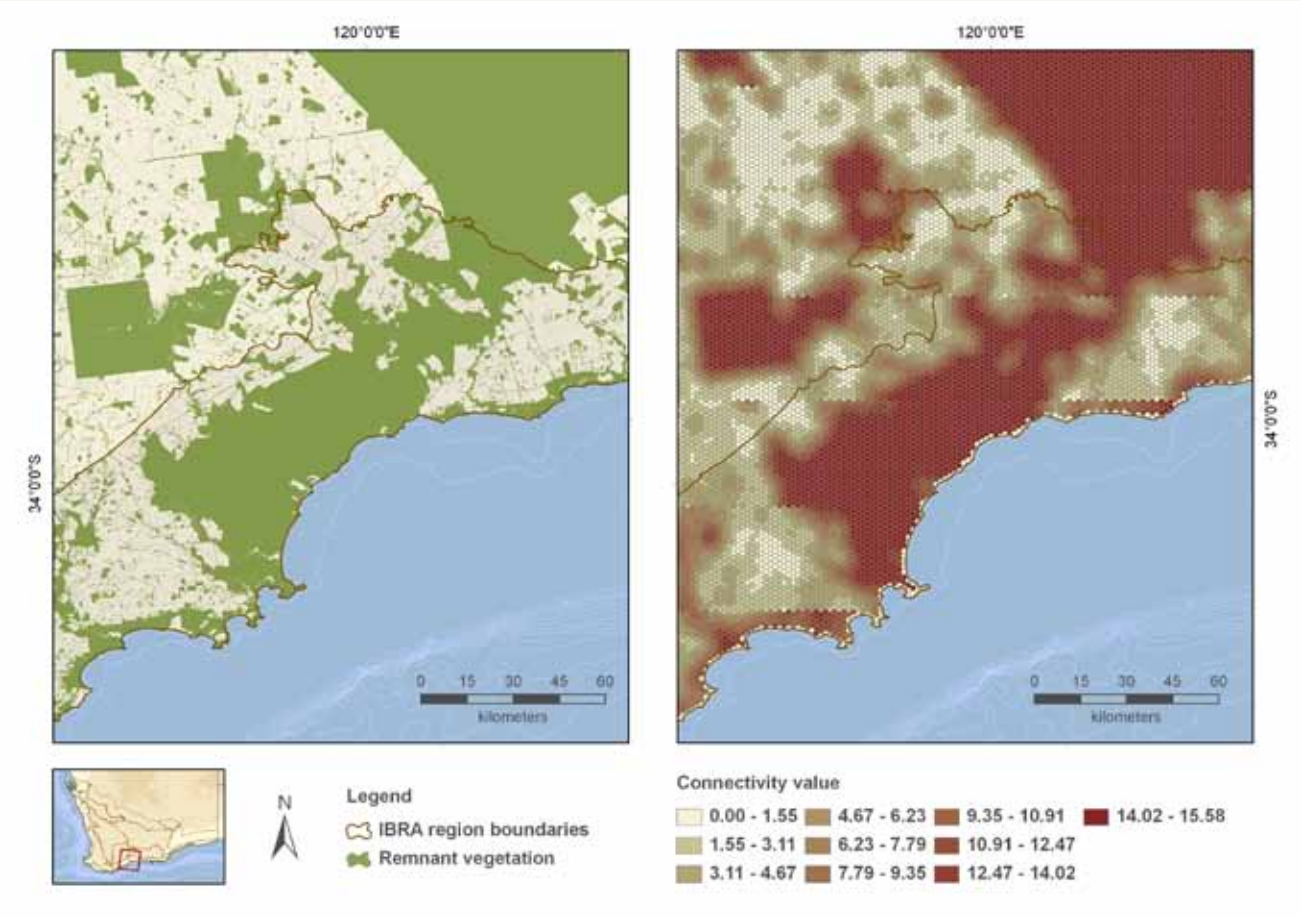
Central planning unit vegetation connectivity value = 8.96



Due to the size of this project area, the shape of the grids and the complexity of the filter tiers, this process was automated using Python scripting. This script is available from WWF on request.

Figure 13. provides an example of the vegetation connectivity data.

Figure 13. Vegetation connectivity model



STEP 6. APPLYING CONSERVATION FEATURES TO PLANNING UNITS

Data used in this analysis was available in a range of different formats (points, lines and polygons). All data was standardised and formatted consistently for the Marxan analysis. All data types were transformed to a regular grid structure of hexagonal cells to identify and minimise bias in the way data was treated.

Conservation features were allocated to planning units depending on data and target achievement and were attributed to a planning unit in one of three ways, according to:

- Their presence in a planning unit (e.g. 1);
- The area of a planning unit (e.g. 0.2511 km² within a grid cell); or
- Their value based on modelling (e.g. 2.35 out of a possible 15.58 for vegetation connectivity).

Presence in a planning unit

This method was used mainly for point or line datasets (such as specific flora and fauna species locations, or waterways). However, some polygon data was included as a "presence" in a planning unit, for example granite outcrops. Because granite outcrops were a combination of points and polygons, all data was entered as a "presence" in a planning unit. If point or line data occurred within a planning unit, it was allocated a single value of 1, indicating "presence", even if more than one point or line for a conservation feature was found in the planning unit. This is illustrated in Figure 14.

Area per planning unit

This method was used for any polygon dataset, such as vegetation types. If a conservation feature polygon intersected with a planning unit, its area in that planning unit (in km²) was calculated. If a point dataset was buffered for any reason, such as Threatened and Priority Ecological communities, or sensitive locations such as Carnaby's black cockatoo breeding sites, then the result was also entered into Marxan as area for each planning unit. All area values were rounded to six decimal places. No data was entered if its size was less than 1 m². Due to the size of the planning units, the maximum amount any conservation feature could have in a planning unit was 2.598076 km² (the area of the planning unit). This is shown in Figure 15.

Value per planning unit

This process was used for the vegetation connectivity data. Each grid cell was allocated a value, based on the processing results, as shown in Figure 16.

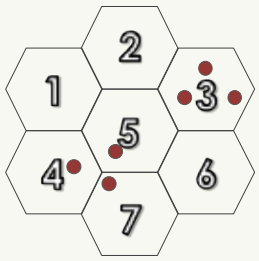
Figure 16. Examples of the value per planning unit method

Table 7. lists how data from each category was applied to the planning units across the various conservation features.

Table 7. Methods for applying conservation features to planning units

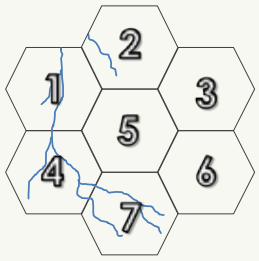
Asset class	Method used for attribution
Fauna	Presence in a planning unit
Flora	Presence in a planning unit
Inland water bodies	Area per planning unit
Inland water species	Presence in a planning unit
Other	Presence in a planning unit and area per planning unit
Vegetation	Area per planning unit and value per planning unit

Figure 14. Examples of presence in a planning unit method



Points
Example: Bird species location

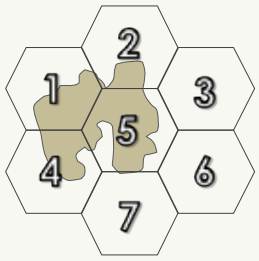
CF Type	PU ID	Amount
Example A	3	1
Example A	4	1
Example A	5	1
Example A	7	1



Lines
Example: Rivers

CF Type	PU ID	Amount
Example B	1	1
Example B	2	1
Example B	4	1
Example B	7	1

Figure 15. Examples of the area per planning unit method



Polygons
Example: Vegetation

CF Type	PU ID	Amount
Example C	1	0.55
Example C	2	0.15
Example C	4	0.40
Example C	5	0.89

Figure 16. Examples of the value per planning unit method

Modeling
Example: Connectivity

CF Type	PU ID	Amount
Example D	1	15.1
Example D	2	0.25
Example D	3	1.4
Example D	4	10.3
Example D	5	5.65
Example D	6	8.02
Example D	7	14.55

STEP 7. SETTING TARGETS

Setting targets specifying how much of each conservation feature should be captured within the analysis is a required Marxan input. These targets serve as initial expert estimates of the necessary levels of replication and abundance needed to ensure conservation feature persistence.

Targets are expressed as the amount of viable occurrences or area within the SWAE and ranged from 15 to 100%. The target for each conservation feature was derived using specific rules that responded to the conservation status, endemism, threats used in the analysis and any special circumstances that the experts felt needed to apply (for example, population declines or being an indicator for ecosystem health). Higher targets ensure that more of the conservation feature will be selected in the outcome; however setting high targets does restrict flexibility within the software by removing potential choices. A lower target may be attributed to a surrogate, or perhaps a less threatened species, while a higher target would normally be needed for a threatened community or a species on the brink of extinction. Target achievement relates to how well targets have been met within the solution.

TARGET FORMULAE

Two main formulae were used to create targets in a systematic manner (See Appendix 4. for a full list of the conservation features used in the analysis, with their targets). The first formula applied to all conservation features apart from the vegetation type and extent datasets, and had the possibility of achieving a maximum score of 90%. It is demonstrated as:

Target for Conservation Feature = Base (15%) + AOR (15%) + Listed (45%) + Endemic (15%)

In this terminology, the following definitions apply:

- Base – the general base percentage given to all conservation features (no target can be below this amount; i.e. no conservation feature included in the analysis should fail to be represented to at least the base level in any Marxan solution);
- AOR (Any Other Reason) – any taxa specifically recommended through expert engagement and any taxa listed as Priority 4 or 5 under the Western Australian *Wildlife Conservation Act 1950*;
- Listed – any taxa listed as Priority 1, 2, or 3 under the Western Australian *Wildlife Conservation Act 1950* and any species listed as threatened under the Federal *Environment Protection and Biodiversity Conservation Act 1999* ; and
- Endemic – any taxa listed as endemic to the SWAE, determined through reference materials or expert recommendation.

Box 16. contains a working example of how this target formula was applied to the western false pipistrelle (*Falsistrellus mckenziei).*

Box 16. Example of target-setting for fauna conservation features

Marxan ID:	2007
Scientific Name:	*Falsistrellus mckenziei*
Common Name:	Western False Pipistrelle
AOR:	Expert recommendation (threatened), DEC Priority Listing (4)
Listed:	No
Endemic:	Yes
Base (15%) + AOR (15%) + Listed (0%) + Endemic (15%)	
Total target: 45%	

The second formula was applied to the vegetation conservation features and consisted of:

(Base (15%) + mallee or kwongan heath (60-80%) + Threats (5-15%)) x (Pre-Europe/Remnant Veg)

In this terminology, the following definitions apply:

- Base – general base percentage given to all conservation features;
- Mallee – if the vegetation conservation feature is a mallee vegetation complex;
- Kwongan heath – if the vegetation conservation feature is a kwongan heath vegetation complex;
- Threats – if a vegetation type at any time intersects with one, two or three threats (salinity, urbanisation, Phytophthora dieback). An incremental 5% weighting was given with a maximum weighting of 15% for all three threats. See Step 8. Introducing a Cost Layer for details about threat processing;
- Pre-Europe – the pre-European extent in km^2; and
- Remnant vegetation – the current extent of remnant vegetation in km^2.

The rationale behind this vegetation formula is to:

- Recognise the high spatial turnover values of both kwongan heath and mallee vegetation types;
- Capture a greater percentage of vegetation types that have been subject to more clearing (and are subsequently less available) relative to pre-European extent; and
- Identify those vegetation types that are at risk of the three threats included in the analysis.

A maximum score for this formula was 100%. Two working examples of this formula are presented in Box 17.

Box 17. Examples of setting targets for vegetation conservation features

Working example 1:		
Description:	Shrublands *Acacia* I Carnarvon	
	Shrublands; *Acacia sclerosperma*, A. *bowgada* and A. *victoriae* scrub	
Base:		
Base:	Yes (all conservation features receive a base weighting)	15%
Mallee:	No (not a mallee vegetation type)	0%
Kwongan:	No (not a kwongan vegetation type)	0%
Threats:		
Urban:	Yes (it has been affected by roads)	5%
Phytophthora dieback:	No (it hasn't been affected by dieback)	0%
Salinity:	No (it hasn't been affected by salinity)	0%
Pre-European extent:	470.962 km^2	
Remnant vegetation:	470.962 km^2	
Calculations:	1. ((Base (15%)) + Threats (5%)) x Pre-Europe (470.962)/Remnant Veg (470.962)	
	2. (0.20 x 470.962)/(470.962) = 0.199 (19.9%)	
	3. Convert to a percentage with a maximum of 100%	
Conservation Target = 20%		

CONTINUED OVER

Working example 2:		
Vegetation type:	Shrublands Scrub heath G Geraldton Sandplains	
Description:	Shrublands; scrub-heath on yellow sandplain, *Banksia-xylomelum* alliance	
Base:		
General	Yes (all conservation features receive a base weighting)	15%
Mallee:	No (is not a kwongan vegetation type)	0%
Kwongan:	Yes (is a kwongan vegetation type)	65%
Threats:		
Urban:	Yes (it has been affected by roads)	5%
Phytophthora dieback:	No (it hasn't been affected by Phytophthora dieback)	0%
Salinity:	Yes (it has been affected by salinity)	5%
Pre-European extent:	1737.444 km²	
Remnant Vegetation:	555.784 km²	
Calculations:	1. ((Base (80%)) + Threats (10%)) x Pre-Europe (1737.444)/Remnant Veg (555.784)	
	2. (0.90 x 1737.444)/(555.784) = 2.81 (281%)	
	3. Convert to a percentage with a maximum of 100%	
Conservation Target = 100%		

SPECIAL FORMULAE

Three exceptions were made to these formulae for specific conservation features:

- Inland water bodies;
- Threatened and Priority Ecological communities; and
- Vegetation connectivity.

Inland water body conservation features

Due to a range of specific issues relating to inland water bodies identified during expert engagement, it was resolved to represent these conservation features as shown in Table 8.

Vegetation connectivity conservation target

The legacy of clearing, particularly in the Wheatbelt and coastal zones, has resulted in some parts of the SWAE becoming highly fragmented. The Avon Wheatbelt IBRA region has been rated as the most stressed area for biodiversity in Western Australia, due to widespread loss of native vegetation, fragmentation of habitat, land salinisation and relatively minimal protection under the conservation estate (May and McKenzie, 2002). However, large intact areas of remnant vegetation still persist in other IBRA regions. The Carnarvon IBRA region, for example, has nearly all of its vegetation intact.

A target of 20% was selected for connectivity to ensure a balance between the disparities of remaining vegetation in different IBRA regions.

Threatened and Priority Ecological community conservation targets

Conservation targets for the TEC and PEC conservation features were determined by the conservation planning team as shown in Table 9.

Table 8: Inland water body conservation target values

Type	Examples	Listed/ Not listed	Target (%)	Target reasoning	Stratified
Wetlands	Wetlands, lakes (permanently inundated basins), sumplands (seasonally inundated basins) Palusmonts, damplands (seasonally waterlogged basins), paluslope (seasonally waterlogged slopes), palusplains (seasonally waterlogged flats), other basin wetlands, floodplains, artificial lakes, artificial channels, basins, flats (e.g. land subject to inundation, marine swamps, saline coastal flats or swamps), slopes, land subject to inundation, saline coastal flats, swamps	Listed	100	Listed as important by a panel of official peers	No
		Not listed	45	Expert recommendation (as with flora and fauna targets)	Yes, by IBRA region
Channels, Major rivers	Mainstream, major river, major tributary	Listed	100	Listed as important by a panel of official peers	No
		Not listed	80	Only a few major rivers. Important to capture those in drier areas	Yes, by IBRA region
Channels, Minor rivers	Minor river, minor tributaries, significant stream	Listed	100	Listed as important by a panel of official peers	No
		Not listed	30	High number of minor rivers in SWAE. Lower target	Yes, by IBRA region
Channel areas	Any river data shown as an area (i.e. polygon format) shows the boundaries of river banks	Listed	100	Listed as important by a panel of official peers	No
		Not listed	45	Expert recommendation, target similar with flora and fauna targets	Yes, by IBRA region
Estuaries	Estuaries	Listed	100	Listed as important by a panel of official peers	No
		Not listed	90	Only a few available and at high risk of development	Yes, by IBRA region
Other water bodies	Springs, water holes, water points, gnamma holes, native wells, pools, soaks, rock holes	Not listed	90	Important areas of water and refugia for flora and fauna	Yes, by IBRA region
Other caves	Caves	Not listed	45	Expert recommendation, target similar with flora and fauna targets	Yes, by IBRA region

Vegetation connectivity conservation target

The legacy of clearing, particularly in the Wheatbelt and coastal zones, has resulted in some parts of the SWAE becoming highly fragmented. The Avon Wheatbelt IBRA region has been rated as the most stressed area for biodiversity in Western Australia, due to widespread loss of native vegetation, fragmentation of habitat, land salinisation and relatively minimal protection under the conservation estate (May and McKenzie, 2002). However, large intact areas of remnant vegetation still persist in other IBRA regions. The Carnarvon IBRA region, for example, has nearly all of its vegetation intact.

A target of 20% was selected for connectivity to ensure a balance between the disparities of remaining vegetation in different IBRA regions.

Threatened and Priority Ecological community conservation targets

Conservation targets for the TEC and PEC conservation features were determined by the conservation planning team as shown in Table 9.

Table 9. TEC and PEC conservation targets

Type	Category	Target %	Stratified
Threatened Ecological Community Sites	All	100	No
Priority Ecological Community Sites	1, 2 and 3	90	Yes, via IBRA region
Priority Ecological Community Sites	4 and 5	45	Yes, via IBRA region

Walker's Bencubbin

STEP 8. IDENTIFYING AND DEFINING LOCK-INS

This step recognises that there are some areas within the SWAE that are already afforded protection and management within the conservation estate. Acknowledging these areas as the foundation of newly prioritised areas is important as it builds on current investment, increases the size and capacity of areas already protected through statutory means, provides protection and buffering, and better connects these areas. Lock-ins are those planning units that represent areas already fixed within the conservation estate. Marxan aims to identify how it can achieve target solutions within locked-in planning units before searching outside.

Choosing lock-ins

Lock-ins included in this analysis included any parcel of land that was:

- Classified as an IUCN category of Ia, II, III or IV (see Table 10.). As the purpose of categories V and VI is not strictly for nature conservation, they were not included; or
- Classed as a
  - > Conservation park;
  - > National park;
  - > Nature reserve;
  - > 5(1)(h) Reserve with "land use" specified for "conservation"; and
  - > 5(1)(g) Reserve with "land use" specified for "conservation".

Table 10. IUCN categories (Dudley, 2008)

IUCN category	Purpose of management
Ia	Strict protection – is "Strict Nature Reserve"
II	Ecosystem conservation and protection
III	Conservation of natural features
IV	Conservation through active management
V	Landscape/seascape conservation and recreation
VI	Sustainable use of natural resources

Lock-in data

The DEC is the custodian of a range of managed land and waters within Western Australia. A dataset (see Box 18.), sourced from DEC, shows their geographic extent.

The DEC dataset contains a variety of different categories of managed lands and waters. Not all are managed for conservation purposes (e.g. timber reserves) or included in the SWAE project area (e.g. marine reserves). Table 11. contains a full listing of the categories in the DEC dataset, along with the number of these areas in Western Australia and the project area. The figures were tallied by taking the unique combination of the category of the polygon lists both datasets.

Box 18. DEC-managed lands and waters

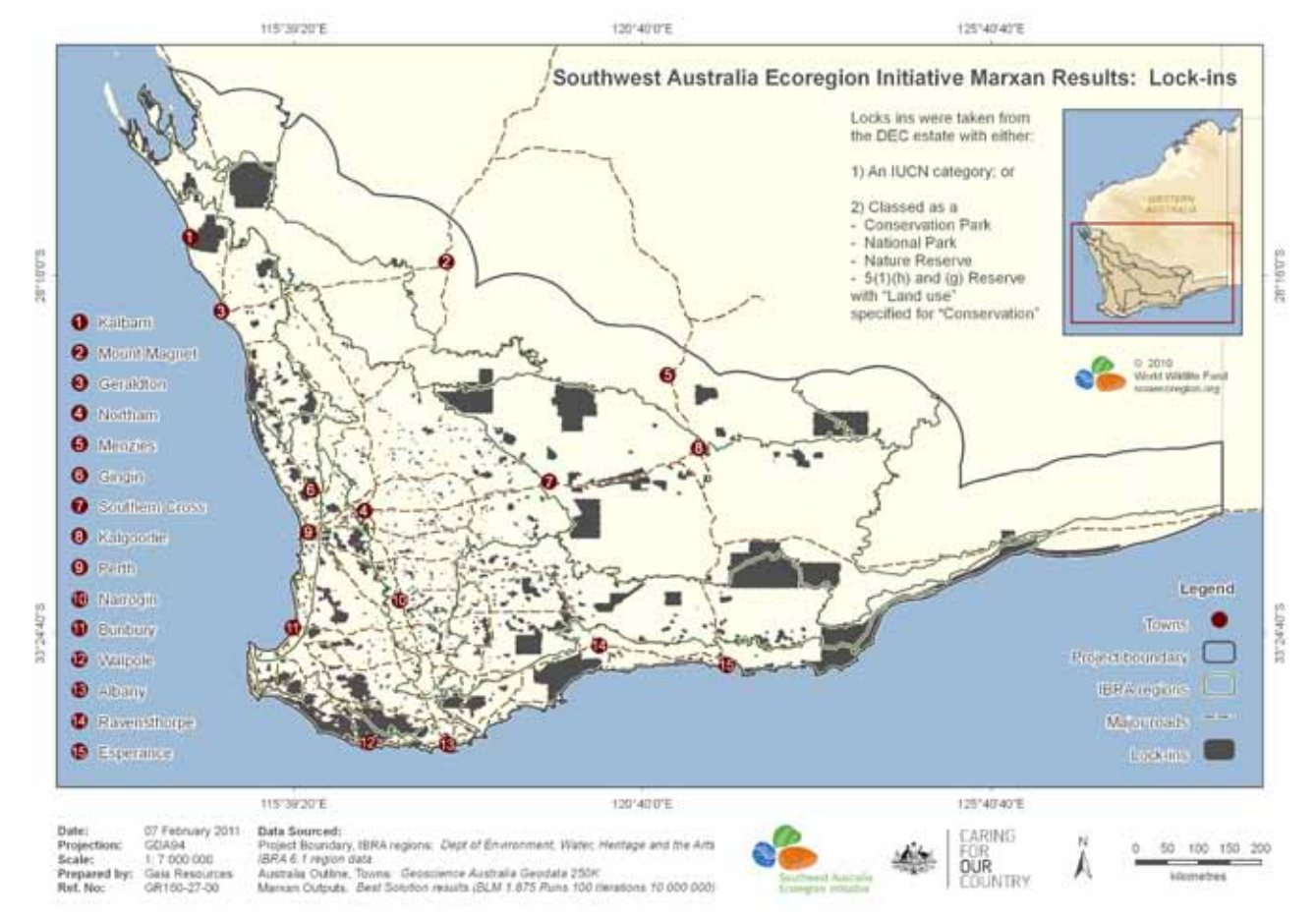
Title:	DEC-managed Lands and Waters
Custodian:	Department of Environment and Conservation
Scale:	Not given (although based on cadastre data)
Coverage:	Western Australia
Ending date:	June 2003
Abstract:	DEC-managed lands and waters within Western Australia. This responsibility is vested under the *DEC Act* and *Wildlife Conservation Act*.
URL link:	https://www2.landgate.wa.gov.au/web/guest

Table 11. DEC-managed lands and waters categories

DEC category	No. in WA	No. in the SWAE
5(1)(g) Reserve	59	54
5(1)(h) Reserve	83	47
CALM exec body	2	2
CALM exec body freehold	406	402
Conservation park	60	50
Former leasehold	3	2
Marine management area	2	0
Marine nature reserve	1	0
Marine park	16	7
Miscellaneous reserve	62	54
National park	161	142
Nature reserve	1286	1191
State forest	60	60
Timber reserve	76	76

This created a lock-in dataset (see Box 19.) that covered a range of areas, as shown in Figure 17.

Figure 17. Lock-ins used in the Southwest Australia Ecoregion



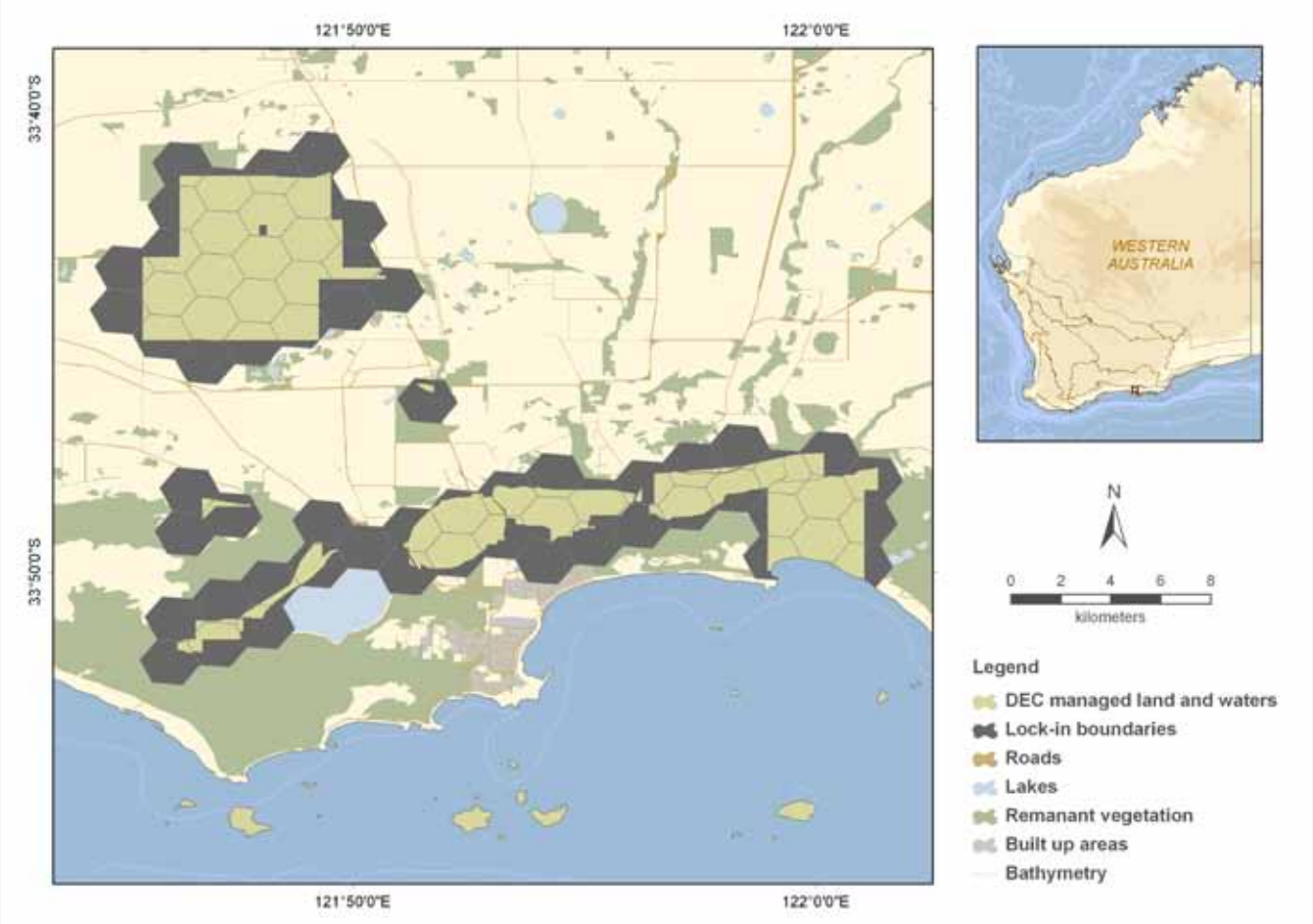
Box 19. Lock-ins dataset used in the analysis

Title:	SWAEI Lock-ins
Custodian:	SWAEI
Scale:	Not given (although based on DEC-managed lands and waters, which, in turn, is based on cadastre data)
Coverage:	Covers the entire SWAEI project area
Ending date:	May 2011
Abstract:	This dataset was created specifically for the SWAEI project as a lock-in layer to be used in the Marxan analysis. It contains a subset of the DEC-managed lands and waters that are classed as strictly for nature conservation.
URL link:	N/A

Applying lock-ins to planning units

In order to finalise the preparation of the lock-ins, the selected areas in the lock-in dataset had to be applied to the planning units. To ensure that all areas of conservation were selected, if any part of the lock-in polygon areas intersected a planning unit, no matter how small that area might be, then the whole planning unit was selected as a lock-in. Figure 18. contains an example of this.

Figure 18. Applying lock-ins to planning units



STEP 9. INTRODUCING A COST LAYER

COST LAYER

Finally, a "suitability" component was included in the analysis. This is where numerical values are identified through a matrix. Although one cost is assigned to each planning unit, several measures can be combined to create a cost metric. In this systematic conservation planning project, the cost layer included three threatening processes (urbanisation, Phytophthora dieback and salinity), land tenure, zoning and uses. These were grouped according to their suitability for conservation management. Numerical values were assigned in the matrix to represent the degree of impediments to likely conservation success. This essentially makes less suitable areas more costly to protect and less likely to be selected.

This process was used to distribute conservation priorities to locations amenable to effective management and long-term persistence of the conservation features. This step defines the current degree of landscape degradation and fragmentation and/or the probability of degradation and fragmentation in the future. It uses spatial data that represents current or future human infrastructure, activity and land-use.

THREATS

Threats not only increase management costs but, additionally, can compromise biodiversity value over time, particularly in the absence of appropriate management regimes. While a range of threats impact the conservation of biodiversity within the SWAE, a set of criteria was used to identify which threats would be included in this project. These criteria included:

- The availability of spatial data demonstrating the extent of the threat;
- The relevance of data at the ecoregion scale; and
- Whether or not the threat was considered regionally significant.

By introducing a "threat layer", solutions were preferentially selected away from planning units that had any of the threats associated with them. Using this criterion, the following threats were used in this project:

- Phytophthora dieback: the extent and range (caused primarily by *Phytophthora cinnamomi*);
- Salinity: high water tables resulting in salt rising to the soil surface; and
- Urbanisation: the impact of human habitation and related activities.

Phytophthora dieback

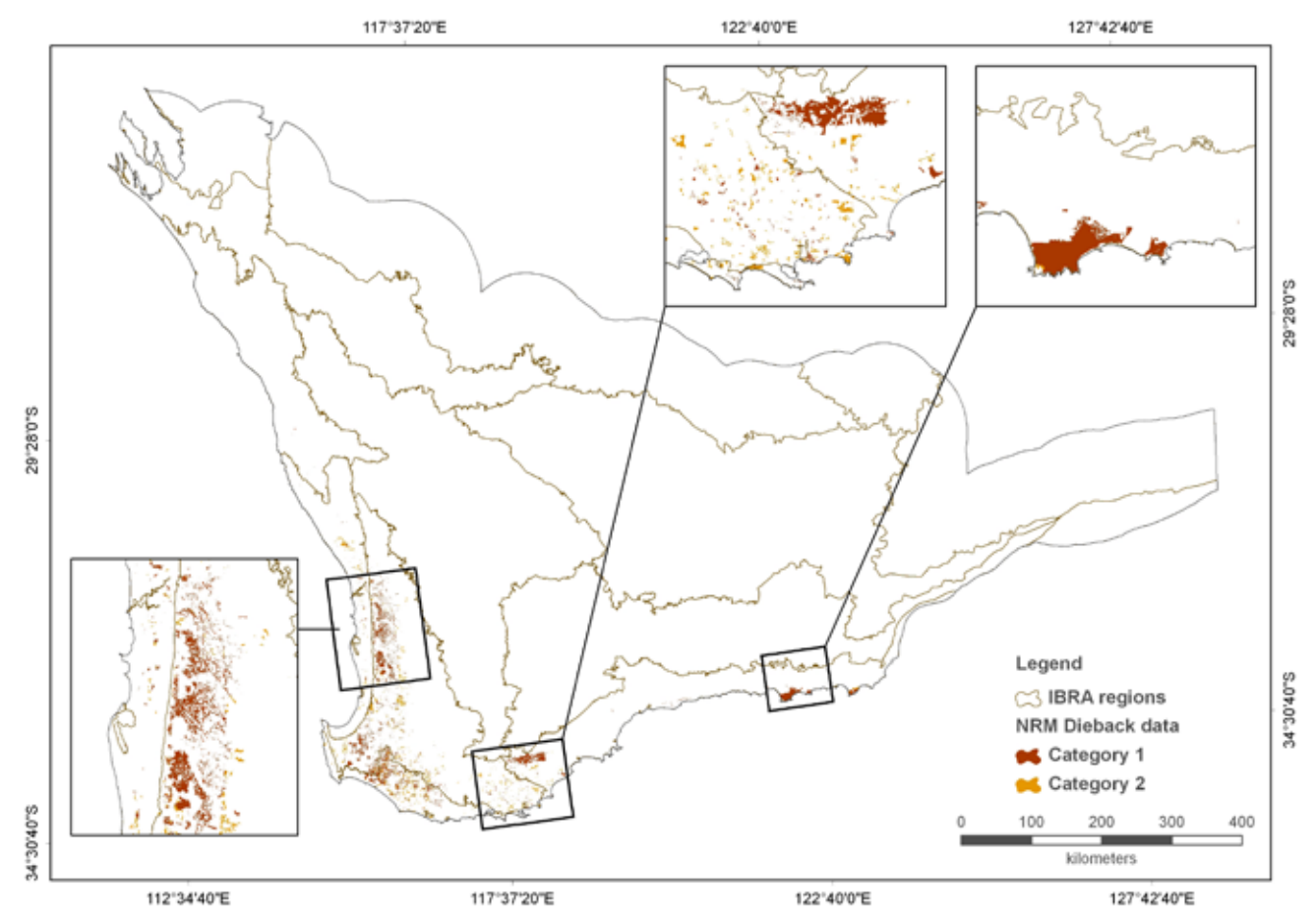
Phytophthora dieback is an introduced plant disease caused primarily by the pathogen *Phytophthora cinnamomi*. Nearly half of Western Australia's plant life is threatened by Phytophthora dieback and over half of the State's rare or endangered plant life is at risk (Dieback Working Group, 2011).

A number of datasets showing the extent of Phytophthora dieback were sourced from South Coast NRM Inc (see Box 20.), who are the custodians of this data. As noted in the metadata for these datasets, this data was initially compiled in the 1970s from aerial photography and some ground-truthing. The datasets have been subsequently updated and revised using updated photography and additional ground-truthing. However, the metadata statement does make reference to the fact that infestations may be underestimated in areas that have not been resurveyed recently. Figure 19. provides an overview of this data.

Box 20. Phytophthora dieback datasets used in the analysis

Title:	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Northern Agricultural NRM Region
Custodian:	South Coast NRM Inc
Scale:	1:4,500; 1:20,000; 1:25,000 and 1:100,000
Coverage:	Northern Agricultural NRM Region
Ending date:	November 2008
Abstract:	Project Dieback is a Natural Resource Management (NRM) initiative that gets community, government and industry working together to take on this challenge.
URL link:	http://www.dieback.net.au/
Title:	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, South Coast NRM Region
Custodian:	South Coast NRM Inc
Scale:	1:4,500; 1:20,000; 1:25,000 and 1:100,000
Coverage:	South Coast NRM Region
Ending date:	November 2008
Abstract:	Project Dieback is a Natural Resource Management (NRM) initiative that gets community, government and industry working together to take on this challenge.
URL link:	http://www.dieback.net.au/
Title:	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Southwest NRM Region
Custodian:	South Coast NRM Inc
Scale:	1:4,500; 1:20,000; 1:25,000 and 1:100,000
Coverage:	South-west NRM Region
Ending date:	November 2008
Abstract:	Project Dieback is a Natural Resource Management (NRM) initiative that gets community, government and industry working together to take on this challenge.
URL link:	http://www.dieback.net.au/
Title:	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Swan and Avon NRM Regions
Custodian:	South Coast NRM Inc
Scale:	1:4,500; 1:20,000; 1:25,000 and 1:100,000
Coverage:	Swan and Avon NRM Regions
Ending date:	November 2008
Abstract:	Project Dieback is a Natural Resource Management (NRM) initiative that gets community, government and industry working together to take on this challenge.
URL link:	http://www.dieback.net.au/

Figure 19. Phytophthora dieback datasets used in the threat analysis



Once these component datasets were amalgamated, it was possible to separate areas possibly affected by Phytophthora dieback based on the nine different categories in the data. Using expert advice, it was decided that categories 1 and 2 were considered the most suitable for inclusion in this analysis. Those areas considered both "infested high confidence" and "infested medium confidence" were geographically demarcated by the combined datasets, which are defined as:

- **Category 1: Infested High Confidence**
  - Degraded vegetation;
  - trong pattern evident;
  - Chronology of deaths;
  - Positive sample recovered and/or previously interpreted as infested;
  - High concentration of vectors in the vicinity; and
  - Polygon can be as small as 5 hectares.
- **Category 2: Infested Medium Confidence**
  - Increased water migration;
  - Presence of vectors and/or disturbance;
  - Some canopy reduction;
  - Previously interpreted as suspect; and
  - Medium concentration of vectors in the vicinity.

Salinity

Salinity, caused by the clearing of native vegetation for agriculture or other activities, is considered to be a significant threat to biodiversity in the SWAE. Western Australia has the largest area of dryland salinity in Australia and the highest risk of increased salinity in the next 50 years. An estimated 4.3 million hectares (16%) of the south-west region has high potential for developing salinity from shallow water tables. This is predicted to rise to 8.8 million hectares (33%) by 2050 (EPA, 2007).

In order to map this threat, two datasets were sourced for the project, as shown in Box 21. The Land Monitor project provided two salinity datasets: New Salt Mosaic and Old Salt Mosaic. The Old Salt Mosaic dataset was extracted from satellite imagery taken between 1988 and 1991 and the New Salt Mosaic dataset from 1991 to 1998. As the New Salt Mosaic dataset is considered a supplementary dataset to the Old Salt Mosaic dataset, both were included in the analysis (Vogwill, R., pers. comm, 2010).

Box 21. Salinity datasets used in the analysis

Title:	New Salt Mosaic Zone 50 and 51
Custodian:	Department of Environment and Conservation (Land Monitor)
Scale:	1:50,000
Coverage:	South-west Australia
Ending date:	1998
Abstract:	Additional mapping and monitoring from Old Salt Mosaic from 1991 to 1998.
URL link:	http://www.landmonitor.wa.gov.au/
Title:	Old Salt Mosaic Zone 50 and 51
Custodian:	Department of Environment and Conservation (Land Monitor)
Scale:	1:50,000
Coverage:	South-west Australia
Ending date:	1991
Abstract:	The Land Monitor project is a part of the Western Australian Salinity Action Plan and is supported by the Natural Heritage Trust. The project originally aimed to systematically monitor salt-affected land and remnant vegetation change over the agricultural area of south-western Western Australia. Its objectives were to map and monitor changes in the area of salt-affected land from 1988 to 1991.
URL link:	http://www.landmonitor.wa.gov.au/

The Land Monitor salinity dataset was compiled using satellite imagery collected over 10 years in the height of the "growing season". Automated processing was applied annually to each image to ascertain areas showing constant "low production", such as dams, degraded land and low pasture growth (Caccetta *et al.*, 2000). Local government completed further ground-truthing to determine the accuracy of outputs.

As this process uses a surrogate of "low production" to determine areas of salinity, consistently bare landscapes such as water-logged areas may be incorrectly classified as having salinity problems and there may be naturally saline areas that are not taken into account. Although naturally saline landscapes are areas of unique and rare biodiversity (and ultimately should be conserved), there is currently no dataset that accurately shows where these areas are located (Vogwill, R., pers. comm, 2010).

Figure 20. shows the combined salinity threat dataset.

In addition to the Old and New Salt Mosaic datasets, Land Monitor also produces a Predicted Salinity dataset. This data is derived from height data, ground-truthing and existing datasets and states areas at risk from developing high water tables. It covers most of the Wheatbelt area and usually follows waterways. As the process followed for this dataset differs to the Old and New Salt Mosaic datasets, the two do not necessarily match when comparing outputs.

As predictive modelling was not used for the other threats, it was decided to exclude this dataset from the analysis. Predictive modelling also introduces an element of uncertainty.

Urbanisation

The final threat included in the project was urbanisation, to represent the effect of human habitation on the environment. Although this category is broad, the purpose of including this layer as a threat was to move selected areas away from:

- Areas that have been zoned as urban, urban-deferred or industrial, as they are likely to be cleared or will be in the future;
- Land that may be more expensive to acquire; and
- Areas that may have many management issues associated with human population. For example, the number of introduced plants and animals, altered fire regimes, roads, traffic or infrastructure.

In the 2009 SWAEI project, urbanisation was represented using three approaches:

- A Geoscience Australia dataset for all areas outside of the Perth metropolitan region, called built-up area boundaries;
- Local government boundaries for all Perth metropolitan suburbs; and
- A Geoscience Australia "roads" dataset (not including tracks) with a 5 m buffer either side. This dataset is digitised at 1:250,000 and covers the whole of Australia. It includes classifications from "primary road" down to "unsealed tracks" but although there is significant coverage of regional roads, the detail in town centres is limited. This dataset is shown in Figure 21.

Figure 20. Salinity threat dataset

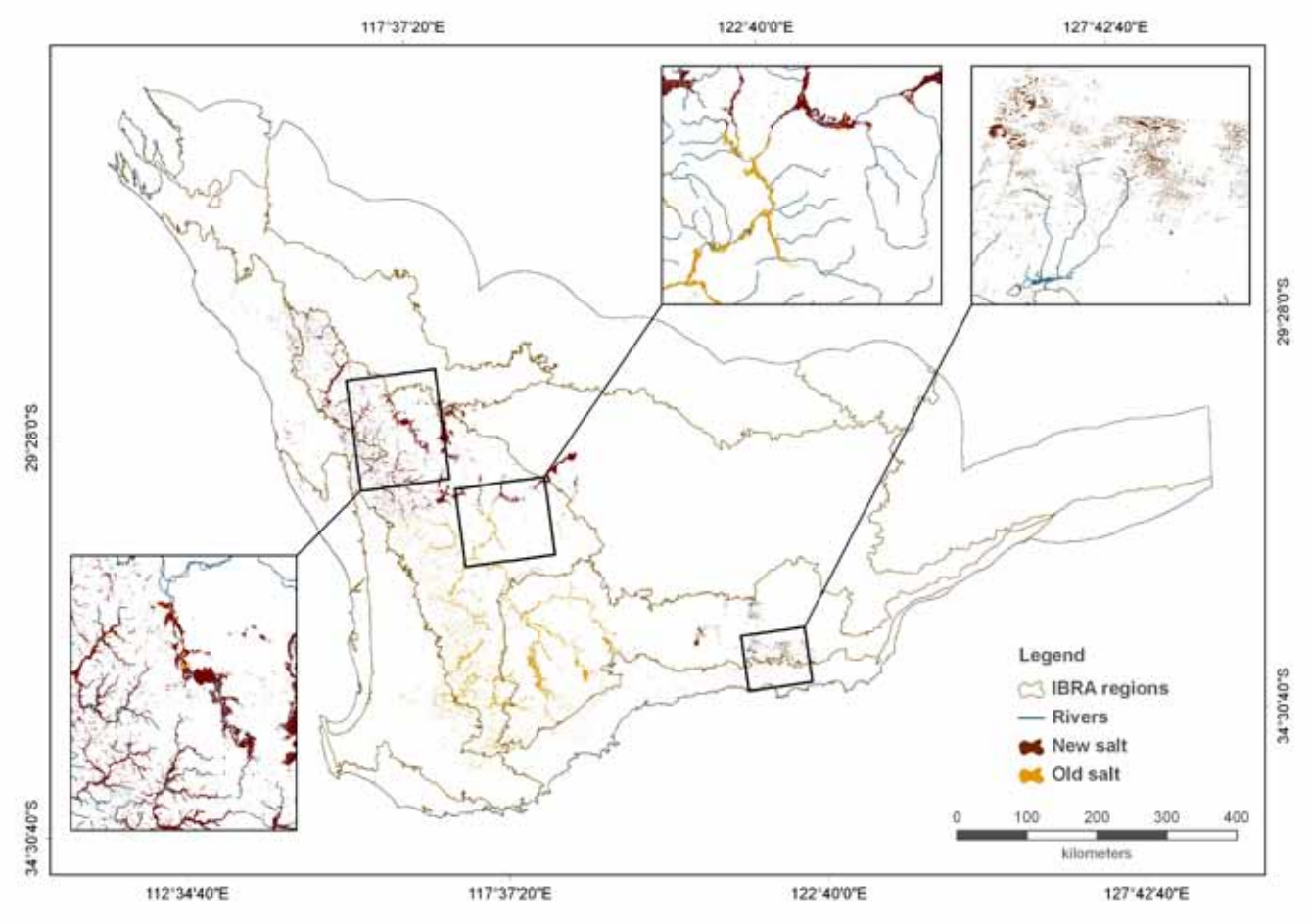
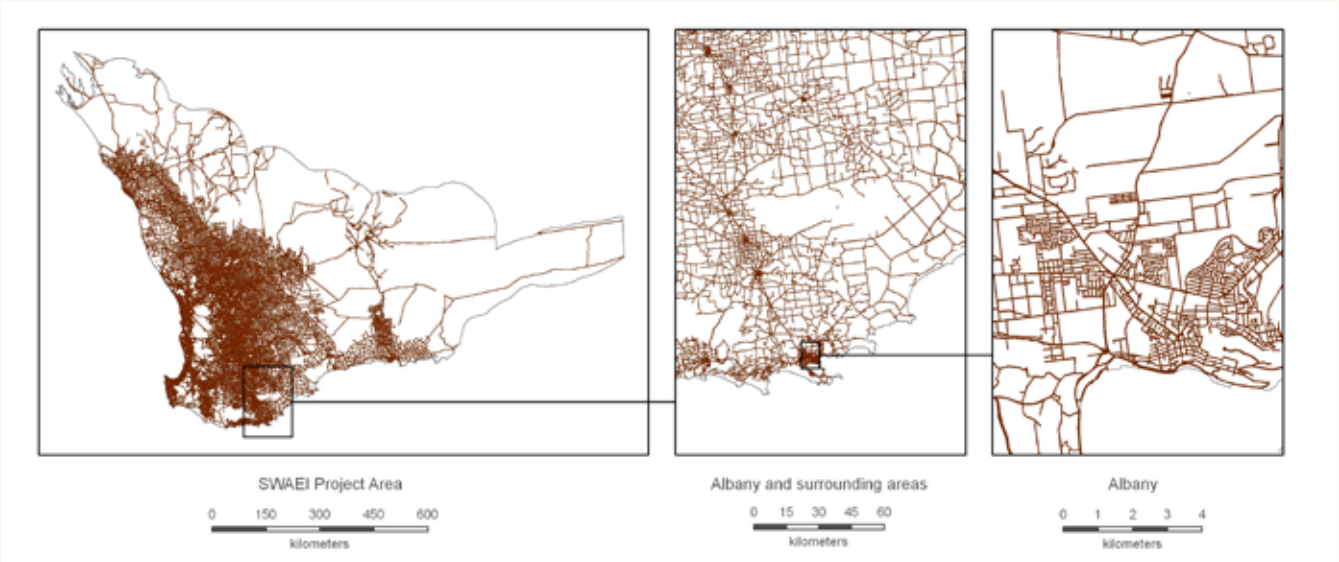


Figure 21. Geoscience Australia roads dataset used in the 2009 analysis

This approach was modified to use cadastre data to better represent roads. This data more accurately defines road width and location, especially in more urban areas. This dataset is shown in Figure 22

Figure 22. Geoscience Australia roads dataset



The Department of Planning's Regional Planning Schemes and Local Government Planning Schemes were identified as being the most suitable data for determining areas of high population. Any areas that were identified as part of the three Regional Planning Schemes relevant in the south-west of Australia (Greater Bunbury Regional Scheme (GBRS), Peel Regional Scheme (PRS) and Perth Metropolitan Regional Scheme (PMRS)) and met the following classification were extracted as surrogates for high population areas:

- Urban – areas in which a range of activities are undertaken, including residential, commercial, recreational and light industry;
- Urban-deferred – land identified for future urban uses following the extension of urban services, the progressive development of adjacent urban areas, and resolution of any environmental and planning requirements relating to development; and
- Industry – land in which manufacturing, processing, warehousing and related activities are undertaken.To identify major town sites outside of the Regional Planning Schemes, two Local Government Planning Schemes (Avon Land Use Plan and the Esperance Structure Plan) were used.

Although using local government planning data exclusively to determine urban boundaries is ideal, this was not possible due to the large number of local governments in the project area (126), the difficulty in obtaining data in a readily usable format and the time needed to process this data.

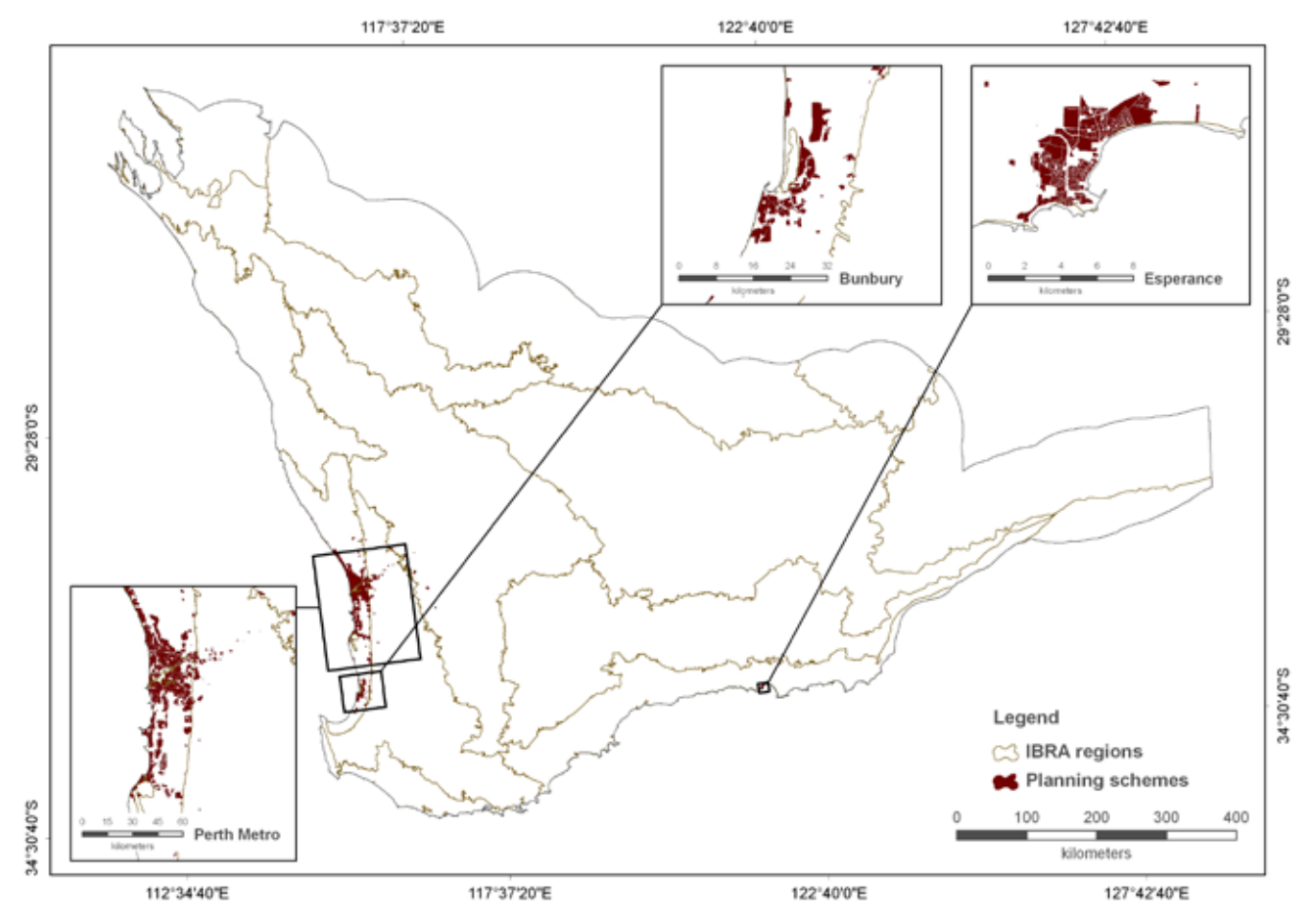
As with the Regional Planning Schemes, a number of categories were used to extract "urban" defined areas from the Local Government Planning Schemes. For the Avon Land Use Plan that included "urban settlements" and "industry", and for the Esperance Structure Plan this included "urban – existing and future" and "light/general industry – existing and future".

Once these datasets were amalgamated, this created the dataset shown in Figure 23.

Smaller town sites not covered by the Regional Planning Schemes or Local Government Planning Schemes were captured using the Landgate Cadastral "Public Roads" data. This is based on the presumption that the higher the road density, the higher the population.

Box 22. contains a full list of the datasets used in the compilation of the urbanisation threat layer.

Figure 23. Urbanisation threat dataset



Box 22. Urbanisation datasets used in the analysis

Title:	Spatial Cadastral Database
Custodian:	Landgate (Department of Land Information)
Scale:	Survey accuracy
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	The SCDB is an integrated database comprising a number of layers of digital spatial data, defining all crown and freehold land parcels within Western Australia.
URL link:	http://www.landgate.wa.gov.au/corporate.nsf/web/ Spatial+Cadastral+Database
Title:	Metro Regional Scheme
Custodian:	Department of Planning and Infrastructure
Scale:	1:500
Coverage:	Perth Metro Area
Ending date:	Continual
Abstract:	The Metropolitan Region Scheme (MRS) is a large town planning scheme for land use in the Perth metropolitan area. The MRS defines the future use of land, dividing it into broad zones and reservations. It requires local government town planning schemes to provide detailed plans for their part of the region.
URL link:	http://www.planning.wa.gov.au/ The+planning+system/Region+schemes/default.aspx

Title:	Peel Regional Scheme
Custodian:	Department of Planning and Infrastructure
Scale:	Not given
Coverage:	Peel Area
Ending date:	April 2003
Abstract:	The Peel Region Scheme (PRS) is a large town planning scheme that guides land use in the Peel Region. The PRS defines the future use of land, dividing it into broad zones and reservations. It requires local government town planning schemes to provide detailed plans for their respective parts of the region.
URL link:	http://www.planning.wa.gov.au/ The+planning+system/Region+schemes/default.aspx
Title:	Greater Bunbury Regional Scheme
Custodian:	Department of Planning and Infrastructure
Scale:	1:25,000
Coverage:	Greater Bunbury Area
Ending date:	Continual
Abstract:	The Greater Bunbury Region Scheme (GBRS) is a local planning scheme for land use in the Greater Bunbury region. The GBRS defines the future of land use, dividing it into zones and reservations.
URL link:	http://www.planning.wa.gov.au/ The+planning+system/Region+schemes/default.aspx
Title:	Esperance Structure Plan and Avon Land Use Plan
Custodian:	Department of Planning and Infrastructure
Scale:	Various
Coverage:	Various
Ending date:	Continual
Abstract:	Boundaries based on planning schemes of areas.
URL link:	http://www.planning.wa.gov.au/ The+planning+system/Region+schemes/default.aspx

INCLUDING THREATS IN THE ANALYSIS

Threats were included in the analysis in two ways: they were used at a generic level in the establishment of conservation targets for vegetation, or they were included in the analysis as a "cost" layer. In both cases, the first step was to compile the three threat layers outlined above into a single threat dataset.

Threat data was factored in the vegetation target formula, which calculated when a vegetation type was spatially intersected by one, two or all three threats. Effectively, each of the 889 conservation features for vegetation were intersected separately with the threat datasets to determine if there was an overlap between the vegetation conservation feature and the threat dataset.

Out of a total of 889 stratified vegetation types:

- 50% (446) of vegetation types were affected by salinity;
- 17% (153) of vegetation types were affected by Phytophthora dieback; and
- 80% (718) of vegetation types were affected by urbanisation.

A total of:

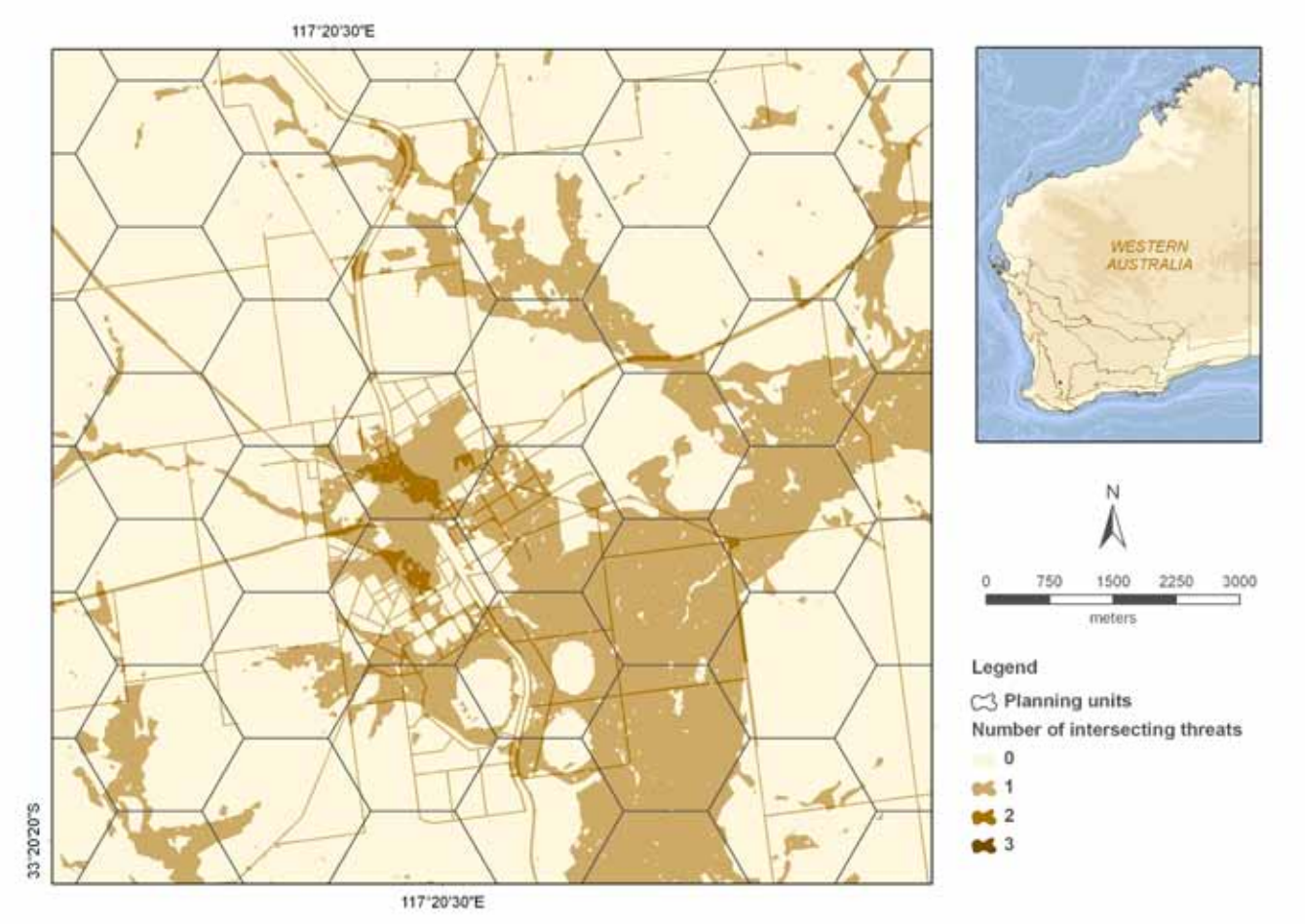
- 14% (131) of vegetation types were not affected by threats;
- 31% (283) of vegetation types were affected by one threat;
- 44% (391) of vegetation types were affected by two threats; and
- 9% (84) of vegetation types were affected by three threats.

In addition to the use of the threat layer in the conservation target-setting for vegetation, it was also used to determine the area (in square kilometres) of intersecting threats within each of the planning units.

Figure 24. provides an example of how this data was intersected.

This amount was then weighted with tenure via a cost matrix value. This result was used as a part of the "cost" layer within Marxan.

Figure 24. Example threat data



LAND CLASSIFICATION

A land-use classification was also included in the cost metric to identify parcels of land considered more favourable for conservation. Areas considered more favourable for conservation, such as covenanted freehold land, or those that may be easier to acquire, such as unallocated crown land, were weighted more favourably than those that are possibly heavily degraded, such as public roads or urban town centres.

The use of tenure or zoning as a weighted matrix in the cost layer required classification of the importance of tenure or zoning type to achieving conservation outcomes. This process also allowed for the preparation of a single consistent dataset. Here we describe how data from a range of datasets (see Box 23. for details) was standardised into this single land classification dataset.

Firstly, the concept of "tenure categories" was produced, which is a classification of tenure and zones into a hierarchy of five different levels of conservation relevance. In order of decreasing favourability for conservation, these categories were:

- Initial reserve;
- Preferred available;
- Available;
- Not preferred available; and
- Not preferred.

Once this core concept was established, workshops were held in 2010 with experts in land-use planning to determine how the different types of tenure and zones should be categorised. One-on-one engagement then occurred to further clarify and refine this decision problem. This resulted in the categorisation of the various tenure and zone types into the broader classifications shown in Table 12.

Table 12. Tenure categories

Tenure category	Tenure type	Attribute classification	Attribute details	Data source
Initial reserve (lock-ins)	Various	Nature conservation reserves	Any IUCN category data	DEC-managed Land and Waters
			Any non-defined IUCN category listed as: "conservation park"; "national park"; "nature reserve"; or "5(1) (h) reserve/5(1) (g) reserve with land use for "conservation" purposes"	
	Crown reserve	Conservation vested reserves	Vested areas with land use for: "conservation"; "open space"; or "national park"	Landgate Cadastre
Preferred available	Freehold	Encumbered freehold: covenants	DEC and National Trust WA covenant boundaries	DEC covenants National Trust WA covenants
	Crown reserve	All other DEC-managed land	All other DEC-managed land that includes: "executive body leasehold"; "miscellaneous reserve"; "executive body freehold"; "5(1) (h) reserve/5(1) (g) reserve with land use for "conservation" purposes"; or "formal leasehold (UCL – former leasehold proposed for conservation)"	DEC-managed Land and Waters
	Crown lease	All other DEC-managed land	All other DEC-managed land that includes: "executive body leasehold"; "miscellaneous reserve"; "executive body freehold"; "5(1) (h) reserve/5(1) (g) reserve with land use for "conservation" purposes"; or "formal leasehold (UCL – former leasehold proposed for conservation)"	DEC-managed Land and Waters
		DEC, AWC and BHGA pastoral leases	All boundaries	DEC-managed Land and Waters AWC boundaries BH boundaries
	Water reserves	Any areas vested by DOW	Any water reserves vested by the: Water and Rivers Commission; Waterway Commission; or Minister for Water Affairs	Landgate Cadastre
Available	Freehold	Unencumbered freehold – voluntary agreements	Includes DAFWA soil covenants and LFW boundaries	DAFWA soil covenants LFW boundaries data
	State and timber reserves	All state and timber reserves	Includes leases on state and timber reserves	Landgate Cadastre
	Crown reserve	All vested and non-vested reserves	Excludes conservation vested reserves Includes Aboriginal reserves	Landgate Cadastre
	Unallocated crown land	All unallocated crown land	Includes all other pastoral leases	Landgate Cadastre
	Crown lease	All other crown leases	Excludes all other DEC-managed land and any pastoral leases	Landgate Cadastre
	Water reserves	Includes all other water	Excludes any vested land under DOW or WCORP	Landgate Cadastre
	All other	Covers all land that was not included in the cadastre dataset	Includes any holes and gaps between the cadastre dataset and the SWAEI project area boundary	Landgate Cadastre

Not preferred available	Freehold	Airports	Boundaries extracted out manually (based on Google Maps data)	Landgate Cadastre
		All other freehold land	Excludes covenants or voluntary agreements Excludes urban areas Includes Aboriginal freehold	Landgate Cadastre
	Water reserves	Any areas vested by the Water Corporation	Any water reserves vested by the Water Corporation or the Water Authority of WA	Landgate Cadastre
Not preferred	Freehold	Urban areas	As per specified by the threat layer	See 2.2.7 for details on data
	Public roads	Public roads	Includes all public roads	Landgate Cadastre

It should be noted that:

- Defence land was not included in the analysis due to the sensitivity of determining accurate boundaries;
- No Aboriginal crown lease or freehold lease areas are found within the SWAE (although there are areas vested in the Aboriginal Commission);
- Due to the lack of easily available data, airport boundaries were extracted out manually;
- Biosphere reserves were not considered in this analysis, as technically this is not a type of tenure. The one biosphere currently located in the SWAE (Fitzgerald National Park) is already included in the analysis as a "lock-in"; and
- DEC pastoral leases are also classified as unallocated crown land – former leasehold proposed for conservation.

As a result of this analysis and categorisation, the land classification for the project area is shown in Figure 25. Figure 26. provides a close-up example.

Figure 25. Land classification across the Southwest Australia Ecoregion

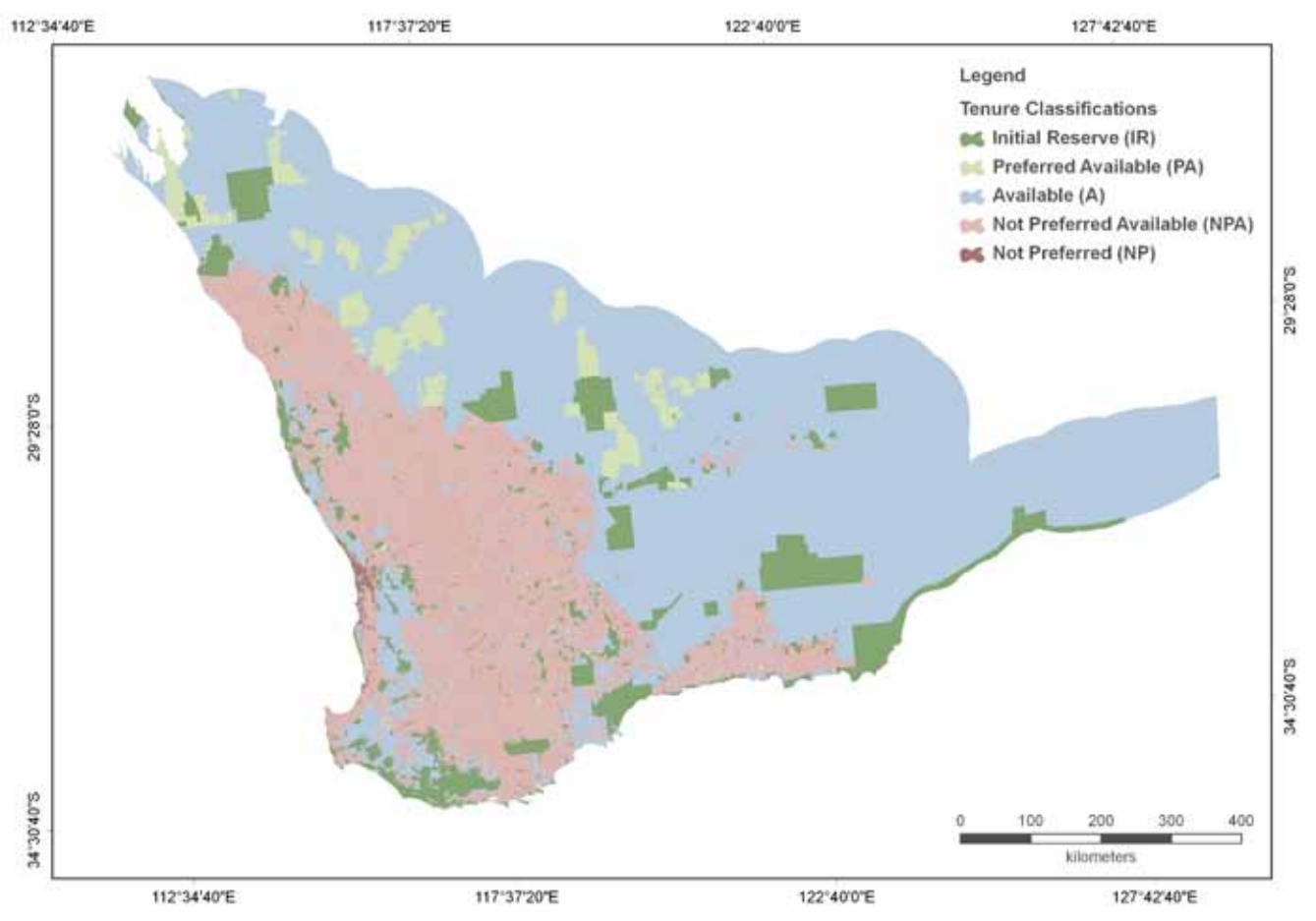


Figure 26. Close-up example of land classification

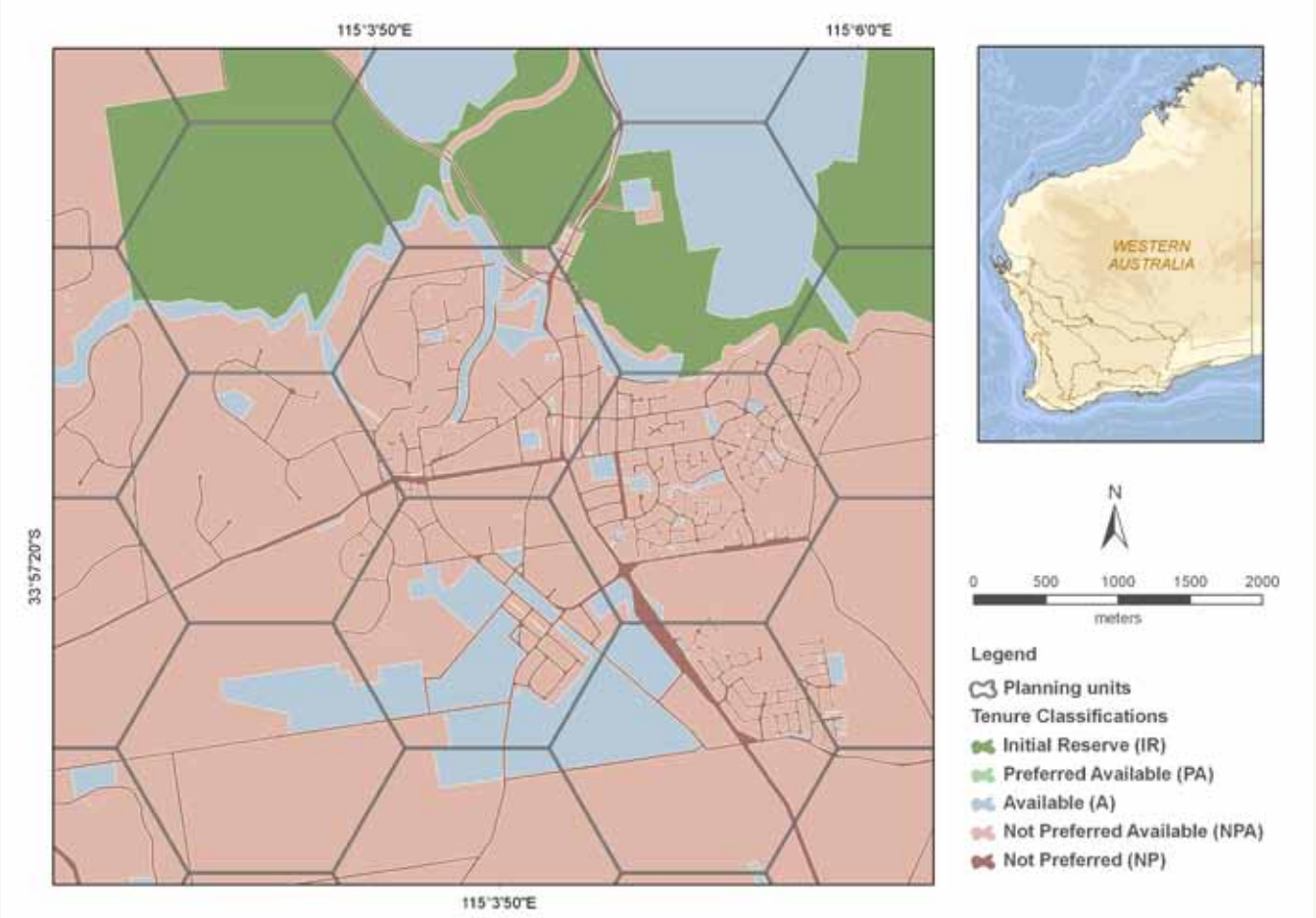


Table 13. includes the size of each tenure classification.

Table 13. Amount of area for each tenure classification in the Southwest Australia Ecoregion

Tenure classification	Area (km²)
Initial reserve	66,059.45
Preferred available	29,805.85
Available	405,431.94
Not preferred available	179,681.27
Not preferred	5,897.24

After the land classifications were determined, the area of each category for each planning unit was calculated. These amounts were then weighted via a cost matrix value (CMV) and combined to produce a final CMV tenure value. This result was then used as a part of the "cost" layer within Marxan.

Box 23. Land classification datasets used in analysis

Title:	Spatial Cadastral Database (SCDB)
Custodian:	Landgate (Department of Land Information)
Scale:	Survey accuracy
Coverage:	Western Australia
Ending date:	Ongoing
Abstract:	The SCDB is an integrated database comprising a number of layers of digital spatial data, defining all crown and freehold land parcels within Western Australia.
URL link:	http://www.landgate.wa.gov.au/corporate.nsf/web/Spatial+Cadastral+Database
Title:	Land and Managed Waters
Custodian:	Department of Environment and Conservation (DEC)
Scale:	Not given (although based on cadastre data)
Coverage:	Western Australia
Ending date:	June 2003
Abstract:	DEC-managed Lands and Waters within Western Australia. This responsibility is vested under the *DEC Act* and *Wildlife Conservation Act*.
URL link:	http://www.dec.wa.gov.au
Title:	Conservation Covenants
Custodian:	Department of Environment and Conservation
Scale:	Not given (polygon data based on cadastre dataset)
Coverage:	Western Australia
Ending date:	August 2008
Abstract:	The nature conservation covenant is a voluntary, legally binding document that has provisions restricting activities that might threaten the land's conservation values.
URL link:	http://www.dec.wa.gov.au/content/view/120/453/
Title:	Conservation Covenants
Custodian:	National Trust Western Australia
Scale:	Not given (point data based on cadastre dataset)
Coverage:	Western Australia
Ending date:	Not given
Abstract:	Nature conservation covenants are voluntary agreements used to protect natural values on private property by restricting potentially damaging activities. Nature conservation covenants provide legal protection in perpetuity.
URL link:	http://www.ntwa.com.au/
Title:	Soil Covenants
Custodian:	Department of Agriculture and Food, Western Australia
Scale:	Not given (point data based on cadastre dataset)
Coverage:	Western Australia
Ending date:	Not given
Abstract:	Boundaries that determine covenants that typically limit clearing and grazing of the native vegetation but may allow uses such as removal of selected timber and seed collection.
URL link:	http://www.agric.wa.gov.au/PC_93234.html

Title:	Land for Wildlife
Custodian:	Department of Environment and Conservation
Scale:	Not given (although based on cadastre data)
Coverage:	Western Australia
Ending date:	November 2008
Abstract:	Land for Wildlife is a voluntary scheme that aims to encourage and assist private landholders in Western Australia to provide habitats for wildlife on their property, even though the property may be managed primarily for other purposes.
URL link:	http://www.dec.wa.gov.au/content/view/118/451/
Title:	Australian Wildlife Conservancy Sanctuaries (AWC)
Custodian:	Australian Wildlife Conservancy
Scale:	Not given (although based on WA CADLITE)
Coverage:	Western Australia
Ending date:	April 2009
Abstract:	The AWC estate incorporates 21 sanctuaries around Australia covering more than 2.5 million hectares. Funded by donations, the AWC acquires land; implements conservation plans; and conducts scientific research and education programs.
URL link:	http://www.australianwildlife.org/AWC-Sanctuaries.aspx
Title:	Bush Heritage and Greening Australia Boundaries
Custodian:	Gondwana Link
Scale:	Not given (although based on cadastre data)
Coverage:	South-western Western Australia
Ending date:	May 2009
Abstract:	Gondwana Link aims to reconnect the larger fragments all the way from the wet forests of the south to the semi-arid woodlands near Kalgoorlie, which will restore a great arc of bushland and protected areas that will once again enable the free movement of species.
URL link:	http://tinyurl.com/689xn57

Table 14. Cost matrix used to create cost layer in analysis

		Threats	No threats	One threat	+ Two threats	+ Three threats
	Example			+ Salinity	++ Dieback	+++ Urbanisation
Tenure		VALUES	0	0.3	0.6	0.9
Initial reserves	Conservation reserve	0	1.5	0	0	0
Available	Encumbered freehold (covenant)	0	0	0.3	0.6	0.9
Preferred available	State forest, water reserve	0.2	0.2	0.5	0.8	1.1
Not preferred available	Unencumbered freehold land	0.5	0.5	0.8	1.1	1.4
Not preferred	Roads	1.5	1.5	1.5	1.5	1.5

ASSIGNING COSTS

Marxan uses a "cost" value as a penalty weighting applied to planning units that are selected within each run. The larger the cost amount for each individual solution (sum of the costs for all the planning units within a specific solution), the higher the penalty associated with that solution and the more likely that Marxan will select other planning units to find a better solution in subsequent runs. The "cost" value is found within the pu.dat file in Marxan.

In this systematic conservation planning project, we used a combination of three threats (salinity, Phytophthora dieback and urbanisation), with tenure classification as the cost layer. A weighting matrix was created to enable the combination of these two very different approaches in assigning a cost layer. This matrix is illustrated in Table 14.

Banksia menziesii (Chittering)

Table 15. Cost values from the cost matrix

Type	Weighting
Initial reserves	
With no threats	0.0
With one threat	0.0
With two threats	0.0
With three threats	0.0
Preferred available	
With no threats	0.0
With one threat	0.3
With two threats	0.6
With three threats	0.9
Available	
With no threats	0.2
With one threat	0.5
With two threats	0.8
With three threats	1.1
Not preferred available	
With no threats	0.5
With one threat	0.8
With two threats	1.1
With three threats	1.4
Not preferred	
With no threats	1.5
With one threat	1.5
With two threats	1.5
With three threats	1.5

Addressing multiple threats and land classifications in planning units

It is unlikely that a single value for threat or land classification category will cover a complete planning unit. It is more likely that a planning unit may include more than one type of tenure, or a variety of different threats. To take this into account, areas of each of the threats and tenure categories were used to scale the cost for each of the planning units. For example, if a planning unit has been classified as "available" and also includes two types of "threat", then the cost weighting applied to that planning unit would be 0.8. The cost values need to be above 1 to give Marxan a positive gearing, so all cost values were adjusted accordingly. A working example of this is provided in Figure 27 and Box 24 shows the results of this analysis.

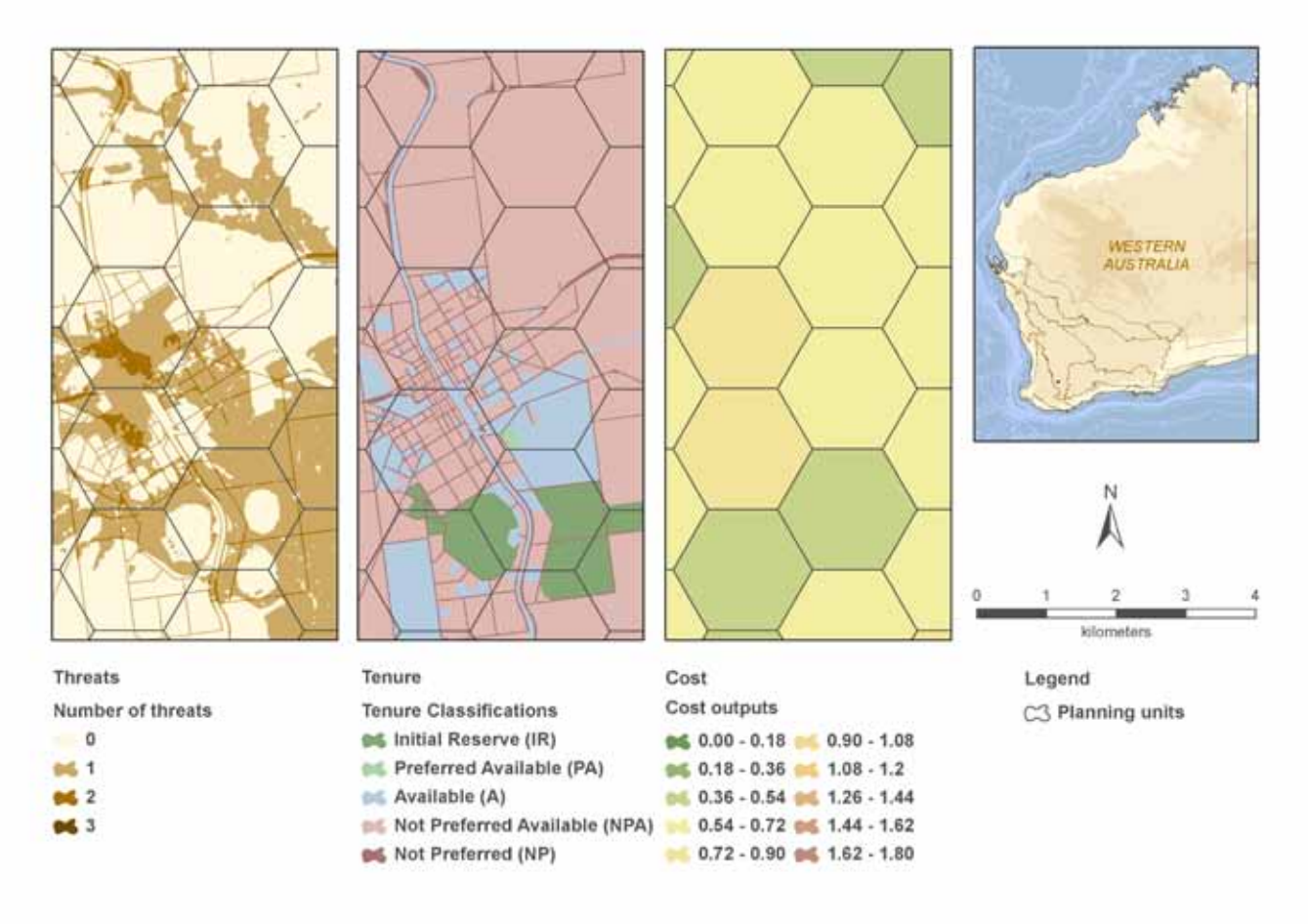
Box 24. Example of applying the cost matrix value to a planning unit

Planning unit ID:	**Planning unit X**	
Planning unit area:	**Total area 2.56 km²**	
Threats in planning unit X:	**Two types of intersecting threat (excluding 0 threats)**	
Tenure in planning unit X:	**Four types of tenure**	
STEP 1: WORK OUT THE THREATS WEIGHTING FOR PLANNING UNIT X		
1. Work out the proportion of intersecting threat per planning unit X (in km²)		
0 intersecting threats	30%	0.77 km²
1 intersecting threat	60%	1.53 km²
2 intersecting threats	10%	0.26 km²
3 intersecting threats	0%	0.00 km²
2. Multiply the proportion of threat by the cost matrix weighting (CMW) values (see Table 14.)		
0 intersecting threats	= 0.77 x 0.0	= 0.000
1 intersecting threat	= 1.53 x 0.3	= 0.456
2 intersecting threats	= 0.26 x 0.6	= 0.156
3 intersecting threats	= 0.00 x 0.9	= 0.000
3. Add CMW threat values together		
4. The total CMW threat value in planning unit X is 0.612.		
STEP 2: WORK OUT THE TENURE WEIGHTING FOR PLANNING UNIT X		
5. Work out the proportion of tenure for planning unit X (in km²)		
Initial reserves	0%	0.00 km²
Preferred available	20%	0.51 km²
Available	60%	1.53 km²
Not preferred available	15%	0.38 km²
Not preferred	5%	0.12 km²
6. Multiply the proportion of tenure by the CMW values (see Table 14.)		
Initial reserves	= 0.00 x 0.0	= 0.000
Preferred available	= 0.51 x 0.0	= 0.000
Available	= 1.53 x 0.2	= 0.306
Not preferred available	= 0.38 x 0.5	= 0.190
Not preferred	= 0.12 x 1.5	= 0.180
7. Add CMW tenure values together		
8. The total CMW tenure value in planning unit X is 0.676		

Box 24. Example of applying the cost matrix value to a planning unit (cont)

STEP 3: WORK OUT THE COST VALUE FOR PLANNING UNIT X		
9. Add together the CMV threats value and the CMV tenure value to find the cost value		
CMV threats value + CMV tenure value = cost value		
CMV threats value	0.621	
CMV tenure value	0.676	
Cost value	1.297	
10. The total cost value in planning unit X is 1.297		

Figure 27. Example of cost values applied to planning units



DATA GAPS AND LIMITATIONS IN THE ANALYSIS

A pervasive limitation of conservation planning is access to appropriate data. While this project used the best data available, there are and always will be gaps in the comprehensiveness and consistency of data across the ecoregion. The absence of data should not preclude this type of analysis, although users should be conscious of the related constraints on conservation planning. Where planning units have not been selected, we are not suggesting that there are no biodiversity values in those areas. The data gaps and other limitations are outlined below.

Conservation features

The conservation features selected are a representation of biodiversity, not a complete inventory of all biodiversity assets and processes across the ecoregion. Hence, they do not represent all important aspects of biodiversity that might need to be managed in any particular area.

A number of conservation features were suggested and considered of interest during the analysis, however, it was not possible to include them due to time and budgetary constraints if no electronic spatial data was available.

Flora species

With more than 2,000 flora species on the endangered and threatened lists, it was agreed that this volume would not allow the objective of being able to prioritise areas. At the ecoregion scale, there are simply too many to provide a good solution for the analysis. This number was subsequently reduced, based on expert advice, to identify those species that are representative both in form, morphology, representation of other species or sub-species and coverage across the ecoregion.

First order streams and sub-catchments

First order streams are where the source of the river first flows and the sub-catchment is the land in which this water drains. Experts suggested the inclusion of first order stream sub-catchments as a surrogate for protecting and maintaining the health of rivers and waterways, however, there is no dataset that shows their location. The Department of Water has a dataset that shows over 2,786 sub-catchments in the project area as well as a rivers dataset that contains no order ranking. First order stream sub-catchments were therefore not used in the analysis, because creation of the required dataset from the existing data was beyond the resources and timeframe available.

Naturally saline water bodies

Naturally saline water bodies contain a variety of unique and rare flora and fauna. Currently, there is no dataset that shows the extent of these areas over the whole of the project area. Naturally saline water bodies were therefore excluded from the analysis.

Palaeochannels

Palaeochannels are old river systems that are filled with sedimentary soils that differ from the current riverbed systems. Currently, there is no dataset that indicates these areas over the whole of the project area. Although palaeochannel data can be derived from the DEC Wetlands of the Wheatbelt dataset, this data was already used to indicate water bodies within the project area. Palaeochannels were therefore excluded from the analysis to avoid replication of multiple conservation features.

Groundwater dependent ecosystems

Groundwater dependant ecosystems are a modelled concept involving groundwater contours and specific ecosystems (such as vegetation or water bodies) that rely on them. They were excluded from the analysis due to the lack of comprehensive datasets currently available within the project area.

Targets

The targets set for conservation features were determined at the scale of the region and, consequently, do not reflect local priorities. For example, some of the insectivorous woodland bird species that are fast disappearing in some of the landscapes across the SWAE, such as in the Perth metropolitan region, remain relatively common elsewhere. The ecoregion-scale targets were therefore lower in percentage terms than might be needed in the smaller region around Perth. In a local-scale planning process, these targets would be re-evaluated to make them more relevant to particular parts of the ecoregion.

Although Marxan aims to meet all the targets set for the conservation features, sometimes this is not possible because of:

- The distribution of data;
- The size of data; and
- Using high targets against a compact BLM.

In this analysis, targets for a small proportion (6%) of conservation features were not fully achieved. Nonetheless, targets for 1,307 of the 1,391 (94%) conservation features were met through this process. This is well within the bounds of acceptable outputs and is discussed further in the results section.

Threats

The systematic conservation planning process cannot define every source of threat to every identified conservation feature. More in-depth information on threats should be collected and analysed when working on specific conservation projects. The planning process used in this project should be considered as an initial evaluation of the threats to biodiversity and not the ultimate one.

Some data provided for local planning schemes could not be used because of problems with:

1. Data format;
2. Data availability; and
3. Data attribute standards.

Climate change

Methods for incorporating climate change into the project have not been included, although there are approaches to doing this. Most of these approaches are based on modelling the prediction of shifts in species ranges and were considered too general for this project. Overcoming differences among model predictions and discrepancies between predicted fundamental and actual realised niches usually requires detailed data on species migration rates, inter-species interactions and rates of adaptation (Iwamura *et al.*, 2010). The value of conservation prioritisation based on future species ranges remains limited by our ability to compile and analyse this data for thousands of species over large spatial scales. Furthermore, there are no immediate or practical actions that can be taken to guarantee the security of biodiversity in the SWAE from the impacts of climate change, and the impacts of climate change remain uncertain. While there are challenges inherent in including climate change in the analysis, we have addressed this to a certain extent by including a range of environmental gradients, a representation of processes and environmental surrogates in the analysis.

Limitations with Marxan

According to Ardron, *et al.* (2010), the main limitations of Marxan can be divided into analytical and operational issues. There are three main analytical limitations. The first is an inability to easily integrate stochastic data, as the data used is a snapshot in time or a collection of various snapshots. Secondly, planning units are either in or out of the reserve solution and, thirdly, while different costs can be included in the cost layer, they must be combined outside of Marxan and included as a single cost surface.

Ardron *et al.* (2010) also points out several operational limitations. Firstly, the quality of data will influence the quality of solutions. Secondly, the terminology can be confusing. Thirdly, the outputs can be misinterpreted and the outputs misused. Fourthly, it is important to remember that Marxan is a decision support tool, not a decision-making tool and, while undertaking a systematic conservation planning process or Marxan analysis can aid stakeholder engagement and discussion, it is not a panacea for participation or acceptance of the planning process. Fifthly, undertaking this process does not address pre-existing stakeholder or political conflicts. Finally, preparing datasets and input files, as well as learning its proper use takes more time than usually anticipated.

Lambertia inermis (Chittick)

STEP 10. RUNNING SCENARIOS

This section details how the Marxan analyses were run within Zonae Cogito and includes the:

- *Input parameters that were applied to the analysis;*
- *Four different scenarios; and*
- *Calibration for each of these scenarios for both the Boundary Length Modifier (BLM) and the Species Penalty Factor (SPF) to fine-tune the solution.*

INPUT PARAMETERS

The outputs produced by Marxan can be considered either "feasible" solutions, where all conservation targets have been met, or "non-feasible" solutions, where the conservation targets have not been met (Ardron, *et al.*, 2010). Marxan allows the user to adjust a SPF to encourage targets to be met within pre-specified constraints.

Another consideration is in regard to "reserve design", or how the compactness of prioritised areas are selected. Modern ecological science reliably informs us that the retention of large contiguous or connected areas that sustain natural ecological processes is important and small areas of habitat may support fewer species and have less persistence of species than large areas of the same habitat. The Single Large or Several Small (SLOSS) theory is where reserve designs can either include a single large area, or a number of small areas to achieve biodiversity conservation, depending on the spatial distribution and home range of the biota (Etienne and Heesterbeek, 2000; Ovaskainen and Hanski, 2001, 2002). To provide greater flexibility with reserve design, Marxan allows the user to adjust another parameter called the Boundary Length Modifier (BLM).

Understanding how Marxan responds to a range of these parameters (e.g.,the BLM, the cost layer and SPF) takes time and experimentation. The analysis presented in this report has been built on work undertaken in the first phase of this project. Performing sensitivity analyses that tested the influence of these input parameters on Marxan outputs was an important step. This is because changes to the input parameters can substantially modify the outputs; consequently, involving expertise to assist with the interpretation of the results has also been an important element.

A standard range of input settings were used in this project for all four scenarios. Table 16. lists the parameters that were used for input.dat file, which controls these parameters in the Marxan analysis.

Boundary Length Modifier (BLM)

Calibrating the BLM allows the user to place greater or lesser emphasis on the compactness of the reserve system when compared to its cost. This can result in either a single large or several small prioritised areas. Marxan does not directly incorporate connectivity, however, by adjusting the BLM, the user can create some forms connectivity by aggregating or increasing the compactness of the reserve solutions (Ardron, *et al.*, 2010).

Increasing the BLM parameter places more emphasis on the selection of areas that are grouped into compact potential reserves. This means that the solutions provided in any of the different scenarios containing one connected patch of units will have a lower boundary cost than a number of scattered, unconnected units. Increasing the BLM increases the cost of having a fragmented portfolio and reduces fragmentation. Three different BLMs were explored – .625, 100 and 1,000 – in an attempt to minimise the boundary length to area ratio, thus increasing the connectivity or aggregation of the highly prioritised Zones for Conservation Action identified in this project.

Species Penalty Factor (SPF)

The SPF is a user-defined multiplier for the penalty applied to the objective function when a conservation feature target is not met in the current reserve scenario. This is an important parameter, as adjusting the SPF will influence the achievement of good results. If the weighting of the SPF is too high, then Marxan becomes too restricted; if it is too low, then targets set for conservation features may not be achieved in all of the runs. If the SPF values are very small (relative to the BLM) then the "lowest cost" solution could miss achieving several targets, because the cost of selecting additional planning units is greater than the small penalties for missing protection targets. If the SPF values are set very high, this will constrain the simulated annealing algorithm in exploring as many options as possible within the solution process, and may result in Marxan producing fewer different solutions with higher average costs (Ardron *et al.* 2010).

Table 16. Marxan input data parameters

Parameter	Value
Repeat runs	100
BLM	1.875
Input file type	New freeform style
Run options	Simulated annealing with normal iterative improvement
Number of iterations	10,000,000
Temperature decreases	10,000
Adaptive annealing	Yes
Cost threshold	No
Starting prop	0.5

SCENARIOS

In phase 1, eight scenarios were identified and analyses run for each, producing a total of 16 maps (the highest selection frequency combined with lock-ins is considered the best solution). This was an important process to undertake as each scenario can produce varied results, some of which deliver a more realistic output than others. In the second phase, only four scenarios were chosen to represent the final form of the decision problem. All scenarios used the same conservation features and targets but had different constraints included (Table 17.)

Table 17. Four scenarios and parameters

Scenario	Description
Scenario 1 – No constraints	• All conservation features; and • Standard conservation targets
Scenario 2 – Lock-ins included	• All conservation features; • Standard conservation targets; and • Lock-in areas included
Scenario 3 – Cost layer included	• All conservation features; • Standard conservation targets; and • Cost values included (including threats)
Scenario 4 – Lock-ins and cost layer included	• All conservation features; • Standard conservation targets; • Cost values included (including threats); and • Lock-in areas included

CALIBRATION

Adjustments were made to both the BLM and SPF in all four scenarios. An initialising calibration was required by running two small analyses to determine the values to be set for both parameters.

Calibrating the BLM

Ten calibration test runs were performed (Table 18.) to determine a BLM value that produced a solution that selected the least number of planning units (or lowest cost) while still achieving the targets set for the conservation features (as demonstrated in Figure 28.). A BLM value of 1.875, identified for Scenario 4, was subsequently used for all four scenarios.

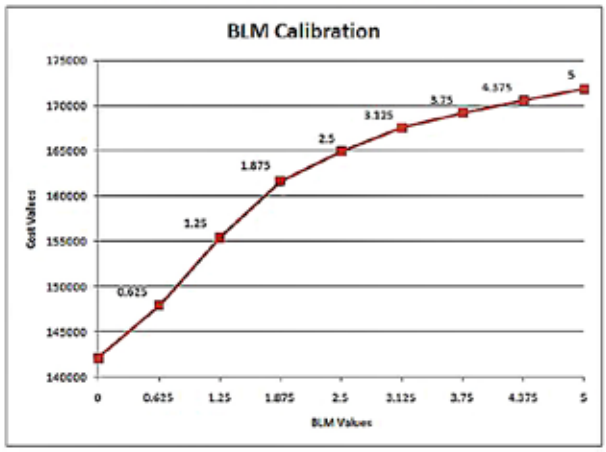
Calibrating the SPF

SPF values of 1, 10, 100 and 1,000 were trialled and plotted against the conservation features that did not fully achieve the targets set (Table 19. and also shown graphically in Figure 29.). An SPF value of 100 was the most efficient parameter that captured the least number of un-met targets for the conservation features. As SPF values higher than 100 did not contribute significantly to the analysis, the value of 100 was used in all four scenarios. It should be noted that after multiple adjustments of the SPF in this analysis, the targets for 6% of conservation features were not fully achieved. This is further discussed in the results.

Table 18. Marxan BLM calibration results for Scenario 4

Test no.	BLM	Cost	Score	Planning units	Boundary length	Penalty	Shortfall	Missing values
1	0	142089.8	142517.6	112458.46	242896.553	427.7826	109915.1	167.38
2	0.625	147903.8	255286.2	116385.97	171661.538	93.96624	100963.6	142.72
3	1.25	155425.7	339390.2	121610.27	147121.092	63.20779	90889.29	132.06
4	**1.875**	**161628.7**	**421321.2**	**125930.16**	**138471.914**	**57.72434**	**82604.79**	**129.21**
5	2.5	164989.7	501318.3	128282.93	134507.596	59.63462	78312.81	127.93
6	3.125	167555.9	582049.6	130087.85	132618.76	60.16786	75083.64	126.99
7	3.75	169238.6	657615.8	131262.58	130217.479	61.62725	72890.61	126.12
8	4.375	170589.7	732560.7	132225.95	128435.322	66.43445	71209.32	124.98
9	5	171826.1	813323.6	133104.08	128286.278	66.11798	69742.54	124.82

Figure 28. Calibration values between cost values and BLM



PREPARING THE OUTPUTS

Once the analyses were run, a range of outputs had to be prepared for final use, most commonly in map products for:

- Summed threats;
- The best solution;
- Selection frequency; and
- A priority index.

These map products were generated from the datasets outlined above. For each output, the underlying datasets were clipped to the best solution for Scenario 4.

In addition, a range of other outputs, including datasets, tables and other figures, were produced during the course of this project. Some general guidance on these outputs is also provided.

Summed threats

The summed threats output was created by taking the amalgamated threat layer that was created from Phytophthora dieback, salinity and urbanisation datasets, and then "clipping" it to the best solution output for the chosen scenario (Scenario 4).

Best solution

Marxan produced two standard outputs. The first was the best solution file, which identifies, out of the specified number of "runs" for each scenario (in this project, each scenario was run 100 times), which produced the solution with the lowest cost according to Marxan's objective function. The best solution output is selected based on the run that has captured as many of the conservation features as possible at the target levels sought with the least number of planning units, or lowest possible cost.

Using the best solution results in a defined boundary which, in turn, gives a clear indication of how many targets were achieved for conservation features within the specified area.

Game and Grantham (2008) recommend exercising caution, as the lowest-cost solution does not, in reality, make the best spatially optimum system that meets all the targets and does not necessarily make the best reserve system. Similarly, the best solution may be only marginally better than the other solutions. Thus, "best" is very narrowly defined and may not be the ideal solution. Rather, it should be seen as indicative of a very good solution, within a continuum of options. A best solution is only considered the best based on the specific set of runs conducted and is not the best possible solution Marxan will ever produce. Figure 30. provides a way of demonstrating this, with the best solution from five run solutions. Selected planning units are shown in green and lock-ins in grey.

Table 19. SPF calibrations for all scenarios and un-met targets for conservation features

Scenario	Number of conservation features with un-met targets for:			
	SPF 1	SPF 10	SPF 100	SPF 1,000
Scenario 1	311	208	**168**	159
Scenario 2	318	228	**187**	188
Scenario 3	76	73	**75**	71
Scenario 4	107	90	**84**	85

Figure 29. Calibration values for un-met targets for conservation features and the SPF value

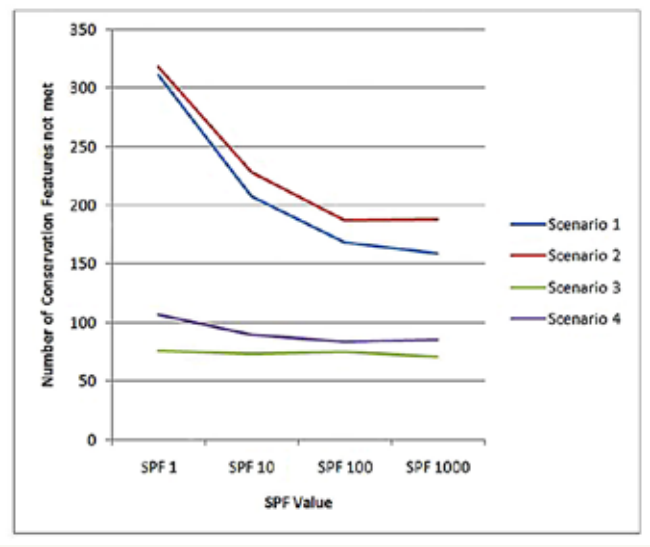
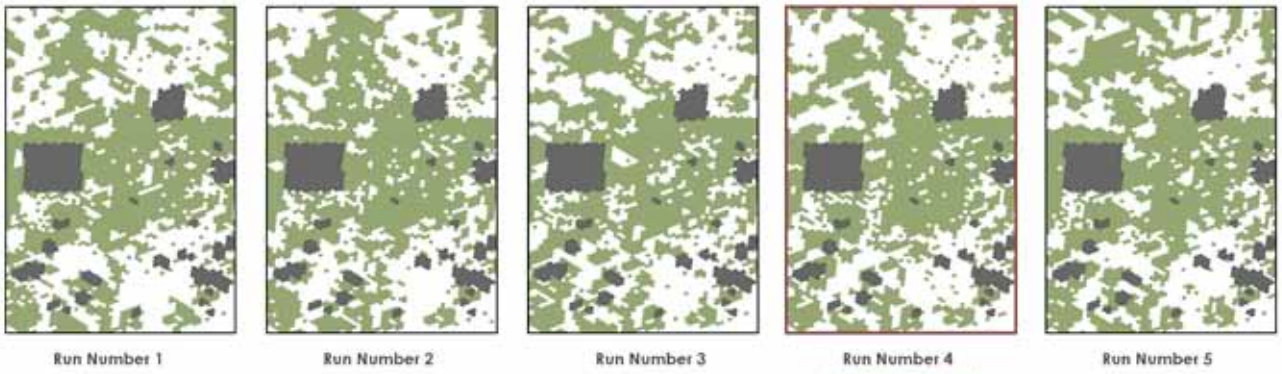


Figure 30. An example of the best solution workings



Run Number	Score	Cost	Planning Units	Boundary Length	Connectivity Total	Connectivity In	Connectivity Edge	Connectivity Out	Connectivity In Fraction	Penalty	Shortfall	Missing Values
1	634085.656	494837	154785	214830.74	922842.63	388996.32	214830.74	319015.57	0.42152	10350.212	78747.025	147
2	636706.744	497115	155364	215262.23	922842.63	390574.53	215262.23	317005.87	0.42323	10434.406	79591.249	148
3	634420.201	493778	155573	217114.54	922842.63	390270.72	217114.54	315457.37	0.422901	10373.477	79234.104	148
4	632647.105	492686	154448	215963.62	922842.63	387286.75	215963.62	319592.26	0.419667	10382.933	78862.837	147
5	637608.139	497264	155673	216282.29	922842.63	390870.96	216282.29	315689.38	0.423551	10574.765	78256.571	144

Selection frequency

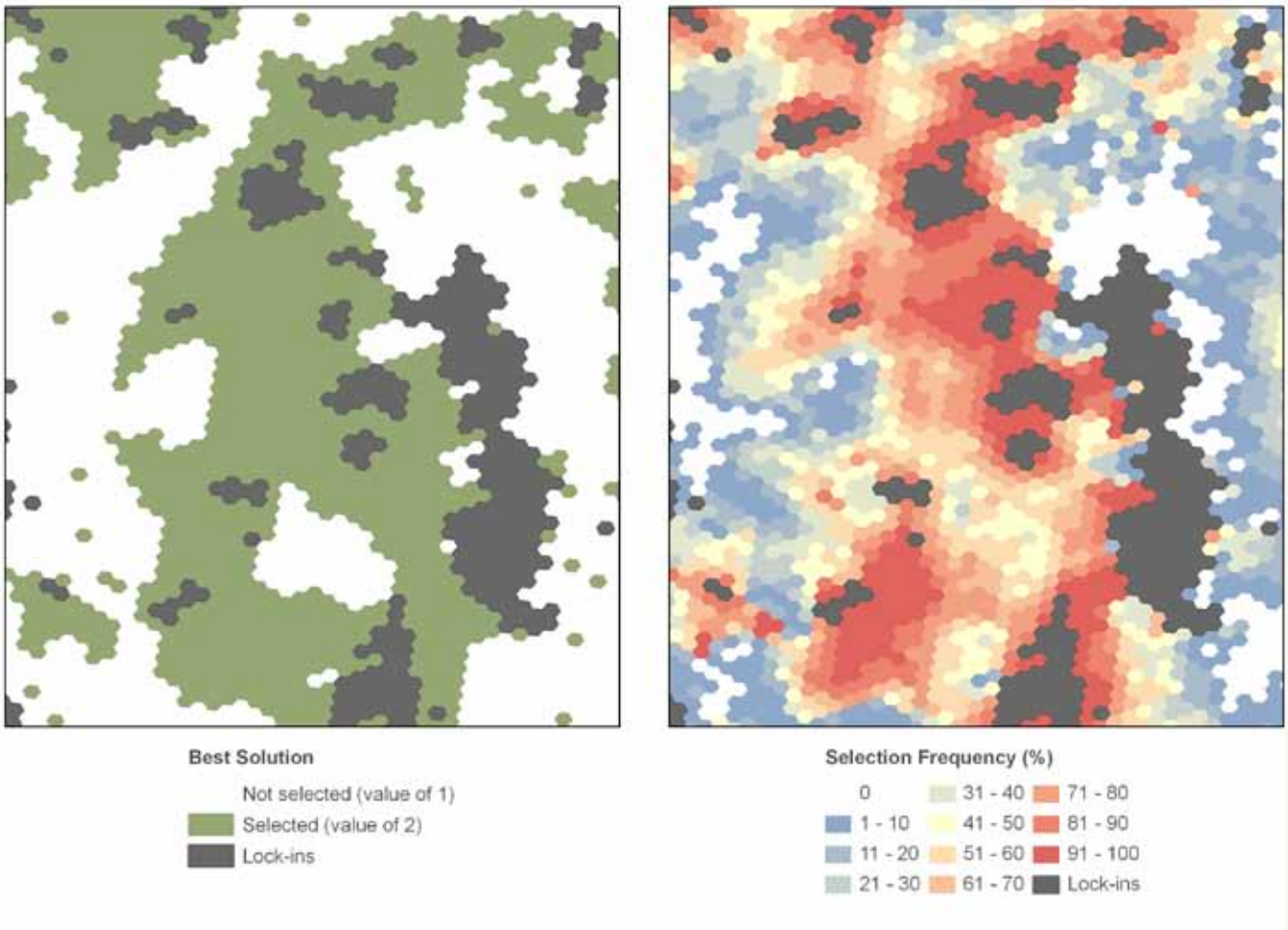
The second map output produced by Marxan summarises how frequently each planning unit has been selected across all the good solutions generated. The selection frequency for a planning unit is a measure of how important that planning unit is to the achievement of the planning objectives for the specific form of the decision problem represented by the specific scenario. Unlike the best solution map outputs, the selection frequency output does not produce a definite boundary for achieving conservation outcomes (as shown in Figure 31.).

The selection frequency value of a planning unit has no intrinsic value outside the specific arrangement of the decision parameters represented in each scenario. Rather, it shows the relative irreplaceability of specific planning units in achieving the conservation targets and the relative importance that can be attached to conservation action in such areas. The selection frequency value of a planning unit in one scenario is therefore not necessarily transferable to another scenario. Planning units are selected less often when there is a range of equally good alternatives and hence more units are considered replaceable.

It is important to note, however, that even the infrequently selected areas are important to achieving the conservation targets and even some of the units of low selection frequency must be included in any plan of conservation action or the conservation targets will not be met. Planning units that become irreplaceable appear in every solution and must be included to achieve the planning objectives.

Zonae Cogito will allow for the different planning units and their selection frequency value to be exported from the system as a spatial dataset, which can then be used for further analysis and interrogation. In this project, the selection frequency dataset was clipped to the best solution output for the chosen scenario (Scenario 4).

Figure 31. Difference between the best solution and selection frequency outputs



Priority index map

An additional example has been included to demonstrate a further form of prioritisation within the ZCAs. This map identifies those areas already selected as ZCAs from Scenario 4 that were:

- Most frequently selected; and
- Most vulnerable to urbanisation, Phytophthora dieback and salinity, to produce a gradient of priorities.

The priority index map allows fine-tuning of the prioritisation process by identifying those areas needing the most urgent action to meet conservation targets.

The selection frequency data was extracted from Scenario 4 and standardised using a range between 0-1. The planning unit cost data for the three combined costs for salinity, urbanisation and Phytophthora dieback were extracted from the summed threats matrix, and, similarly, the range standardised 0-1 for each planning unit. These two datasets were then summed for each planning unit to create a priority index. This was clipped to the best solution from Scenario 4, and the priority index data mapped in 10% bins. This map provides a summary of the priority areas for conservation action, representing both the importance of conservation features and the extent of threats affecting them to establish prioritised areas where conservation action would be both most urgent and likely to be most effective.

RESULTS

As previously described, four different scenarios were explored in this analysis. Each scenario produced two types of outputs, being the selection frequency and best solution. As the first three scenarios (Table 19) were not considered the final outputs, they are provided in Appendix 1 for context, however, the results focus on the outputs for Scenario 4.

Scenario 4 is the primary scenario that is being used for the final project outputs, being the scenario that considers both lock-ins and the cost layer. As such, the following maps, with accompanying descriptions, are provided:

- A summed threats map;
- A best solution map;
- A selection frequency map; and
- A priority index map.

The following additional analysis for Scenario 4 was also completed using a range of relatively simple methods, such as spatial intersections and queries. This included:

- An analysis of the conservation features that did not meet the set targets;
- Identification of areas of the best solution that were present within each IBRA bioregion;
- Summary statistics for each category of conservation features; and
- A local example of the use of the analysis, based within the Perth Region NRM area.

In addition, a CD was prepared for this project, which contains several datasets that may be re-used under licence from the SWAEI. Most of the source data for this project was licensed in such a way that it cannot be redistributed, however, details of how the data could be sourced again from custodians is provided in Appendix 3.

SCENARIO 4

Scenario 4 represents the combination of all parameters tested in scenarios 1–3. Scenario 4 is considered the most realistic analysis as it recognises parcels of land that already have existing protection and management. These areas are accounted for in the analysis and are locked-in to the solution.

This analysis includes the cost layer, which combines the three threats used in the analysis (urbanisation, Phytophthora dieback and salinity) as well as a weighting based on different land classifications. This process is used to favour the selection of planning units in certain areas over others where there is a greater risk of management issues and land-use conflict.

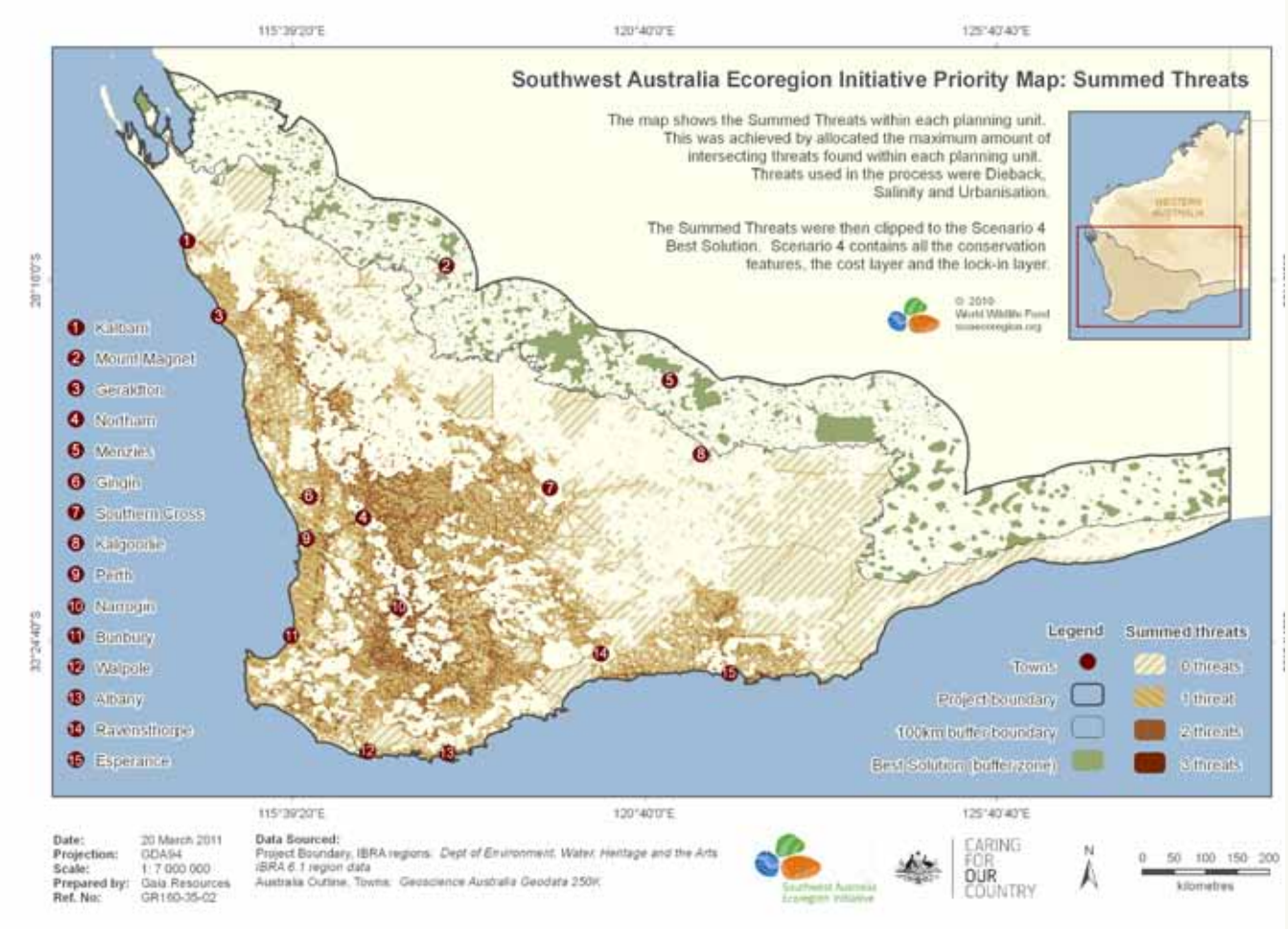
Summed threats in the ZCAs

This map demonstrates the summed threats in the ZCAs. It shows that the ZCAs within the western part of the ecoregion are not impacted by the three threats (salinity, urbanisation and Phytophthora dieback) used in this analysis. However, large parts of the ecoregion are impacted by at least one of these threats. The Avon Wheatbelt, Jarrah Forest, Swan Coastal Plain, and parts of the Mallee and Yalgoo bioregions are impacted by all three of the combined threats (Figure 32). Eighty-three of the conservation features are contiguous, with all three of the threats in various places across the SWAE, although, 1,006 features do not intersect with any of these threats. The features occurring in areas subject to all three threats include 27 taxa of birds and bird-related features, 17 vegetation types and floral species, eight mammals, various reptiles and invertebrates, and various classes of water bodies.

Table 20. Parameters of Scenario 4

Scenario	Description
Scenario 4 – Lock-ins and cost layer included	• All conservation features; • Standard conservation targets; • Cost values included (including threats); and • Lock-in areas included

Figure 32. Threats to biodiversity across the SWAE



Best solution map

This map (Figure 33.) illustrates the ZCA, which are widely distributed across the SWAE landscape and span 324,582 km2 (47%) of the SWAE region. They cover a range of less than 20% to above 80% of their respective bioregions (Table 21.). This spatial distribution reflects the variety of conservation features included in the analysis. The ZCAs are spatially compact and take into consideration three threatening processes (salinity, Phytophthora dieback and urbanisation) as well land suitability. This map is important because it shows the areas that most closely achieve targets for all conservation features.

The best solution map illustrates:

- Locked-in areas reserved within the conservation estate that meet the IUCN criteria (classified as (I) strict nature reserves, (Ia) wilderness areas, (II) national parks, (III) natural monuments or features and (IV) habitat species management areas) (IUCN, 2011). This also included crown reserves classified for the purpose of conservation parks, national parks, nature reserves, or reserves with land use or purpose-specified for conservation. These areas are illustrated in dark green;
- The ZCAs in sage green;
- Areas selected in the buffer zone, illustrated in grey. The buffer zone provides context for the analysis and is not considered a priority for the systematic conservation plan; and
- IBRA boundaries (black lines).

Figure 33. Best solution map

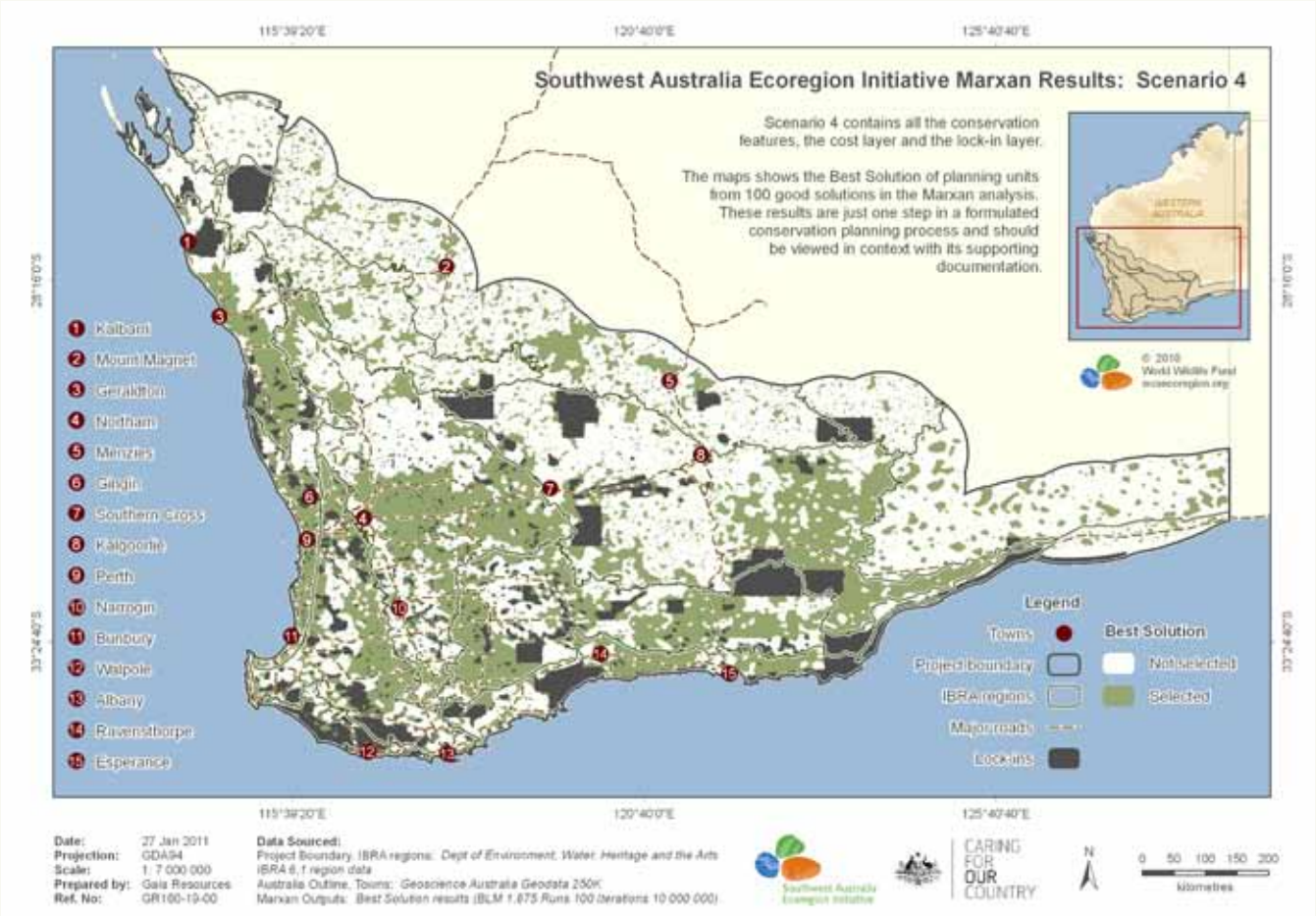


Table 21. compares the amount of area the ZCAs represent across each IBRA bioregion.

Table 21. Area represented across IBRA bioregions (Scenario 4)

IBRA region	Total area (km²)	Area selected in best solution (km²)	Best solution coverage per region (%)
Avon Wheatbelt	95,164	53,192	55.9
Carnarvon	17,941	4,036	22.5
Coolgardie	129,170	63,274	49.0
Esperance Plains	29,133	21,833	74.9
Geraldton Sandplains	31,453	20,770	66.0
Great Victoria Desert	16,747	3,309	19. 8
Hampton	10,413	2,509	24.1
Jarrah Forest	45,085	31,654	70.2
Mallee	73,955	50,838	68.7
Murchison	100,860	25,991	25.8
Nullarbor	62,990	12,500	19.8
Swan Coastal Plain	15,307	11,536	75.4
Warren	8,496	6,983	82.2
Yalgoo	50,157	16,157	32.21

Table 22. illustrates the amount of area used by each asset class included in the analysis.

Table 22. Conservation feature summary statistics

Asset class	Number of conservation features (taxa or surrogates) representing each asset class used in analysis	Total area in SWAEI (km²)	Minimum area in SWAEI (km²)	Maximum area in SWAEI (km²)	Mean area in SWAEI (km²)
Birds	100	194,342.50	2.6	11,654.97	1,943.42
Mammals	31	12,559.11	2.6	1,701.74	405.13
Reptiles	35	2,982.59	2.6	558.59	85.23
Amphibians	7	1,088.61	15.59	457.26	155.51
Inland water species	49	5,463.78	2.6	1,990.13	111.50
Invertebrates	43	1,530.28	2.6	615.74	35.59
Inland water bodies	82	101,044.50	0.042	10,327.35	1,232.25
Flora	137	3,735.98	2.6	296.10	27.27
Other	45	3,068,272.00	0.139	761,579.00	68,183.83
Vegetation	862	671,266.40	0.001	177,354.00	778.73
Total	**1,391**				

Selection frequency map

This map (see Figure 34.) illustrates that within the ZCA there are some planning units that are selected more frequently during the 100 runs for the specified scenario. It demonstrates the relative irreplaceability of specific planning units in achieving the conservation targets and the relative importance that can be attached to conservation action in such areas. While all planning units of the best solution are needed to achieve the conservation targets, the most frequently selected places are those where (a) there are few alternative areas elsewhere in which these conservation features may be secured at the same cost, and (b) there is a greater opportunity to achieve higher rates of return on investment into conservation action (because of the close proximity of features that may be sensitive to on-ground intervention). Planning units are selected less often where there is a range of equally good alternatives and hence more units are considered replaceable.

The selection frequency map illustrates:

- The range of areas that have been selected 100% of each of the 100 runs (maroon) to those areas that have been selected 1% of each of the 100 runs (pink);
- Areas selected in the buffer zone, shown in grey. The buffer zone provides context for the analysis and is not considered a priority for the systematic conservation plan; and
- IBRA boundaries (black lines).

Priority index map

The priority index map (see Figure 35.) shows areas where a form of further prioritisation indexing has been applied to the ZCAs (from best solution) by identifying those areas that were:

1. Most frequently selected; and
2. Most vulnerable to urbanisation, Phytophthora dieback and salinity.

This produces a gradient of priorities within the ZCAs. The priority index map allows fine-tuning of the prioritisation process by identifying those areas needing the most urgent action to meet conservation targets.

The priority index map shows:

- A priority index applied to the ZCAs, demonstrating gradations that identify importance and urgency;
- Areas, illustrated in yellow, which are selected less frequently and are less threatened;
- Areas, shaded red, which are selected more frequently and are more threatened; and
- The buffer zone, illustrated in grey.

Figure 34. The range of selection frequencies for 100 runs map

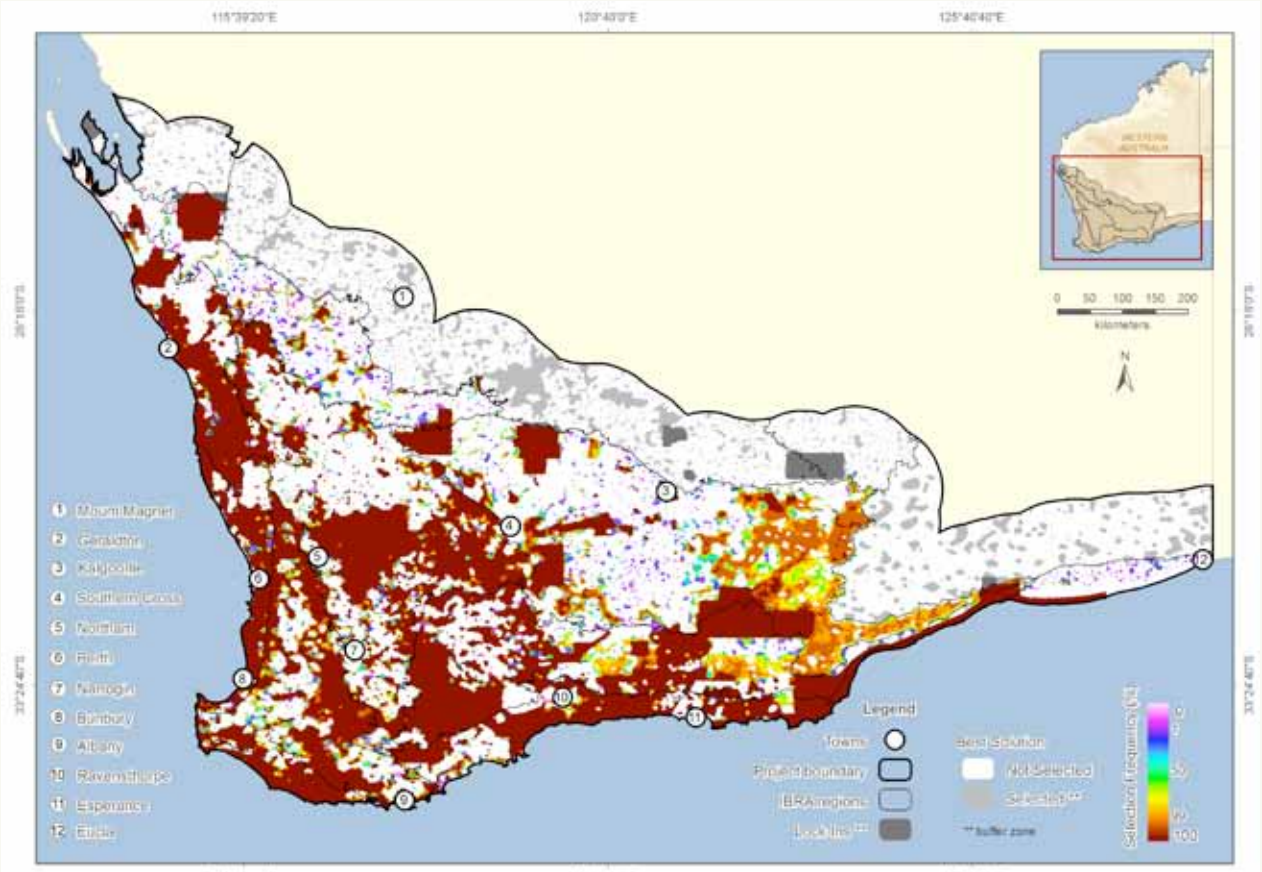


Figure 35. The priority index map

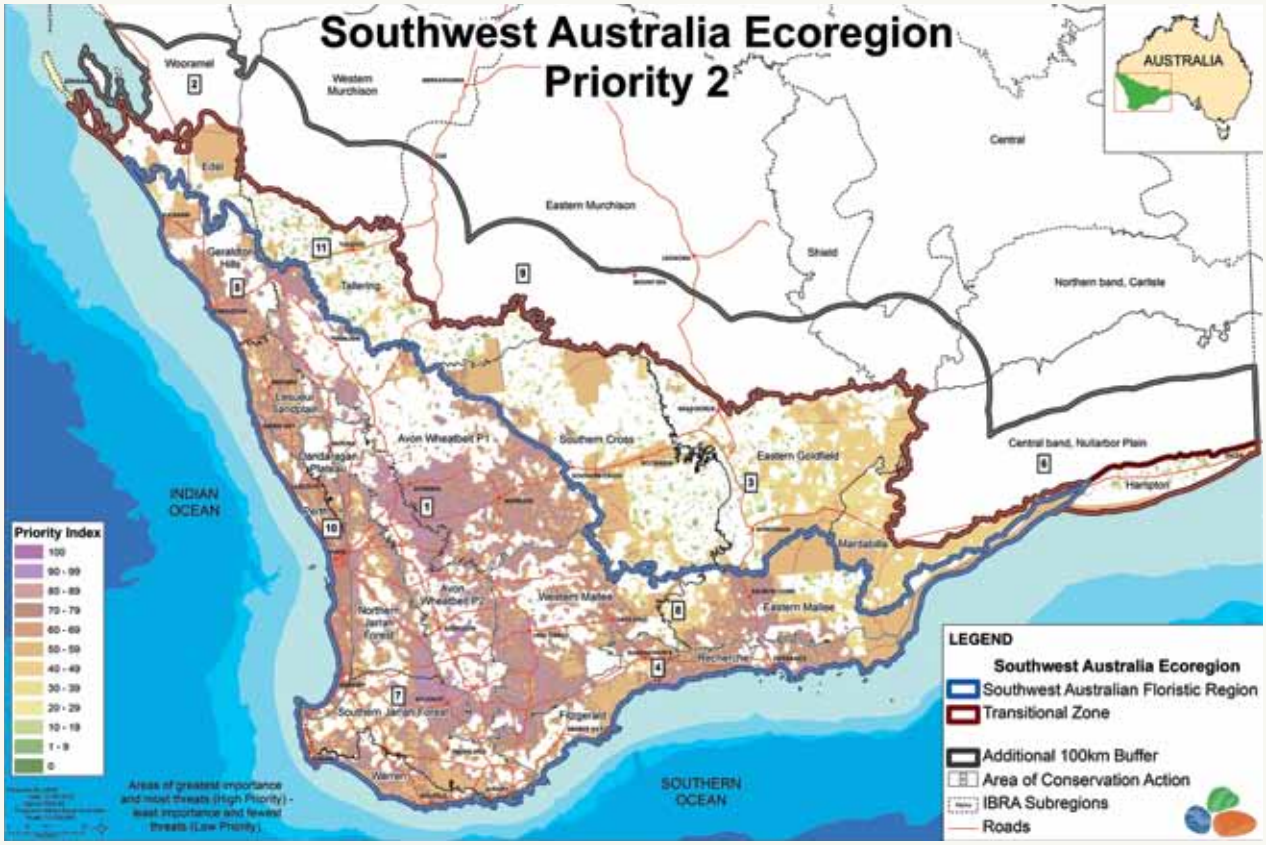
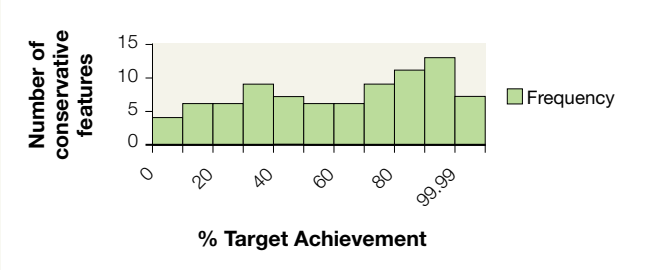


Table 23. Conservation targets not met in the ZCAs

SWAEI target achieved for Scenario 4 (%)	No. of conservation features
0	4
1 to 10	6
11 to 20	6
21 to 30	9
31 to 40	7
41 to 50	6
51 to 60	6
61 to 70	9
71 to 80	11
81 to 90	13
91 to 99.99	7
Total	**84**

Histogram 1. Conservation features with un-met targets in the ZCAs



Conservation features with un-met targets

Eighty-four conservation features (6%) included in the analysis did not meet their conservation targets (see Table 23.). These conservation features included a composite data layer for Threatened Ecological Communities (TECs and/or others) and 82 of the vegetation types. All of the conservation features with un-met targets were trying to achieve 100% of their existing occurrences or extent in the analysis. However, the vegetation types still achieved 87% and TECs and/or others achieved 61% of their targets.

The conservation features that did not achieve their targets do not appear to be related to any specific characteristic, with a broad spread of data points across the under-achievement scale (Histogram 1.). There is no systematic representation of the vegetation types in these unmet features. However, all the conservation features were endemic to the ecoregion and have a very small extent. The vegetation types are highly fragmented and spatially disbursed, (particularly in the Avon Wheatbelt bioregion), which predisposes them to be being more difficult to include in a large priority setting problem with high costs, such as the SWAE. The best solution could have been forced to meet all the targets, but this would have resulted in a 20% increase in the ZCA area (65,000 km2).

Nonetheless, targets for 1,307 of the 1,391 (94%) conservation features were met through this process, which is well within the bounds of acceptable outputs.

EXAMPLE OF HOW TO USE ANALYSIS

Many organisations are delivering on-ground biodiversity conservation management within the SWAE. The strength of the SWAEI partnerships has demonstrated that these organisations are keen to contribute to the implementation of this framework.

This framework aims to provide a program and project planning structure that allows these organisations to combine geographically specific conservation objectives and actions with ecoregional goals and targets as new projects are developed and implemented within the ZCAs. The success of implementing the systematic conservation planning outcomes will be determined by the focus, quality, effectiveness and cumulative effort of the on-ground biodiversity conservation activities within the ecoregion.

Using a program and project planning structure consistent with this framework will benefit both the SWAE and organisations undertaking biodiversity conservation management by:

- Ensuring the efforts of individual organisations to improve biodiversity conservation collaboratively contribute to the recognised biodiversity values of the ecoregion;
- Building on the expert opinion built into the systematic conservation planning approach to assist and underpin prioritisation processes and decision-making;
- Identifying areas in which organisations can work that will provide the best biodiversity conservation return on investment;
- Allowing organisations to identify environmental values that are important and aligning these to local priorities and management efforts;
- Providing a catalyst for organisations to build partnerships with other like-minded organisations and developing projects that make a greater collective contribution to biodiversity conservation; and
- Assisting organisations and partnerships to justify the ecoregion-wide importance of geographically specific conservation work.

Using Scenario 4, we demonstrate a way to query the results to inform biodiversity conservation decisions. In this example, a ZCA has been identified covering the Perth Region NRM boundary (see Figure 36.). Using this ZCA, a subset area has been selected for further interrogation, referred to as an Area for Conservation Action (ACA). Basic statistics about the conservation features that appear in the ACA and their contribution to meeting regional-scale targets are provided in Table 24. For a methodology that describes how to apply the results for program and project planning, refer to *A Strategic Framework for Biodiversity Conservation Report A: For decision-makers and practitioners.*

Figure 36. Local example area

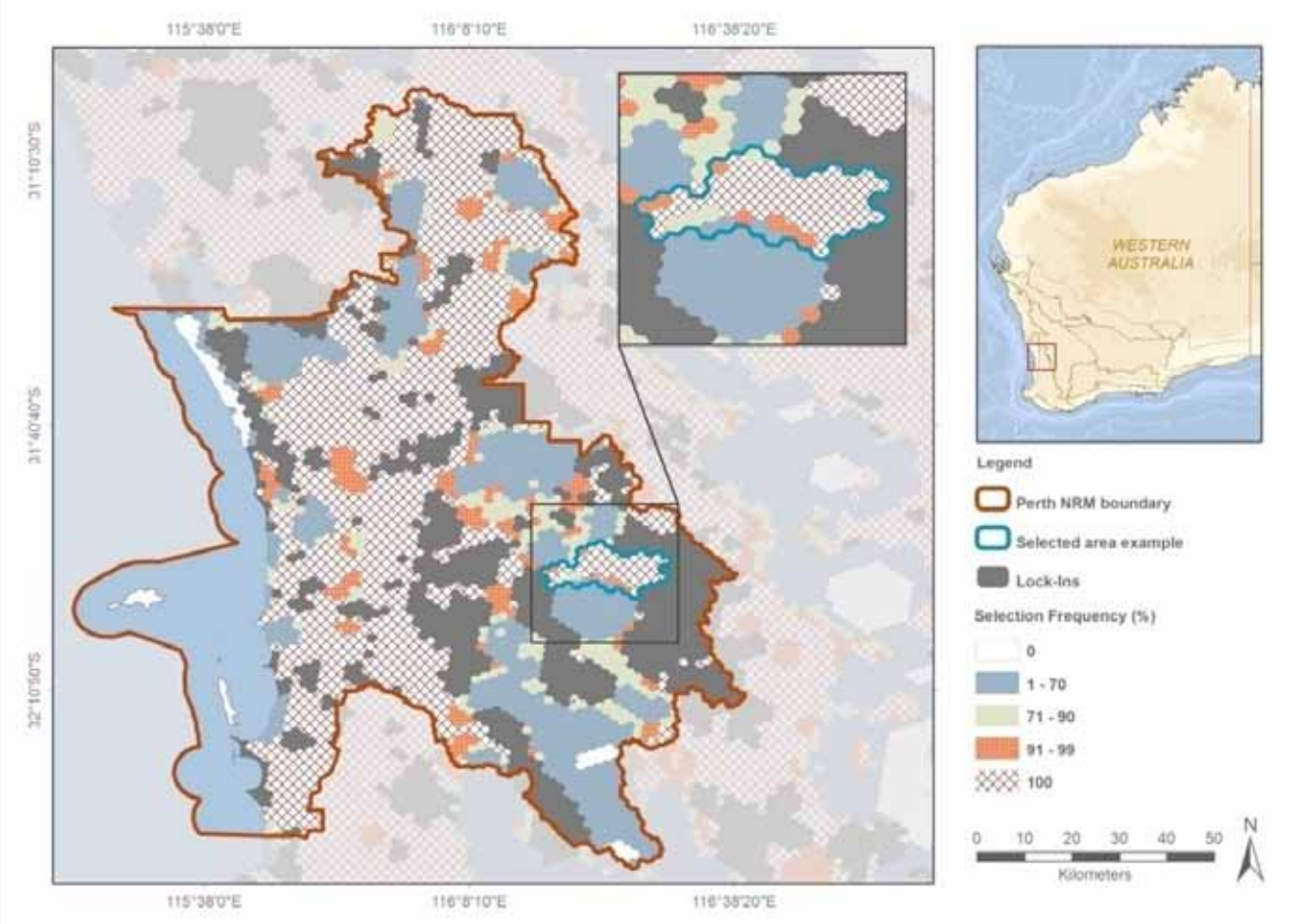


Table 24. Conservation features found within the ACA and their contribution to meeting regional-scale targets

Conservation feature name	Known populations or hectares found in ACA	Known populations or hectares found across the SWAE	The % found in the ACA, compared to SWAE
Shrublands teatree A jarrah forest	5.93	18.71	31.7
Medium forest H jarrah forest	55.14	406.97	13.5
Crested shrike-tit	5	117	4.3
Medium woodland A jarrah forest	105.54	3,132.39	3.4
Rufous treecreeper	13	861	1.5
Hooded robin	5	333	1.5
Yellow-plumed honeyeater	13	994	1.3
Western yellow robin	10	936	1.1
White-naped honeyeater	13	1,200	1.1
Western spotted froglet	2	176	1.1
Scarlet robin	16	1,634	1
Restless flycatcher	5	526	1
Connectivity jarrah forest	1,417.5	150,534	0.9
Dusky woodswallow	10	1,139	0.9
Candlestick banksia	1	114	0.9
Water-rat (rakali)	1	111	0.9
Western thornbill	10	1,245	0.8
Channels major rivers Non-listed jarrah	23	2,925	0.8
Carnaby's black-cockatoo (other) Wheatbelt/rest of SWAE	6	893	0.7
Includes springs, waterholes and water points	1	152	0.7
Spotted pardalote	7	1,266	0.6
Numbat	2	342	0.6
Masked woodswallow	1	154	0.6
Splendid fairy-wren	18	3,416	0.5
Little eagle	3	609	0.5
Medium forest A jarrah forest	68.77	16,644.6	0.4
Striated pardalote	17	4,486	0.4
Common bronzewing	10	2,651	0.4
Tawny-crowned honeyeater	4	991	0.4
Red-capped parrot	8	2,271	0.4
Western spinebill	7	1,825	0.4
Tree martin	15	3,748	0.4
Western rosella (south)	7	1,631	0.4
Grey shrike-thrush	13	4,043	0.3
Western quoll (chuditch)	2	636	0.3
Channels minor rivers Non-listed jarrah	10	3,050	0.3
Rufous whistler	11	3,319	0.3
White-necked heron	1	323	0.3
Western little wattlebird	2	1,113	0.2
Red-winged fairy-wren	2	1,047	0.2
Grey currawong	3	1,856	0.2
Emu	2	1,155	0.2
Baudin's black-cockatoo (long-billed black cockatoo)	1	576	0.2
Pacific black duck	2	2,065	0.1
White-browed babbler (western wheatbelt)	1	1,994	0.1
Purple-crowned lorikeet	2	1,522	0.1

DISCUSSION

Marxan is a software tool that can guide conservation planners by helping to identify areas with conservation potential at realistic cost. The Marxan algorithm enables complex calculations that incorporate multiple factors relevant to conservation planning and their relationships. The outputs offer a valuable information basis for conservation planners. However, when using the outputs and in order to achieve the greatest benefit from them, the following points should be considered.

The outputs do not:

- Model the persistence of species or ecological and evolutionary processes;
- Recommend management designations or determine the level of protection that a site requires;
- Determine ecological irreplaceability. Rather, Marxan calculates the selection frequency of a planning unit, or how frequently a site is selected within the different good solutions that it found;
- Deliver a single optimal solution. Marxan determines multiple "near optimal" solutions;
- Ensure species viability or sustainability; or
- Tell the user how to integrate costs with different currencies. While Marxan can include costs with different currencies, all of these costs must be integrated into a single cost surface layer before Marxan is used. The integration of this information is not straightforward and requires much thought and sometimes sophisticated socio-economic methods.

A number of parameters are used by the Marxan algorithm, which is calibrated to adjust to conservation planning requirements and the decision-making problem. Interdependencies exist between these Marxan parameters, and results should be checked carefully after each modification of any of the parameters.

There are, and always will be, limitations to the input data, such as:

- Data not available at the scale of the region;
- Data not presented in a format that allows it to be assigned to planning units;
- Data spatial or attribute inaccuracies; and
- Data effectively becoming "dead" once accessed and requiring subsequent updating.

Where to from here?

The basic foundation of this planning process is to identify an efficient representation of the biodiversity in the ecoregion (i.e. the minimum amount of space and avoiding threats and land-use conflict). Focusing effort in these areas will deliver the highest return on investment.

The analysis has been undertaken at the ecoregion scale and the ZCAs should not be considered as stand-alone areas. Rather, they each make a contribution to the persistence and representation of biodiversity across the ecoregion and need to be considered in this context. The exception to this is where there are unique conservation features that are entirely contained within a ZCA.

The identified ZCAs are representative; however, they will not necessarily protect all biodiversity values in the SWAE due to data and knowledge gaps. Nor have all decision variables been captured within the scope of this analysis. It does not consider all threats to biodiversity in the ecoregion or additional conflicts, such as land that should be protected for primary production.

This systematic conservation planning project is a decision support tool, not a decision-making tool, and the results presented in this report are a snapshot, based on current data. As patterns of biodiversity change, either in response to changes in climate or other threatening processes, or as new and additional data comes to light, it will be necessary to reconsider the boundaries of the prioritised areas and the likely success of implementation projects.

The results of this rigorous analysis should provide a basis for allocating resources for management initiatives that respond to region-wide threats and that require a national, state and local response. The results should inform a coordinated response by those organisations involved with on-ground implementation activities, and help guide policy and decision-making processes, including land-use planning and funding objectives. Stakeholder capacity should be strengthened by increasing the autonomy of decision-making and program implementation.

It is recommended that implementation strategies are developed based on the results of this systematic conservation planning project. These strategies should be managed in such a way as to foster cooperation and coordination, in order to ensure a synchronised and cost-effective approach. This will require the refinement of the boundaries at the local scale and the verification of data based on local knowledge.

Management actions should be identified, and set at the scale of the ecoregion and able to be incorporated into international, regional, national and sectoral programs, so that all conservation efforts within the SWAE can be integrated.

Importantly, this process should provide the basis for a monitoring and evaluation system that will enable stakeholders to track the progress of contributions to biodiversity conservation in the ecoregion. Measuring the incremental impact from management actions by continuously building on past accomplishments should feed back into the systematic conservation planning process. This will encourage efficient solutions to be explored and provide stability and investment within the context of changing funding and policy decisions.

GLOSSARY

Commonly used Marxan terminology can be found below (adapted from Ardron *et al.*, 2010).

Biosphere Reserves are an area of conservation nominated by the United Nations Educational, Scientific and Cultural Organisation (UNESCO).

Best Solution is the solution with the lowest objective function value (i.e. the solution with the lowest overall "Marxan cost"). This is best thought of as being one of many "very-good" solutions, not the best and only solution.

Boundary Length Modifier (BLM) creates greater connectivity by aggregating or increasing the compactness of the Marxan solutions.

Conservation Features are any part of the environment, ecosystem or biodiversity for which a target is to be achieved within the decision-making problem of designing effective and efficient prioritised areas.

Conservation Targets specify how much of each conservation feature (such as a species or a habitat type) to protect within the reserve network. Target achievement relates to how well targets have been met within the solution.

Costs can consist of any spatially explicit factor, such as the total area occupied by the solution, or extraneous factors such as costs to acquire or manage areas, or, as used in this project, threats to the ecological integrity of areas or classes of conservation features.

Cost Matrix Value is the numerical value assigned to each cost relationship (i.e., threat to tenure) to give a relative score.

Cost Matrix Weighting is achieved when each cost is weighted in accordance with the relationship of threat to tenure.

Irreplaceability (also referred to as Selection Frequency) represents the number of times a planning unit was selected as part of a good solution from all runs in a scenario. The frequency with which planning units are selected in multiple runs gives an indication of the importance of that planning unit for efficiently meeting solution targets.

Lock-ins are those planning units that are considered required in the solution. Marxan will aim to identify how it can achieve target solutions within the locked-in planning units before searching for other planning units to include in the solution.

Planning Units are an overlay that divides the planning region into square grids or hexagons. They must cover all the area from which the solution should be selected as part of the decision problem, and their size should be at a scale appropriate for both the ecological features and the size of the management areas likely to be implemented.

Runs are the number of software runs (as specified by the user) that are repeated by Marxan for any one scenario. Each run creates a slightly different solution to the decision problem that is independent of the previous one, but all runs use the same parameter and variable values.

Solutions are an area-specific outcome to the decision problem, based on a minimum cost and the decision constraints (such as targets to be achieved) as specified by the user.

Species Penalty Factor (SPF) is a user-defined penalty applied to the objective function when a conservation feature target is not met within the algorithm runs. This can be adjusted upward to push the solution towards meeting all targets within the pre-specified constraints.

Threats used in this project are proxies for many different types of threat to ecological integrity, including proximity to urban areas, roads, Phytophthora dieback and salinity.

ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACA	Areas for Conservation Action
ANRDL	Australian Natural Resources Data Library
AOR	All Other Reasons
ASDD	Australian Spatial Data Directory
BLM	Boundary Length Modifier
CPT	Conservation Planning Team
CR	Critically Endangered
DAFWA	Department of Agriculture and Food, Western Australia
DEC	Department of Environment and Conservation
DEHWA	Department of Environment, Heritage, Water and the Arts (now DSEWPaC)
DEM	Digital Elevation Model
DIA	Department of Indigenous Affairs
DIG	Discover Information Geographically
DMP	Department of Mines and Petroleum
DOW	Department of Water
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
ELZ	Extensive land-use zone
EN	Endangered
EPBC	Environmental Protection and Biodiversity Conservation Act
GA	Geoscience Australia
GB	GigaByte
GDA94	Geocentric Datum of Australia 1994
GIS	Geographical Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation of Australia
ID	Identifier
ILZ	Intensive Land-use Zone
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
NACC	Northern Agricultural Catchment Council
NLWRA	National Land and Water Resource Audit
NRM	Natural Resources Management
OSP	Other Specially Protected
PEC	Priority Ecological Community
PRNRM	Perth Region NRM
RFA	Regional Forest Agreement
RNRM	Rangelands NRM Coordinating Group
SCNRM	South Coast Natural Resource Management Inc.
SCP	Swan Coastal Plain
SLIP	Shared Land Information Platform
SPEC	Marxan species file
SPF	Species Penalty Factor
SRG	Stakeholder Reference Group
SSP	Subspecies
SWAE	Southwest Australia Ecoregion
SWAEI	Southwest Australia Ecoregion Initiative
SWCC	South West Catchment Council
TEC	Threatened Ecological Community
VU	Vulnerable
WA	Western Australia
WAHERB	Western Australia Herbarium
WAM	Western Australian Museum
WB	Wheatbelt
WG	Working Group
WNRM	Wheatbelt Natural Resource Management
WWF	World Wildlife Fund
ZC	Zonae Cogito
ZCA	Zones for Conservation Action

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APPENDICES

APPENDIX 1. SCENARIOS 1-3

For Scenarios 1 to 3, we have provided the best solution and selection frequency maps. Note that these maps use a historical colour scheme that was amended for Scenario 4. These scenarios are defined below.

Scenario	Description
Scenario 1 – No constraints	• All conservation features; and • Standard conservation targets
Scenario 2 – Lock-ins included	• All conservation features; • Standard conservation targets; and • Lock-in areas included
Scenario 3 – Cost layer included	• All conservation features; • Standard conservation targets; and • Cost values included (including threats)

Figure 37. Scenario 1 best solution

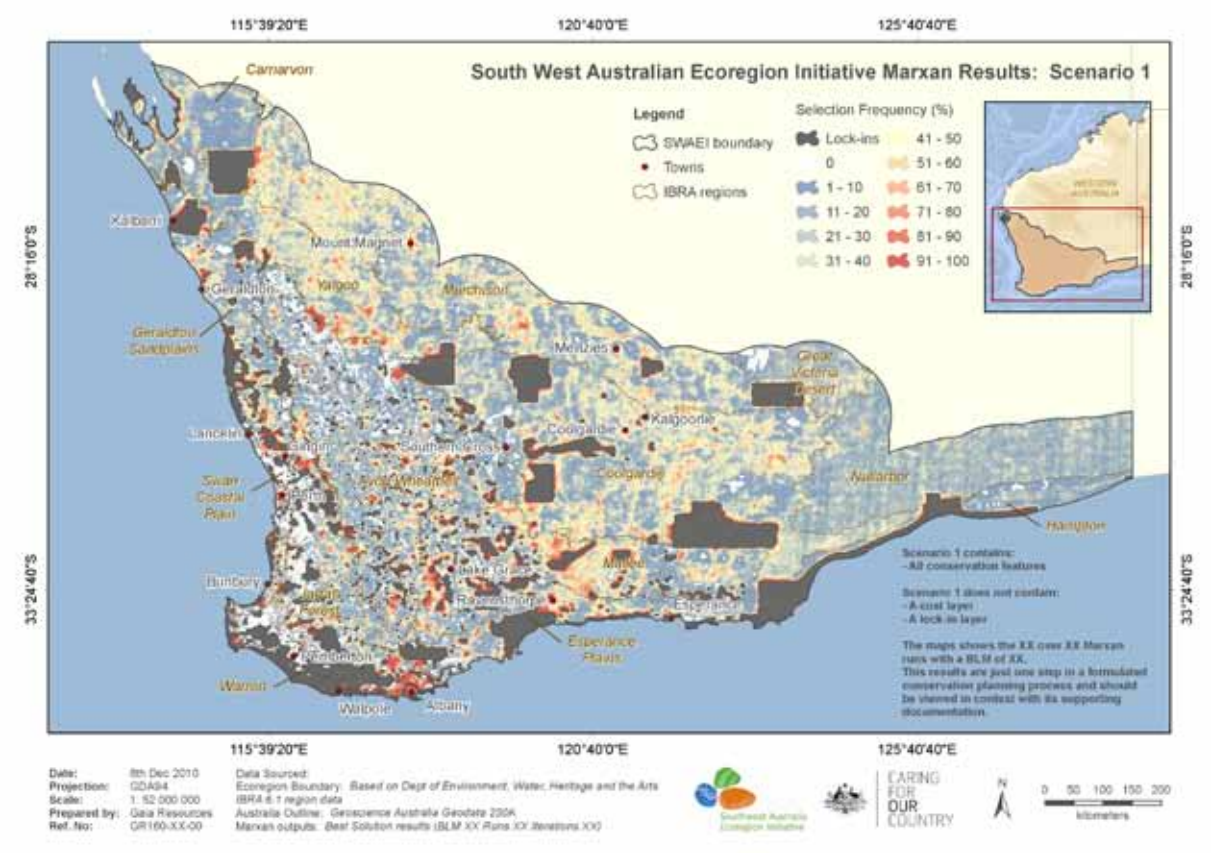


Figure 38. Scenario 1 selection frequency

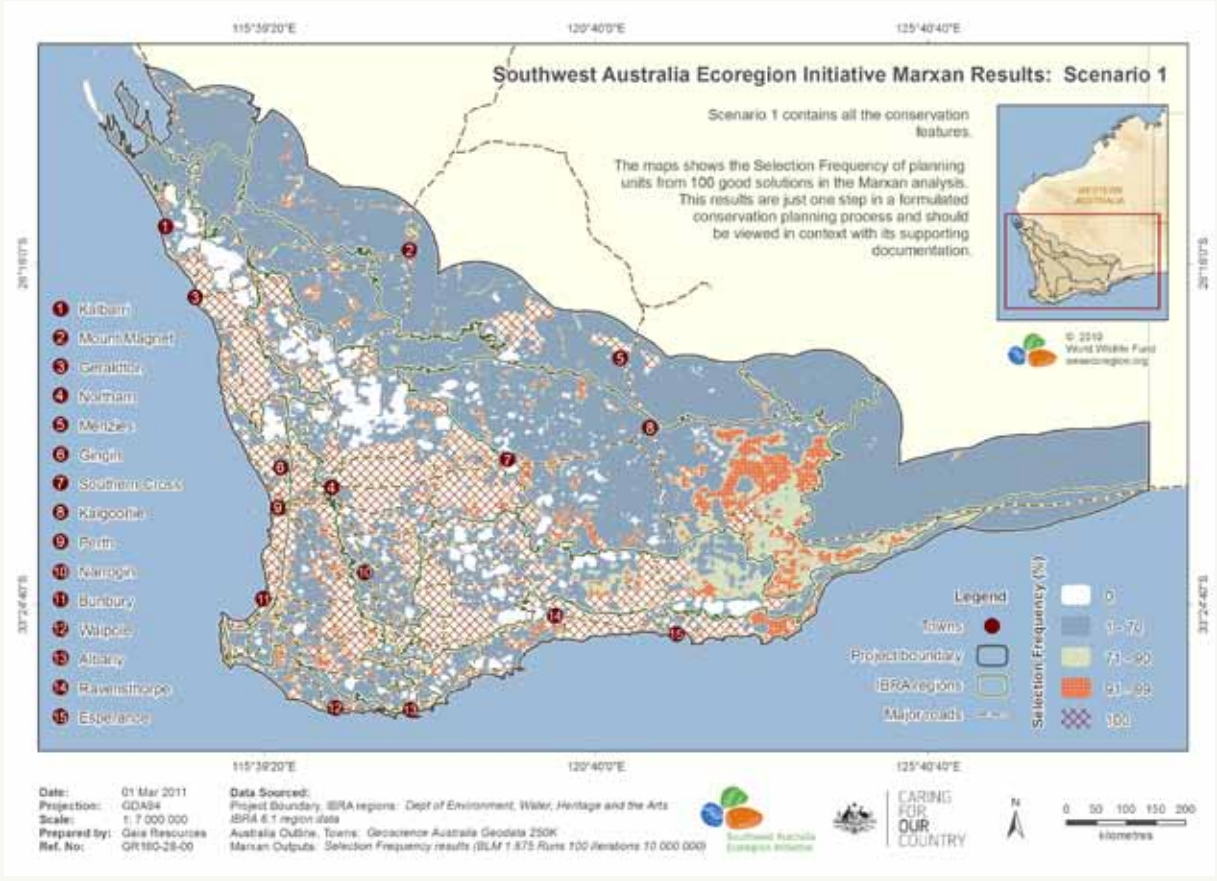


Figure 39. Scenario 2 best solution

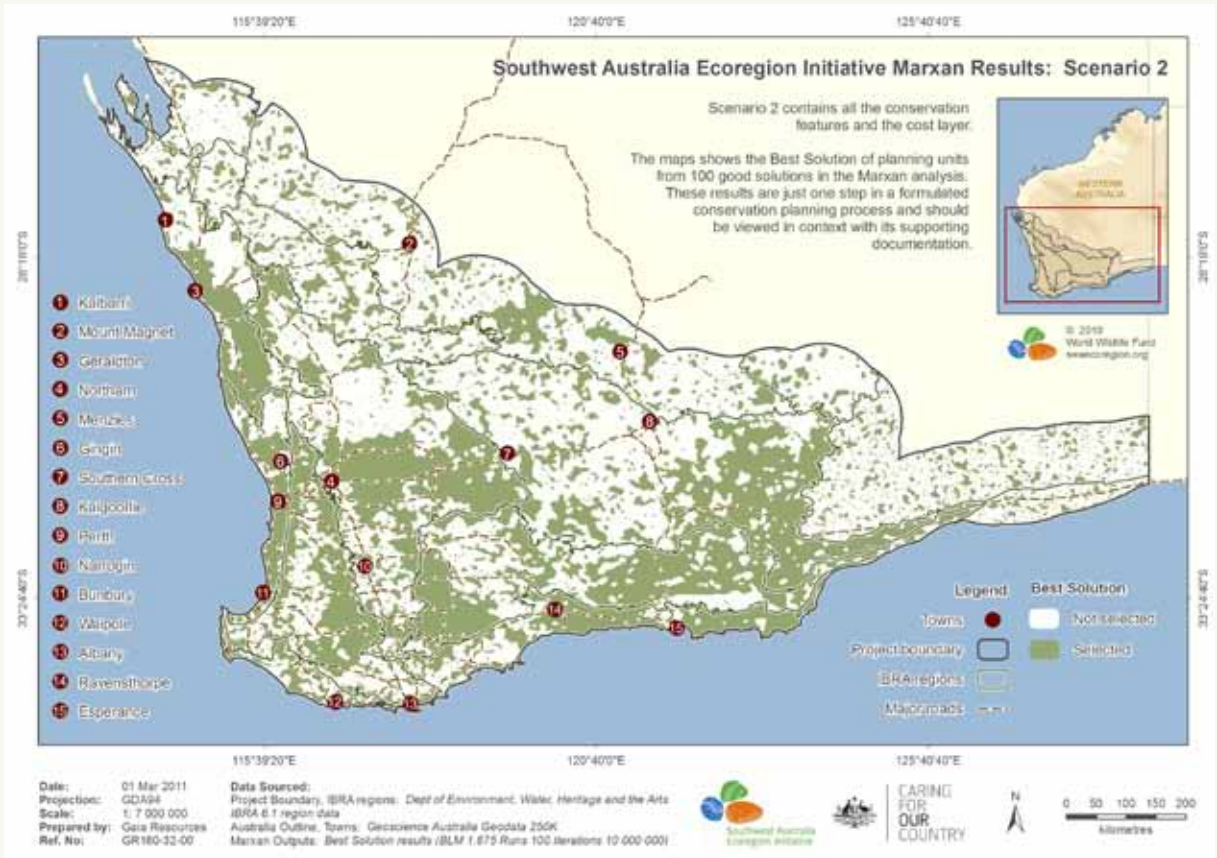


Figure 40. Scenario 2 selection frequency

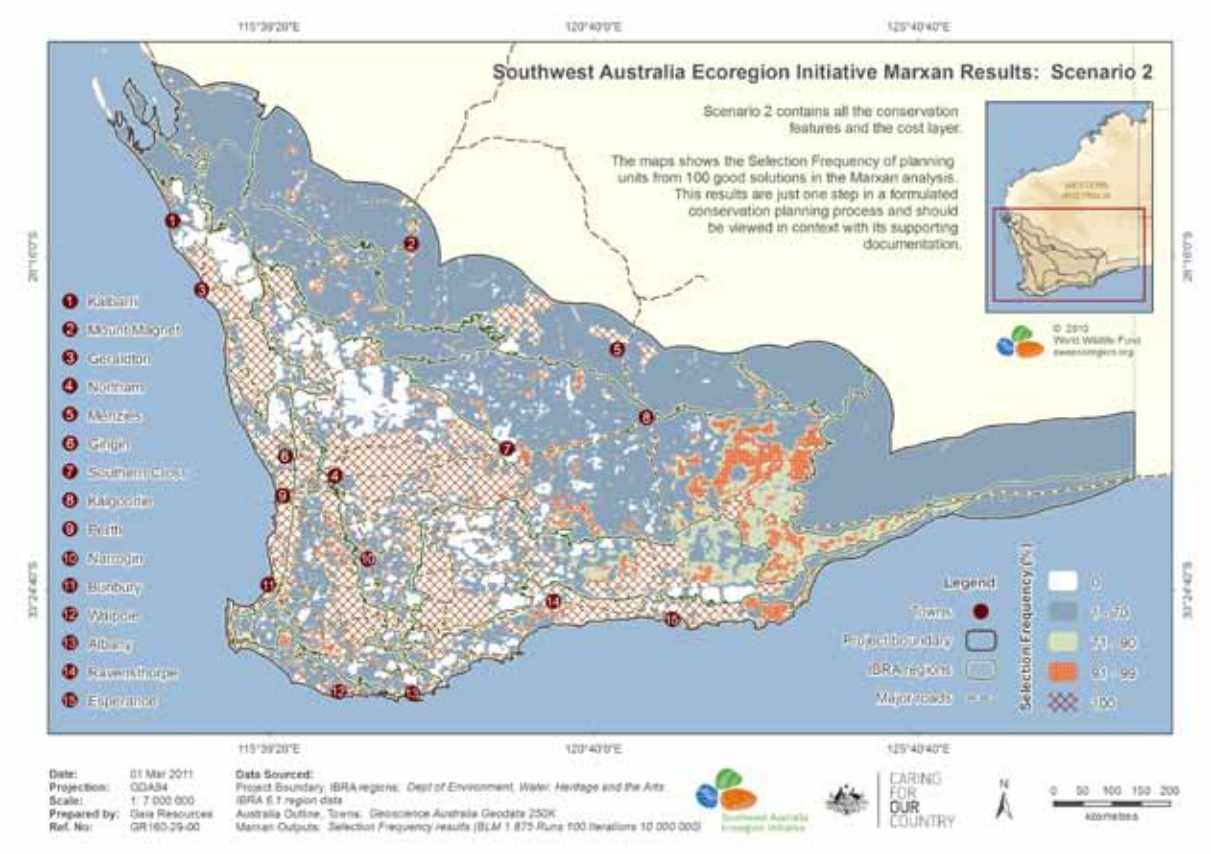


Figure 41. Scenario 3 best solution

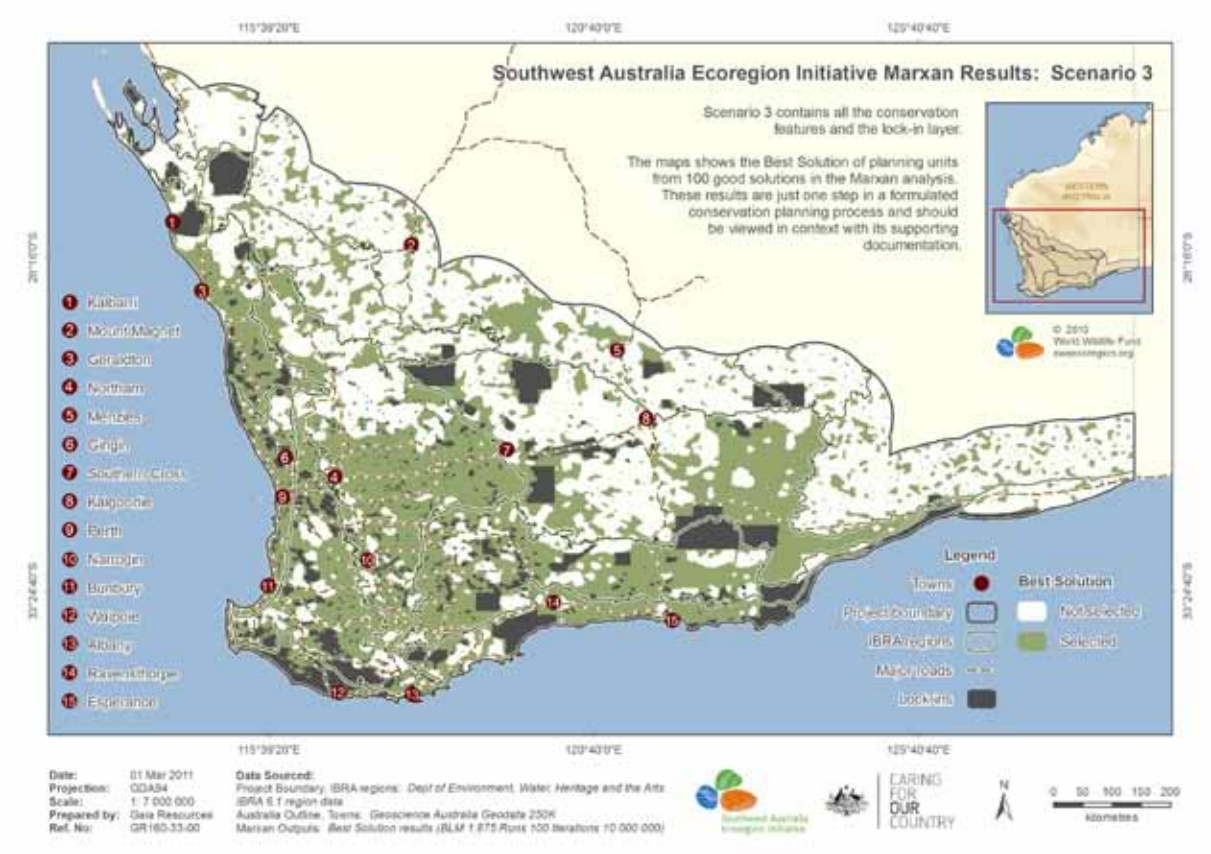
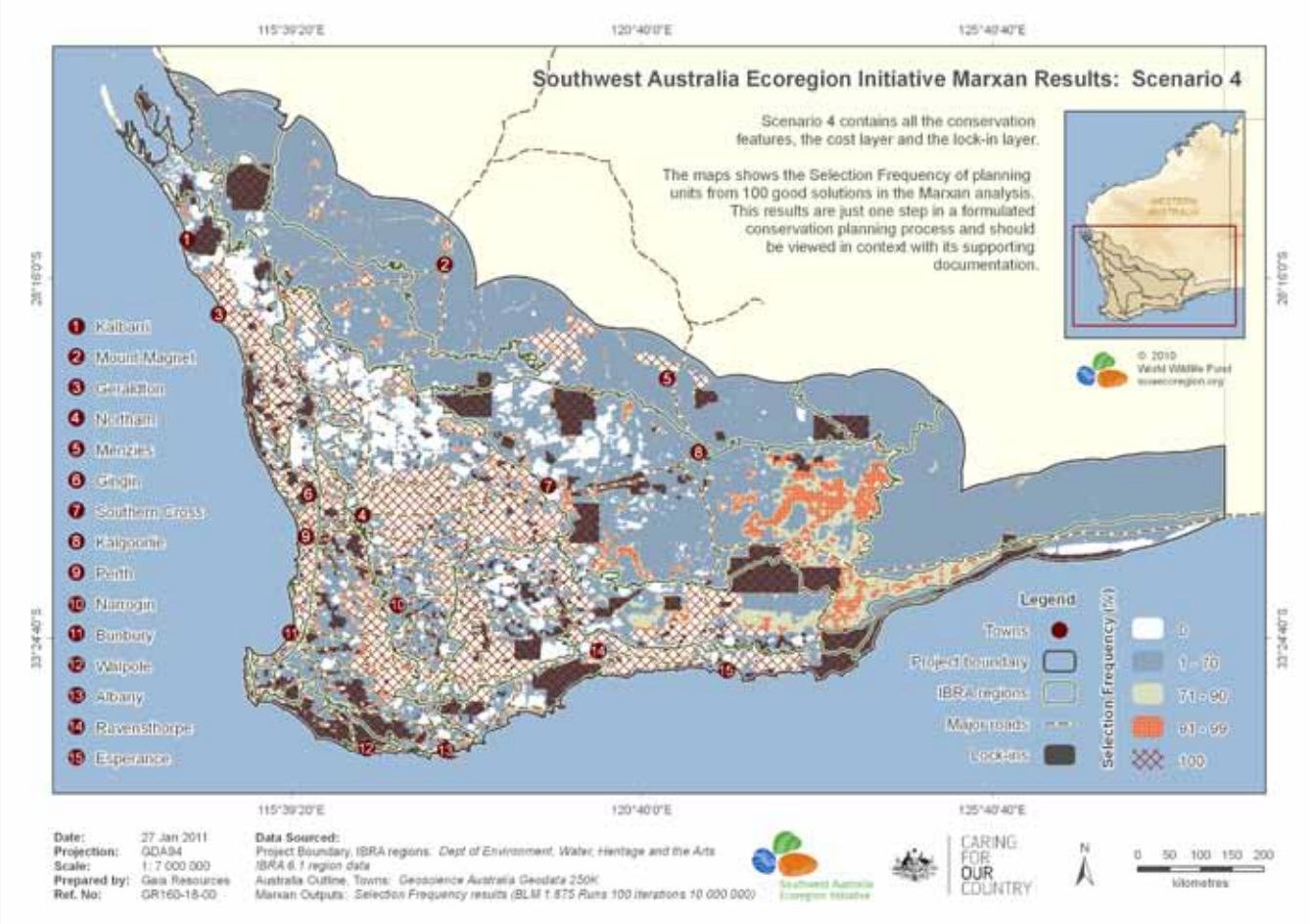


Figure 42. Scenario 3 selection frequency



APPENDIX 2. DATASETS USED FOR THE SWAEI PROJECT

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
SWAEI boundary	Biogeographic Regionalisation of Australia Boundaries (IBRA) version 6.1	Department of Sustainability, Environment, Water, Population and Communities	1:250,000	Australia-wide	Dec 2004	A landscape-based approach to classifying the land surface of Australia. Nominal attributes that make up IBRA are: climate, lithology/ geology, landform, vegetation, flora and fauna, and land use.	http://www.environment.gov.au
Lock-ins	Land and Managed Waters	Department of Environment and Conservation	Not given (although based on cadastre data)	Western Australia	June 2003	DEC-managed Lands and Waters within Western Australia. This responsibility is vested under the DEC Act and *Wildlife Conservation Act*.	http://www.dec.wa.gov.au
Cost (dieback)	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Northern Agricultural NRM Region	Department of Environment and Conservation	1:4,500; 1:20,000; 1:25,000 and 1:100,000	South-west Australia	Nov 2008	The Phytophthora Dieback Atlas was prepared for the State Government's Dieback Response Group by the Department of Environment and Conservation, the community-based Dieback Working Group and industry.	http://www.dec.wa.gov.au
Cost (dieback)	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, South Coast NRM Region	Department of Environment and Conservation	1:4,500; 1:20,000; 1:25,000 and 1:100,000	South-west Australia	Nov 2008	The Phytophthora Dieback Atlas was prepared for the State Government's Dieback Response Group by the Department of Environment and Conservation, the community-based Dieback Working Group and industry.	http://www.dec.wa.gov.au
Cost (dieback)	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Southwest NRM Region	Department of Environment and Conservation	1:4,500; 1:20,000; 1:25,000 and 1:100,000	South-west Australia	Nov 2008	The Phytophthora Dieback Atlas was prepared for the State Government's Dieback Response Group by the Department of Environment and Conservation, the community-based Dieback Working Group and industry.	http://www.dec.wa.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Cost (dieback)	Project Dieback (*Phytophthora cinnamomi*) Strategic Mapping, Swan and Avon NRM Regions	Department of Environment and Conservation	1:4,500; 1:20,000; 1:25,000 and 1:100,000	South-west Australia	Nov 2008	The Phytophthora Dieback Atlas was prepared for the State Government's Dieback Response Group by the Department of Environment and Conservation, the community-based Dieback Working Group and industry.	http://www.dec.wa.gov.au
Cost (salinity)	New Salt Mosaic Zone 50 and 51	Department of Environment and Conservation (Land Monitor)	1:50,000	South-west Australia	1998	Additional mapping and monitoring from Old Salt Mosaic from 1991 to 1998.	http://www.landmonitor.wa.gov.au/
Cost (salinity)	Old Salt Mosaic Zone 50 and 51	Department of Environment and Conservation (Land Monitor)	1:50,000	South-west Australia	1991	The Land Monitor project is part of the Western Australian Salinity Action Plan and is supported by the Natural Heritage Trust. The project originally aimed to systematically monitor salt-affected land and remnant vegetation change over the agricultural area of south-western Western Australia. Its objectives were to map and monitor changes in the area of salt-affected land from 1988 to 1991.	http://www.landmonitor.wa.gov.au/
Cost (urbanisation)	Spatial Cadastral Database (SCDB)	Landgate (Department of Land Information)	Survey accuracy	Western Australia	Ongoing	The SCDB is an integrated database comprising a number of layers of digital spatial data, defining all crown and freehold land parcels within Western Australia.	http://www.landgate.wa.gov.au
Cost (urbanisation)	Metro Regional Scheme (MRS)	Department of Planning and Infrastructure	1:500	Perth Metro Area	Ongoing	The MRS is a large town planning scheme for land use in the Perth metropolitan area. The MRS defines the future use of land, dividing it into broad zones and reservations. It requires local government town planning schemes to provide detailed plans for their part of the region.	http://www.planning.wa.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Cost (urbanisation)	Peel Regional Scheme (PRS)	Department of Planning and Infrastructure	Not given	Peel Area	Ongoing	The PRS is a large town planning scheme that guides land use in the Peel Region. The PRS defines the future use of land, dividing it into broad zones and reservations. It requires local government town planning schemes to provide detailed plans for their respective parts of the region.	http://www.planning.wa.gov.au
Cost (urbanisation)	Greater Bunbury Regional Scheme (GBRS)	Department of Planning and Infrastructure	1:25,000	Greater Bunbury Area	Ongoing	The GBRS is a local planning scheme for land use in the Greater Bunbury region. The GBRS defines the future of land use, dividing it into zones and reservations.	http://www.planning.wa.gov.au
Cost (urbanisation)	Esperance Structure Plan	Department of Planning and Infrastructure	Not given	Esperance Area	Ongoing	Structure plan for Esperance area.	http://www.planning.wa.gov.au
Cost (urbanisation)	Avon Land Use Plan	Department of Planning and Infrastructure	Not given	Avon Area	Ongoing	Land use plan for Avon area.	http://www.planning.wa.gov.au
Cost (tenure)	Spatial Cadastral Database (SCDB)	Landgate (Department of Land Information)	Survey accuracy	Western Australia	Ongoing	The SCDB is an integrated database comprising a number of layers of digital spatial data, defining all crown and freehold land parcels within Western Australia.	http://www.landgate.wa.gov.au
Cost (tenure)	Land and Managed Waters	Department of Environment and Conservation	Not given (although based on cadastre data)	Western Australia	Jun 2003	DEC-managed Lands and Waters within Western Australia. This responsibility is vested under the DEC Act and Wildlife Conservation Act.	http://www.dec.wa.gov.au
Cost (tenure)	Conservation Covenants	Department of Environment and Conservation	Not given (polygon data based on cadastre dataset)	Western Australia	Aug 2008	The nature conservation covenant is a voluntary, legally binding document that has provisions restricting activities that might threaten the land's conservation values.	http://www.dec.wa.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Cost (tenure)	Conservation Covenants	National Trust Western Australia	Not given (point data based on cadastre dataset)	Western Australia	Not given	Nature conservation covenants are voluntary agreements used to protect natural values on private property by restricting potentially damaging activities. Nature conservation covenants provide legal protection in perpetuity.	http://www.ntwa.com.au
Cost (tenure)	Soil Covenants	Department of Agriculture and Food, WA	Not given (point data based on cadastre dataset)	Western Australia	Not given	Boundaries that determine covenants that typically limit clearing and grazing of the native vegetation but may allow uses such as the removal of selected timber and seed collection.	http://www.agric.wa.gov.au
Cost (tenure)	Land For Wildlife (LFW)	Department of Environment and Conservation	Not given (although based on cadastre data)	Western Australia	Nov 2008	LFW is a voluntary scheme that aims to encourage and assist private landholders in Western Australia to provide habitats for wildlife on their property, even though the property may be managed primarily for other purposes.	http://www.dec.wa.gov.au
Cost (tenure)	Australian Wildlife Conservancy Sanctuaries	Australian Wildlife Conservancy (AWC)	Not given (although based on cadastre data)	Western Australia	April 2009	The AWC estate incorporates 21 sanctuaries around Australia covering more than 2.5 million hectares. Funded by donations, the AWC acquires land, implements conservation plans, and conducts scientific research and education programs.	http://www.australianwildlife.org
Cost (tenure)	Bush Heritage and Greening Australia Boundaries (BHGA)	Gondwana Link	Not given (although based on cadastre data)	South-west Australia	May 2009	Gondwana Link aims to reconnect the larger fragments all the way from the wet forests of the south to the semi-arid woodlands near Kalgoorlie, which will restore a great arc of bushland and protected areas to enable the free movement of species.	http://www.bushheritage.org.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Flora	Collections database	Western Australian Herbarium	GPS points	Western Australia	Ongoing	The WA Herbarium and associated regional herbaria form a unique, dynamic, state-wide team that gathers, manages, researches and communicates information on the geography, systematics and biology of our unique and precious flora on behalf of the Western Australian community.	http://www.dec.wa.gov.au
Flora	Banksia Atlas	Western Australian Herbarium	GPS points	Western Australia	Dec 1990	A dataset comprised of volunteer surveying effort between the years 1984 to 1986. Level of detail included distribution, growth form, habitat and other biological details.	http://www.florabase.dec.wa.gov.au/
Flora	Declared Rare and Priority Flora List	Department of Environment and Conservation	GPS points	Western Australia	Ongoing	A database of ongoing surveying work detailing rare and priority flora points over Western Australia.	http://www.dec.wa.gov.au
Fauna	Atlas 2	Birds Australia	GPS points	Western Australia	Ongoing	Atlas data forms the basis for research such as The State of Australia's Birds Report. Since 1998 a dedicated band of over 7,000 atlassers have amassed over 420,000 surveys, comprising over 7.1 million bird records.	http://www.birdsaustralia.com.au
Fauna	Hooded Plover Nesting Sites	Birds Australia	GPS points	Western Australia	Ongoing	A database monitoring nesting sites and chick counts for the hooded plover.	http://www.birdsaustralia.com.au
Fauna	Threatened and Priority Fauna	Department of Environment and Conservation	GPS points	Western Australia	Ongoing	A database of ongoing surveying work detailing rare and priority fauna points over Western Australia.	http://www.dec.wa.gov.au
Fauna	Carnaby's Black Cockatoo Roosting Sites	Department of Environment and Conservation	GPS points	South-west Australia	Ongoing	A confidential database detailing known roosting sites throughout the south-west of Australia.	http://www.dec.wa.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Fauna	Carnaby's Black Cockatoo Breeding Site	Department of Environment and Conservation	GPS points	South-west Australia	Ongoing	A confidential database detailing known breeding sites throughout the south west of Australia.	http://www.dec.wa.gov.au
Fauna	Carnaby's Black Cockatoo Feeding Sites	Department of Environment and Conservation	GPS points	South-west Australia	June 2009	Broadly defined feeding sites, based on a variety of vegetation data surrogates. Data used includes Pre-European Vegetation, Tuart Woodlands, Vegetation Complexes and System 6 data (Heddle vegetation complexes) with data being clipped to a remnant vegetation and outputs cleaned to consider areas that have been lost to degradation, clearing, development and changing climatic conditions from the potential food sources.	http://www.dec.wa.gov.au
Fauna	Collections database (various)	Western Australian Museum	GPS points	Western Australia	Ongoing	A database collection for a wide variety of fauna for Western Australia.	http://www.museum.wa.gov.au/
Fauna	Western Swamp Tortoise Boundaries	Environmental Protection Authority	GPS points	South-west Australia	Ongoing	Boundaries showing the location of the Western Swamp Tortoise habitats in Western Australia.	http://www.epa.wa.gov.au
Vegetation	Pre-European Vegetation dataset	Department of Agriculture and Food, WA	1:250,000	Western Australia	Feb 2005	Comprehensive vegetation dataset based on J.S. Beard with mapping of the south-west corner compiled by A.J.M. Hopkins from various sources.	http://www.agric.wa.gov.au
Vegetation	Vegetation Extent Baseline dataset (remnant vegetation)	Department of Agriculture and Food, WA	Various	Western Australia	August 2008	A dataset containing vegetation extent polygons from the mapping of remnant vegetation in Western Australia.	http://www.agric.wa.gov.au
Vegetation	Biogeographic Regionalisation of Australia Boundaries (IBRA) version 6.1	Department of Sustainability, Environment, Water, Population and Communities	1:250,000	Australia-wide	Dec 2004	A landscape-based approach to classifying the land surface of Australia. Nominal attributes that make up IBRA are: climate, lithology/geology, landform, vegetation, flora and fauna, and land use.	http://www.environment.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Granite outcrops	Wetlands of the Wheatbelt	Department of Environment and Conservation	1:100,000	Avon Wheatbelt	Oct 2008	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as in a small area of the Rangelands to the east and the Darling Scarp to the west.	http://www.dec.wa.gov.au
Granite outcrops	Western Australia Granite Outcrop locations	Wikipedia	GPS points	Western Australia	Ongoing	The dataset includes all gazetted rocks, boulders, pinnacles, crags, needles, pillars, rock formations and tors in Western Australia, both inland and offshore. It does not include monoliths gazetted as mounts or hills, such as Mount Augustus.	http://en.wikipedia.org/wiki/Granite_outcrops_of_Western_Australia
Granite outcrops	Pre-European Vegetation dataset	Department of Agriculture and Food, WA	1:250,000	Western Australia	Feb 2005	Comprehensive vegetation dataset based on J.S. Beard, with mapping of the south-west corner compiled by A.J.M. Hopkins from various sources.	http://www.agric.wa.gov.au
Granite outcrops	Deformation Areas	Geoscience Australia	1:250,000	Australia-wide	Ongoing	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia. Deformation areas are a combination of distorted surfaces and outcrops.	http://www.ga.gov.au
South-facing slopes	GEODATA 9 Second DEM (DEM-9S) Version 3	Geoscience Australia	1:250,000	Australia-wide	June 2008	A gridded digital elevation model computed, using the ANUDEM elevation gridding program Version 5.2.2, from continent-wide topographic data including point elevations, streamlines, water body boundaries and cliff lines. The grid spacing is 9 seconds in longitude and latitude (approximately 250 metres).	http://www.ga.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
TECs and PECs	Threatened and Priority Ecological Community Sites	Department of Environment and Conservation	GPS point location within 100 m accuracy. Polygons manually determined.	Western Australia	Ongoing	Ecological communities throughout WA that are "Presumed Totally Destroyed", "Critically Endangered", "Endangered", "Vulnerable", "Priority 1-5", "Lower Risk" and "Not evaluated". Communities are based on various lifeforms, including plants, invertebrates and micro-organisms.	http://www.dec.wa.gov.au
Water bodies	Geomorphic Wetlands Darkan-Duranillin	Department of Environment and Conservation	1:25,000	Darkan to Duranillin	Mar 2010	The dataset displays the location, boundary and geomorphic classification of wetlands within Darkan to Duranillin. Wetlands in this dataset have been classified into types according to the geomorphic wetland classification system.	http://www.dec.wa.gov.au
Water bodies	Geomorphic Wetlands from Augusta to Walpole	Department of Environment and Conservation	1:25,000	Augusta to Walpole	Jun 2008	The dataset displays the location, boundary and geomorphic classification (wetland type) of wetlands from Augusta to Walpole.	http://www.dec.wa.gov.au
Water bodies	Geomorphic Wetlands of the Swan Coastal Plains	Department of Environment and Conservation	1:25,000	South Coastal Plains	Ongoing	The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.	http://www.dec.wa.gov.au
Water bodies	Wetlands of the Wheatbelt	Department of Environment and Conservation	1:100,000	Avon Wheatbelt	Oct 2008	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as in a small area of the Rangelands to the east and the Darling Scarp to the west.	http://www.dec.wa.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Water bodies	Rivers	Department of Water	1:100,000–250,000	Western Australia	Nov 2007	Major streamlines of WA, coded with hierarchy and names.	http://www.water.wa.gov.au/
Water bodies	Wild Rivers	Department of Water	1:250,000	Western Australia	Dec 2002	Catchments in Western Australia that have not been significantly altered by humans. These catchments are considered of very high environmental value, due to the undisturbed state, for their water quality and biodiversity	http://www.water.wa.gov.au/
Water bodies	Springs	Geoscience Australia	1:250,000	Australia-wide	June 2006	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia.	http://www.ga.gov.au
Water bodies	Lakes	Geoscience Australia	1:250,000	Australia-wide	June 2006	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia.	http://www.ga.gov.au
Water bodies	Water points	Geoscience Australia	1:250,000	Australia-wide	June 2006	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia.	http://www.ga.gov.au
Water bodies	Water holes	Geoscience Australia	1: 250 000	Australia-wide	June 2006	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia.	http://www.ga.gov.au
Water bodies	Caves	Geoscience Australia	1:250,000	Australia-wide	June 2006	A part of the Terrain data in the TOPO 250K Series 3 Topographic dataset issued by Geoscience Australia.	http://www.ga.gov.au
Water bodies: Listed	Ramsar wetlands	Department of Sustainability, Environment, Water, Population and Communities	1:25,000	Australia-wide	Mar 2007	Ramsar wetlands are those that are representative, rare or unique wetlands, or are important for conserving biological diversity. These are included on the List of Wetlands of International Importance developed under the Ramsar convention.	http://www.environment.gov.au

Used in SWAEI	Dataset name	Custodian	Scale	Coverage	End date	Abstract	URL link
Water bodies: Listed	Wetlands of National Significance: Directory of Important Wetlands in Australia (DIWA)	Department of Sustainability, Environment, Water, Population and Communities	1:250,000 (largely derived from GA Topo 250K Water bodies data)	Australia-wide	Oct 2008	The directory not only identifies nationally important wetlands, it provides a substantial knowledge base of what defines wetlands, their variety, and the many flora and fauna species that depend on them.	http://www.environment.gov.au
Water bodies: Listed	Environmental Protection (Swan Coastal Plain Lakes) Policy 1992	Environmental Protection Authority	1:50,000	South Coastal Plains	Dec 1992	Boundaries showing areas of environmental values for lakes on the Swan Coastal Plain. The policy made the filling, draining, excavating, polluting and clearing of these lakes an offence unless authorised by the EPA.	http://www.epa.wa.gov.au
Water bodies: Listed	Geomorphic Wetlands South Coastal Plains	Department of Environment and Conservation	1:25,000	South Coastal Plains	Ongoing	The dataset displays the location, boundary, geomorphic classification (wetland type) and management category of wetlands on the Swan Coastal Plain.	http://www.dec.wa.gov.au
Water bodies: Listed	Wetlands of the Wheatbelt	Department of Environment and Conservation	1:100,000	Avon Wheatbelt	Oct 2008	The data contained within the Basin Wetlands of the Wheatbelt and other prioritised areas mapping layer covers wetlands within most of the Wheatbelt region of south-western Western Australia, as well as in a small area of the Rangelands to the east and the Darling Scarp to the west.	http://www.dec.wa.gov.au
Vegetation connectivity	Vegetation Extent Baseline dataset (remnant vegetation)	Department of Agriculture and Food, WA	Various	Western Australia	August 2008	A dataset containing vegetation extent polygons from the mapping of remnant vegetation in Western Australia.	http://www.agric.wa.gov.au

APPENDIX 3. DATA SOURCES

Custodian	Dataset	How to obtain data
Birds Australia (Western Australia)	Hooded Plover Database	Apply to the Hooded Plover Project (Marcus Singor, msingor@iprimus.com.au)
Birds Australia (Western Australia)	Bird Atlas 2	Apply to Birds Australia (http://www.birdsaustralia.com.au/our-projects/atlas-birdata.html)
Department of Agriculture and Food WA	Native Vegetation Extent by Type	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Agriculture and Food WA	Pre-European Vegetation, WA	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	River Drainage	Apply to Species and Communities Branch, DEC
(Manager, Ken Atkins)		
Department of Environment and Conservation	Geomorphic wetland: Augusta to Walpole	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	Geomorphic wetland: Swan Coastal Plain	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	Ramsar Sites	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	South Coast Significant Wetlands	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	Wheatbelt wetlands	Apply to Wetlands, DEC (Adrian Pinder http://www.avonnaturaldiversity.org/index.php?option=com_content&task=view&id=26&Itemid=34)
Department of Environment and Conservation	DEC-managed Lands and Waters	https://www2.landgate.wa.gov.au/slip/portal/services/services.html
Department of Environment and Conservation	Threatened Ecological Communities	Apply to Species and Communities Branch, DEC (Ken Atkins, Manager)
Department of Environment and Conservation	Banksia Atlas	Apply for data at Species and Communities Branch, DEC (Manager, Ken Atkins)
Department of Environment and Conservation	Declared and Endangered Flora	Apply to Species and Communities Branch, DEC (Manager, Ken Atkins)
Department of Environment and Conservation	WA Herbarium data	Need to apply for data at Species and Communities Branch, DEC (Manager, Ken Atkins)
Department of Environment and Conservation	Threatened and Priority Fauna	Apply to Species and Communities Branch, DEC (Manager, Ken Atkins)
Department of Environment, Water, Heritage and the Arts	IBRA Regions 6.1	http://www.environment.gov.au/metadataexplorer/explorer.jsp
Department of Environment, Water, Heritage and the Arts	IBRA Subregions 6.1	http://www.environment.gov.au/metadataexplorer/explorer.jsp
Department of Environment, Water, Heritage and the Arts	National directory of Important Wetlands	http://www.environment.gov.au/metadataexplorer/explorer.jsp
Department of Indigenous Affairs	Aboriginal Heritage Site	http://www.dia.wa.gov.au/templates/ExistingSite/SD_X_SitesDownload.aspx
Department of Water	Rivers	Apply to GIS department (Bradley Tapping, GIS Officer, Spatial.Data@water.wa.gov.au)

Custodian	Dataset	How to obtain data
Department of Water	Wild Rivers	Apply to GIS department (Bradley Tapping, GIS Officer, Spatial.Data@water.wa.gov.au)
Department of Water	South Eastern Coast wetlands	Apply to GIS department (Bradley Tapping, GIS Officer, Spatial.Data@water.wa.gov.au)
Environmental Protection Authority	Western swamp tortoise misc areas	Apply to GIS department at EPA (Rodney Nowrojee, Manager of the EPA's Spatial Services, Rod.Nowrojee@dec.wa.gov.au)
Environmental Protection Authority	Western swamp tortoise policy boundaries	Apply to GIS department at EPA (Rodney Nowrojee, Manager of the EPA's Spatial Services, Rod.Nowrojee@dec.wa.gov.au)
Environmental Protection Authority	SCP lakes register	Apply to GIS department at EPA (Rodney Nowrojee, Manager of the EPA's Spatial Services, Rod.Nowrojee@dec.wa.gov.au)
Environmental Protection Authority	South-west Wetlands (EPP-1998) Ag Zone candidate areas	Apply to GIS department at EPA (Rodney Nowrojee, Manager of the EPA's Spatial Services, Rod.Nowrojee@dec.wa.gov.au)
Environmental Protection Authority	South-west Wetlands (EPP-1998) register boundaries	Apply to GIS department at EPA (Rodney Nowrojee, Manager of the EPA's Spatial Services, Rod.Nowrojee@dec.wa.gov.au)
Gaia Resources	Ecoregion Boundary (SWAEI boundary)	Apply to Gaia (enquiries@gaiaresources.com.au) or alternatively can be produced using the IBRA 6.1 regions
Gaia Resources	Ecoregion Boundary with 100 km buffer (clipped to coast)	Apply to Gaia (enquiries@gaiaresources.com.au) or alternatively can be produced using the IBRA 6.1 regions
Gaia Resources	Transitional Zone	Apply to Gaia (enquiries@gaiaresources.com.au) or alternatively can be produced using the IBRA 6.1 regions
Gaia Resources	Botanical province	Apply to Gaia (enquiries@gaiaresources.com.au) or alternatively can be produced using the IBRA 6.1 regions
Geoscience Australia	GEODATA 9 Second DEM and D8 (Digital Elevation Model Version 3 and Flow Direction Grid)	http://www.geoscience.gov.au/bin/mapserv36?map=/public/http/www/geoportal/gadds/gadds.map&mode=browse or order CD through Geoscience Australia (sales@ga.gov.au)
Geoscience Australia	GEODATA COAST 100K 2004	https://www.ga.gov.au/products/servlet/controller?event=PRODUCT_SELECTION&keyword=GEODATA+COAST+100K+2004
Geoscience Australia	GEODATA TOPO 250K Series 3 Topographic Data	Order CD from Geoscience Australia (sales@ga.gov.au)
Department of Environment and Conservation (Land Monitor)	Salinity extent and change data	Apply to Landgate (Ken Dawbin, ken.dawbin@landgate.wa.gov.au)
Landgate	Local Government Authority (LGA) Boundaries	https://www2.landgate.wa.gov.au/slip/portal/services/services.html

Custodian	Dataset	How to obtain data
OZ Coasts	Estuaries (near pristine)	http://www.ozcoasts.org.au/search_data/estuary_data.jsp (only in .csv form)
SCNRM	Dieback: Swan and Avon NRM Group	Apply to Project Dieback project manager (Lindy Twycross lindy.twyross@water.wa.gov.au)
SCNRM	Dieback: Northern Agriculture NRM Group	Apply to Project Dieback project manager (Lindy Twycross lindy.twyross@water.wa.gov.au)
SCNRM	Dieback: South Coast NRM Group	Apply to Project Dieback project manager (Lindy Twycross lindy.twyross@water.wa.gov.au)
SCNRM	Dieback: South West NRM Group	Apply to Project Dieback project manager (Lindy Twycross lindy.twyross@water.wa.gov.au)
WA Museum	Collection databases	Apply to the WA Museum collections and Research Facility (reception@museum.wa.gov.au)

APPENDIX 4. CONSERVATION FEATURE LIST, SHOWING TARGETS

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
Vegetation												
9000000	Vegetation	No data or other	Non remnant veg, water bodies, others	0.03	0.19	0.15			n/a	n/a	n/a	**1**
9010001	Vegetation	Tall forest A Avon Wheatbelt	Tall forest Karri	0.01	0.20	0.15				0.05	0.05	**1**
9010003	Vegetation	Medium forest A Avon Wheatbelt	Medium forest; jarrah-marri	7.95	24.37	0.15				0.05	0.05	**0.77**
9010004	Vegetation	Medium woodland A Avon Wheatbelt	Medium woodland; marri & wandoo	5.34	37.63	0.15				0.05	0.05	**1**
9010005	Vegetation	Medium woodland B Avon Wheatbelt	Medium woodland; wandoo & powderbark (*Eucalytpus accedens*)	91.01	179.51	0.15				0.05	0.05	**0.49**
9010007	Vegetation	Medium woodland D Avon Wheatbelt	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	170.23	1432.07	0.15				0.05	0.05	**1**
9010008	Vegetation	Medium woodland E Avon Wheatbelt	Medium woodland; salmon gum & gimlet	374.78	3568.66	0.15				0.05	0.05	**1**
9010013	Vegetation	Medium open woodland A Avon Wheatbelt	Medium open woodland; wandoo	0.67	2.39	0.15				0.05	0.05	**0.89**
9010025	Vegetation	Low woodland H Avon Wheatbelt	Low woodland; Allocasuarina huegeliana & York gum	21.20	89.62	0.15				0.05	0.05	**1**
9010027	Vegetation	Low woodland I Avon Wheatbelt	Low woodland; paperbark (*Melaleuca sp.*)	10.08	25.85	0.15				0.05	0.05	**0.64**
9010036	Vegetation	Shrublands Thicket A Avon Wheatbelt	Shrublands; thicket, acacia-casuarina alliance	671.52	3009.52	0.15				0.05	0.05	**1**
9010037	Vegetation	Shrublands Teatree A Avon Wheatbelt	Shrublands; teatree thicket	10.69	38.61	0.15				0.05	0.05	**0.9**
9010040	Vegetation	Shrublands Acacia B Avon Wheatbelt	Shrublands; acacia scrub, various species	6.12	13.90	0.15			0.05	0.05	0.05	**0.68**
9010047	Vegetation	Shrublands Other A Avon Wheatbelt	Shrublands; tallerack mallee-heath	16.87	37.37	0.15		0.65		0.05	0.05	**1**
9010048	Vegetation	Shrublands Scrub heath A Avon Wheatbelt	Shrublands; scrub-heath	14.19	34.16	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010049	Vegetation	Shrublands Mixed A Avon Wheatbelt	Shrublands; mixed heath	1.04	1.96	0.15				0.05	0.05	**0.47**
9010131	Vegetation	Mosaic A Avon Wheatbelt	Mosaic: Medium woodland; salmon gum & gimlet/shrublands; mallee scrub, redwood & black marlock	33.52	689.79	0.15		0.65		0.05	0.05	**1**
9010141	Vegetation	Medium woodland I Avon Wheatbelt	Medium woodland; York gum, salmon gum & gimlet	702.01	2513.74	0.15				0.05	0.05	**0.9**
9010142	Vegetation	Medium woodland J Avon Wheatbelt	Medium woodland; York gum & salmon gum	677.76	5616.40	0.15				0.05	0.05	**1**
9010145	Vegetation	Mosaic B Avon Wheatbelt	Mosaic: Medium woodland; York gum & salmon gum/shrublands; thicket, acacia-casuarina-melaleuca alliance	3.32	80.54	0.15				0.05	0.05	**1**
9010147	Vegetation	Succulent steppe with scrub A Avon Wheatbelt	Succulent steppe with scrub; acacia species over saltbush	35.72	42.85	0.15				0.05		**0.24**
9010221	Vegetation	Succulent steppe A Avon Wheatbelt	Succulent steppe; saltbush	54.38	54.40	0.15				0.05	0.05	**0.25**
9010314	Vegetation	Succulent steppe with open woodland A Avon Wheatbelt	Succulent steppe with open woodland; York gum over saltbush	12.75	12.75	0.15				0.05	0.05	**0.25**
9010325	Vegetation	Succulent steppe B Avon Wheatbelt	Succulent steppe; saltbush & samphire	76.71	81.25	0.15				0.05	0.05	**0.26**
9010352	Vegetation	Medium woodland M Avon Wheatbelt	Medium woodland; York gum	1098.87	6317.61	0.15				0.05	0.05	**1**
9010354	Vegetation	Shrublands Jam B Avon Wheatbelt	Shrublands; jam and Acacia rostellifera (+hakea) scrub with scattered York gum	57.49	917.73	0.15				0.05	0.05	**1**
9010355	Vegetation	Shrublands Bowgada D Avon Wheatbelt	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	39.65	66.57	0.15		0.65		0.05	0.05	**1**
9010356	Vegetation	Succulent steppe with open woodland B Avon Wheatbelt	Succulent steppe with open woodland; eucalypts over saltbush	28.50	43.30	0.15				0.05	0.05	**0.38**
9010358	Vegetation	Shrublands Bowgada E Avon Wheatbelt	Shrublands; bowgada & *Acacia quadrimarginea* on stony ridges	2.19	2.74	0.15				0.05	0.05	**0.31**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010365	Vegetation	Shrublands Bowgada J Avon Wheatbelt	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	0.23	4.17	0.15		0.65		0.05	0.05	**1**
9010374	Vegetation	Shrublands Bowgada K Avon Wheatbelt	Shrublands; bowgada scrub with scattered York gum	22.52	49.30	0.15				0.05	0.05	**0.55**
9010380	Vegetation	Shrublands Scrub heath D Avon Wheatbelt	Shrublands; scrub-heath on sandplain	23.03	228.14	0.15		0.65			0.05	**1**
9010385	Vegetation	Shrublands Bowgada L Avon Wheatbelt	Shrublands; bowgada & jam scrub with scattered York gum	3.36	15.48	0.15				0.05	0.05	**1**
9010392	Vegetation	Shrublands Melaeuca E Avon Wheatbelt	Shrublands; *Melaeuca thyioides* thicket	1.67	13.91	0.15				0.05	0.05	**1**
9010404	Vegetation	Shrublands Bowgada M Avon Wheatbelt	Shrublands; bowgada & *Acacia murrayana* scrub	2.57	3.29	0.15				0.05	0.05	**0.32**
9010412	Vegetation	Succulent steppe with scrub D Avon Wheatbelt	Succulent steppe with scrub; teatree (*Melaleuca thyioides*) over samphire	1.21	3.89	0.15				0.05	0.05	**0.8**
9010413	Vegetation	Shrublands Acacia O Avon Wheatbelt	Shrublands; *Acacia neurophylla & A. spp.* thicket	0.87	3.75	0.15				0.05	0.05	**1**
9010419	Vegetation	Shrublands Bowgada N Avon Wheatbelt	Shrublands; bowgada, jam and *Melaleuca uncinata* thicket	61.12	101.85	0.15				0.05	0.05	**0.42**
9010420	Vegetation	Shrublands Bowgada O Avon Wheatbelt	Shrublands; bowgada & jam scrub	154.51	450.79	0.15				0.05	0.05	**0.73**
9010435	Vegetation	Shrublands Acacia T Avon Wheatbelt	Shrublands; *Acacia neurophylla, A. beauverdiana* & *A. resinomarginea* thicket	287.96	2560.27	0.15				0.05	0.05	**1**
9010437	Vegetation	Shrublands Mixed C Avon Wheatbelt	Shrublands; mixed acacia thicket on sandplain	1437.42	1750.93	0.15					0.05	**0.24**
9010438	Vegetation	Shrublands Other E Avon Wheatbelt	Shrublands; dodonaea scrub	1.54	3.30	0.15					0.05	**0.43**
9010495	Vegetation	Shrublands Thicket C Avon Wheatbelt	Shrublands; thicket, jam & *Allocasuarina acutivalvis* on ironstone	84.93	84.93	0.15				0.05	0.05	**0.25**
9010511	Vegetation	Medium woodland V Avon Wheatbelt	Medium woodland; salmon gum & morrel	119.94	966.50	0.15					0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010516	Vegetation	Shrublands Mallee J Avon Wheatbelt	Shrublands; mallee scrub, black marlock	0.14	2.61	0.15		0.65		0.05	0.05	**1**
9010519	Vegetation	Shrublands Mallee K Avon Wheatbelt	Shrublands; mallee scrub, *Eucalyptus eremophila*	46.64	117.93	0.15		0.65		0.05	0.05	**1**
9010536	Vegetation	Medium woodland ZA Avon Wheatbelt	Medium woodland; morrell & rough-fruited mallee (*Eucalyptus corrugata*)	39.46	111.71	0.15	0.65				0.05	**1**
9010538	Vegetation	Shrublands Acacia W Avon Wheatbelt	Shrublands; *Acacia brachystachya* scrub	0.60	7.88	0.15				0.05	0.05	**1**
9010551	Vegetation	Shrublands Allocasuarina A Avon Wheatbelt	Shrublands; *Allocasuarina campestris* thicket	407.04	2581.68	0.15					0.05	**1**
9010552	Vegetation	Shrublands Casuarina A Avon Wheatbelt	Shrublands; *Casuarina acutivalvus* & *calothamnus* (also *melalueca*) thicket on greenstone hills	112.95	114.64	0.15				0.05	0.05	**0.25**
9010631	Vegetation	Succulent steppe with woodland D Avon Wheatbelt	Succulent steppe with woodland and thicket; York gum over *Melaleuca thyoides* & samphire	586.36	1048.21	0.15				0.05	0.05	**0.45**
9010676	Vegetation	Succulent steppe F Avon Wheatbelt	Succulent steppe; samphire	257.78	1249.68	0.15				0.05	0.05	**1**
9010684	Vegetation	Mosaic ZI AvonWheatbelt	Mosaic: Shrublands; Shrublands; jam scrub with scattered York gum in the valleys/*Allocasuarina campestris* thicket	336.07	2135.66	0.15				0.05	0.05	**1**
9010686	Vegetation	Medium woodland ZD Avon Wheatbelt	Medium woodland; York gum & red mallee	40.26	90.70	0.15	0.65			0.05	0.05	**1**
9010687	Vegetation	Shrublands Bowgada P Avon Wheatbelt	Shrublands; bowgada & jam scrub with scattered *Allocasuarina heugelliana* & York gum	97.90	378.82	0.15				0.05	0.05	**0.97**
9010691	Vegetation	Shrublands Other G Avon Wheatbelt	Shrublands; *Dryandra quercifolia & Eucalytpus spp*. thicket	9.40	100.11	0.15				0.05	0.05	**1**
9010692	Vegetation	Shrublands Casuarina B Avon Wheatbelt	Shrublands; casuarina & melaleuca thicket	16.93	28.80	0.15				0.05	0.05	**0.43**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010693	Vegetation	Mosaic ZJ Avon Wheatbelt	Mosaic: Low woodland: *Allocasuarina heugeliana* over mallee and acacia scrub/Allocasuarina campestris thicket	32.27	43.96	0.15	0.65			0.05	0.05	**1**
9010694	Vegetation	Shrublands Scrub heath G Avon Wheatbelt	Shrublands; scrub-heath on yellow sandplain banksia-xylomelum alliance in the Geraldton Sandplain & Avon Wheatbelt Regions	128.63	1727.49	0.15		0.65		0.05	0.05	**1**
9010695	Vegetation	Shrublands Allocasuarina B Avon Wheatbelt	Shrublands; *Allocasuarina campestris* scrub	0.90	6.58	0.15				0.05	0.05	**1**
9010696	Vegetation	Shrublands Casuarina C Avon Wheatbelt	Shrublands; casuarina & dryandra thicket with wandoo & powderbark wandoo	8.92	26.49	0.15			0.05	0.05	0.05	**0.89**
9010697	Vegetation	Shrublands Scrub heath H Avon Wheatbelt	Shrublands; scrub-heath on lateritic sandplain in the southern Geraldton Sandplain Region	211.29	1055.26	0.15		0.65		0.05	0.05	**1**
9010698	Vegetation	Mosaic ZK Avon Wheatbelt	Mosaic: Shrublands; scrub-heath dryandra-calothamnus association with Banksia prionotes on limestone in the northern Swan Region/sparse low woodland; wandoo & powderbark wandoo	21.30	113.44	0.15		0.65		0.05	0.05	**1**
9010931	Vegetation	Medium woodland ZE Avon Wheatbelt	Medium woodland; yate	7.30	15.51	0.15				0.05	0.05	**0.53**
9010936	Vegetation	Medium woodland ZF Avon Wheatbelt	Medium woodland; salmon gum	1.85	19.42	0.15				0.05	0.05	**1**
9010945	Vegetation	Mosaic ZO Avon Wheatbelt	Mosaic: Medium woodland; salmon gum /shrublands; mallee scrub, redwood & black marlock	40.19	355.00	0.15		0.65		0.05	0.05	**1**
9010946	Vegetation	Medium woodland ZH Avon Wheatbelt	Medium woodland; wandoo	81.91	433.20	0.15				0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010947	Vegetation	Medium woodland ZI Avon Wheatbelt	Medium woodland; powderbark & mallet	124.38	340.33	0.15				0.05	0.05	**0.68**
9010948	Vegetation	Medium woodland ZJ Avon Wheatbelt	Medium woodland; York gum & river gum	4.43	14.41	0.15				0.05	0.05	**0.81**
9010949	Vegetation	Low woodland Z Avon Wheatbelt	Low woodland; banksia	12.88	49.73	0.15				0.05	0.05	**0.97**
9010950	Vegetation	Medium woodland ZK Avon Wheatbelt	Medium woodland; *Casuarina obesa*	2.87	4.97	0.15				0.05	0.05	**0.43**
9010951	Vegetation	Succulent steppe with sparse woodland and thicket A Avon Wheatbelt	Succulent steppe with sparse woodland & thicket; York gum & Kondinin blackbutt over teatree thicket & samphire	202.11	275.08	0.15				0.05	0.05	**0.34**
9010952	Vegetation	Shrublands Other H Avon Wheatbelt	Shrublands; dryandra heath	60.57	192.58	0.15				0.05	0.05	**0.79**
9010953	Vegetation	Succulent steppe with thicket A Avon Wheatbelt	Succulent steppe with thicket; teatree over samphire (m5)	7.48	23.62	0.15				0.05	0.05	**0.79**
9010954	Vegetation	Shrublands Thicket D Avon Wheatbelt	Shrublands; thicket, jam & *Allocasuarina huegelliana*	16.16	65.02	0.15				0.05	0.05	**1**
9010955	Vegetation	Mosaic ZP Avon Wheatbelt	Mosaic: Shrublands; scrub-heath (South East Avon)/shrublands; *Allocasuarina campestris* thicket	123.93	1211.42	0.15		0.65		0.05	0.05	**1**
9010956	Vegetation	Shrublands Allocasuarina C Avon Wheatbelt	Shrublands; *Allocasuarina campestris* thicket with scattered wandoo	31.15	255.56	0.15				0.05	0.05	**1**
9010959	Vegetation	Succulent steppe with sparse woodland and thicket B Avon Wheatbelt	Succulent steppe with sparse woodland & thicket; yorrell & Kondinin blackbutt over teatree & samphire	19.53	48.53	0.15				0.05	0.05	**0.62**
9010960	Vegetation	Shrublands Mallee P Avon Wheatbelt	Shrublands; mallee scrub, redwood & black marlock	8.59	86.07	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9010961	Vegetation	Mosaic ZQ Avon Wheatbelt	Mosaic: shrublands; scrub-heath (South East Avon)/Shrublands; *Allocasuarina campestris* thicket	3.08	16.62	0.15		0.65		0.05	0.05	**1**
9010962	Vegetation	Medium woodland ZL Avon Wheatbelt	Medium woodland; mallet (*Eucalytpus astringens*)	0.05	0.62	0.15				0.05	0.05	**1**
9010963	Vegetation	Medium woodland ZM Avon Wheatbelt	Medium woodland; yate & paperbark (*Melaleuca spp.*)	14.64	40.19	0.15				0.05	0.05	**0.69**
9010967	Vegetation	Medium woodland ZO Avon Wheatbelt	Medium woodland; wandoo & yate	114.48	768.67	0.15				0.05	0.05	**1**
9010968	Vegetation	Medium woodland ZP Avon Wheatbelt	Medium woodland; jarrah, marri & wandoo	2.03	8.92	0.15				0.05	0.05	**1**
9010976	Vegetation	Succulent steppe with low woodland B Avon Wheatbelt	Succulent steppe with low woodland; myoporum over samphire	9.13	19.03	0.15				0.05		**0.42**
9010986	Vegetation	Shrublands Mallee T Avon Wheatbelt	Shrublands; mallee-heath (Stirling Range)	0.36	2.60	0.15		0.65		0.05	0.05	**1**
9010988	Vegetation	Succulent steppe with thicket B Avon Wheatbelt	Succulent steppe with thicket; *Melaleuca thyoides* over samphire	267.13	942.67	0.15				0.05	0.05	**0.88**
9011004	Vegetation	Mosaic ZV Avon Wheatbelt	Mosaic: medium open woodland wandoo & shrublands mixed heath	25.63	81.10	0.15				0.05	0.05	**0.79**
9011022	Vegetation	Succulent steppe with woodland F Avon Wheatbelt	Succulent steppe with woodland; *Casuarina obesa & samphire*	1.91	4.56	0.15				0.05	0.05	**0.6**
9011023	Vegetation	Medium woodland ZZA Avon Wheatbelt	Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*)	1666.36	15254.49	0.15				0.05	0.05	**1**
9011024	Vegetation	Shrublands Mallee V Avon Wheatbelt	Shrublands; mallee & casuarina thicket	728.79	7391.95	0.15		0.65		0.05	0.05	**1**
9011025	Vegetation	Mosaic ZZD Avon Wheatbelt	Mosaic: medium woodland; York gum, salmon gum & morrel/Succulent steppe; saltbush & samphire	11.49	19.20	0.15				0.05	0.05	**0.42**
9011031	Vegetation	Mosaic ZZG Avon Wheatbelt	Mosaic: shrublands; hakea scrub-heath/Shrublands; dryandra heath	0.98	4.11	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9011041	Vegetation	Low woodland ZF Avon Wheatbelt	Low woodland; *Allocasuarina huegeliana* & jam	15.56	47.81	0.15				0.05		**0.61**
9011042	Vegetation	Succulent steppe with low woodland C Avon Wheatbelt	Succulent steppe with low woodland; sheoak over samphire	0.54	2.69	0.15				0.05	0.05	**1**
9011044	Vegetation	Mosaic ZZK Avon Wheatbelt	Mosaic: medium woodland; York gum & salmon gum/shrublands; *Melaleuca thyioides* thicket	0.22	8.18	0.15				0.05	0.05	**1**
9011046	Vegetation	Succulent steppe with woodland G Avon Wheatbelt	Succulent steppe with woodland; York gum & samphire	0.84	8.62	0.15				0.05	0.05	**1**
9011048	Vegetation	Mosaic ZZL Avon Wheatbelt	Mosaic: shrublands; melaleuca patchy scrub/succulent steppe; samphire	81.50	138.15	0.15				0.05	0.05	**0.42**
9011049	Vegetation	Medium woodland ZZF Avon Wheatbelt	Medium woodland; wandoo, York gum, salmon gum, morrel & gimlet	620.71	8333.85	0.15				0.05	0.05	**1**
9011053	Vegetation	Shrublands Melaeuca I Avon Wheatbelt	Shrublands; *Melaleuca uncinata* thicket with scattered York gum	44.69	138.23	0.15				0.05	0.05	**0.77**
9011055	Vegetation	Shrublands York Gum B Avon Wheatbelt	Shrublands; York gum & *Eucalyptus sheathiana* mallee scrub	149.12	1268.06	0.15		0.65		0.05	0.05	**1**
9011056	Vegetation	Shrublands Thicket E Avon Wheatbelt	Shrublands; thicket, acacia & Allocasuarina campestris	40.54	210.73	0.15				0.05	0.05	**1**
9011057	Vegetation	Mosaic ZZM Avon Wheatbelt	Mosaic: shrublands; Medium woodland; salmon gum & gimlet/York gum & Eucalyptus sheathiana mallee scrub	143.83	1453.11	0.15		0.65		0.05	0.05	**1**
9011058	Vegetation	Shrublands York Gum C Avon Wheatbelt	Shrublands; York gum & Eucalyptus gonglocarpa mallee scrub	2.64	93.63	0.15		0.65				**1**
9011059	Vegetation	Mosaic ZZN Avon Wheatbelt	Mosaic: medium woodland; salmon gum & gimlet/shrublands; mallee Eucalyptus longicornis & E. sheathiana scrub	0.10	22.60	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9011061	Vegetation	Mosaic ZZO Avon Wheatbelt	Mosaic: medium sparse woodland; salmon gum & yorrell/succulent steppe; saltbush & samphire	179.46	427.47	0.15				0.05	0.05	**0.6**
9011062	Vegetation	Succulent steppe with open woodland C Avon Wheatbelt	Succulent steppe with open woodland & thicket; York gum over *Melaleuca thyiodes* & samphire	101.25	225.27	0.15						**0.33**
9011063	Vegetation	Medium-Low woodland A Avon Wheatbelt	Medium-low woodland; York gum & cypress pine (*Callitris columellaris*)	3.36	3.36	0.15				0.05	0.05	**0.25**
9011065	Vegetation	Mosaic ZZP Avon Wheatbelt	Mosaic: shrublands; medium woodland; wandoo & gimlet/York gum & *Eucalyptus sheathiana* mallee scrub	4.48	8.63	0.15		0.65		0.05	0.05	**1**
9011067	Vegetation	Medium woodland ZZG Avon Wheatbelt	Medium woodland; salmon gum, morrel, gimlet & rough-fruited mallee	41.41	60.28	0.15	0.65			0.05	0.05	**1**
9011068	Vegetation	Medium woodland ZZH Avon Wheatbelt	Medium woodland; salmon gum, morrel, gimlet & *Eucalyptus sheathiana*	339.71	753.48	0.15				0.05	0.05	**0.55**
9011073	Vegetation	Medium woodland ZZI Avon Wheatbelt	Medium woodland; wandoo & mallet	59.79	143.14	0.15				0.05	0.05	**0.6**
9011074	Vegetation	Succulent steppe with open woodland D Avon Wheatbelt	Succulent steppe with open woodland & thicket; wandoo & *Allocasuarina obesa* over teatree & samphire	25.90	46.25	0.15				0.05	0.05	**0.45**
9011075	Vegetation	Shrublands Mallee X Avon Wheatbelt	Shrublands; mallee scrub, *Eucalyptus eremophila* & black marlock (*Eucalyptus redunca*)	12.48	89.36	0.15		0.65		0.05	0.05	**1**
9011077	Vegetation	Medium woodland ZZJ Avon Wheatbelt	Medium woodland; jarrah & river gum	10.11	13.92	0.15				0.05	0.05	**0.34**
9011080	Vegetation	Succulent steppe with malle and thickets A Avon Wheatbelt	Succulent steppe with malle & thickets; mallee and *Melaleuca uncinata* thickets on salt flats	6.79	39.51	0.15	0.65			0.05	0.05	**1**
9011081	Vegetation	Shrublands Mallee Y Avon Wheatbelt	Shrublands; mallee scrub, *Eucalyptus longicornis* & *E. sheathiana*	26.75	151.48	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9011083	Vegetation	Succulent steppe with open woodland E Avon Wheatbelt	Succulent steppe with open woodland & scrub; wandoo, salmon gum & *Allocasuarina obesa* over teatree & samphire	37.12	103.80	0.15				0.05	0.05	**0.7**
9011085	Vegetation	Medium woodland ZZL Avon Wheatbelt	Medium woodland; wandoo & blue mallet (*Euclayptus gardneri*)	79.43	517.87	0.15				0.05	0.05	**1**
9011087	Vegetation	Medium woodland ZZM Avon Wheatbelt	Medium woodland; wandoo, morrell & blue mallet	2.57	7.53	0.15				0.05	0.05	**0.73**
9011088	Vegetation	Medium woodland ZZN Avon Wheatbelt	Medium woodland; mallet & blue mallet	1.45	3.95	0.15				0.05	0.05	**0.68**
9011091	Vegetation	Low woodland ZG Avon Wheatbelt	Low woodland; banksia prionotes & *Allocasuarina huegeliana*	2.93	7.16	0.15				0.05	0.05	**0.61**
9011092	Vegetation	Medium woodland ZZO Avon Wheatbelt	Medium woodland; wandoo, York gum & morrell	82.48	779.52	0.15				0.05	0.05	**1**
9011093	Vegetation	Succulent steppe with open woodland F Avon Wheatbelt	Succulent steppe with open woodland & thicket; eucalypts & *Allocasuarina obesa* over teatree & samphire	16.29	71.77	0.15				0.05	0.05	**1**
9011094	Vegetation	Mosaic ZZS Avon Wheatbelt	Mosaic: medium woodland; York gum & salmon gum/shrublands; mallee scrub, *Eucalyptus eremophila* & black marlock	5.68	51.18	0.15		0.65		0.05	0.05	**1**
9011095	Vegetation	Medium woodland ZZP Avon Wheatbelt	Medium woodland; York gum, yate & salmon gum	1.33	3.74	0.15				0.05	0.05	**0.71**
9011143	Vegetation	Shrublands Allocasuarina D Avon Wheatbelt	Shrublands; *Allocasuarina campestris* thicket with patches of heath	41.71	654.58	0.15				0.05	0.05	**1**
9011147	Vegetation	Shrublands Scrub heath J Avon Wheatbelt	Shrublands; scrub-heath in the south-east Avon-Wheatbelt Region	39.83	428.55	0.15		0.65		0.05		**1**
9011149	Vegetation	Shrublands Scrub heath L Avon Wheatbelt	Shrublands; scrub-heath acacia-ecdeiocolia association in the south-east Geraldton Sandplain Region	0.30	4.94	0.15		0.65		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9011154	Vegetation	Shrublands Acacia ZC Avon Wheatbelt	Shrublands; Acacia thicket with patches of heath	36.00	390.49	0.15				0.05	0.05	**1**
9011155	Vegetation	Mosaic ZZZ Avon Wheatbelt	Mosaic: medium woodland; York gum/shrublands; *Allocasuarina campestris* thicket	29.91	78.12	0.15				0.05	0.05	**0.65**
9011156	Vegetation	Shrublands Allocasuarina E Avon Wheatbelt	Shrublands; *Allocasuarina campestris* thickets with scattered jam & casuarina	3.36	17.30	0.15				0.05		**1**
9011164	Vegetation	Mosaic ZZZB Avon Wheatbelt	Mosaic: shrublands; scrub-heath on sandplain (banksia-xylomelum alliance) in the Geraldton Sandplain & Avon Wheatbelt Regions/shrublands; *Allocasuarina campestris* thicket	0.51	20.08	0.15		0.65		0.05	0.05	**1**
9011198	Vegetation	Mosaic ZZZC Avon Wheatbelt	Mosaic: succulent steppe with thicket; *Melaleuca thyiodes* over samphire/ shrublands; bowgada open scrub	87.55	105.05	0.15					0.05	**0.24**
9011271	Vegetation	Bare Areas F Avon Wheatbelt	Bare areas; claypans	4.95	8.36	0.15				0.05	0.05	**0.42**
9011413	Vegetation	Shrublands Acacia ZE Avon Wheatbelt	Shrublands; acacia, casuarina & melaleuca thicket	1383.58	5486.06	0.15				0.05	0.05	**0.99**
9011967	Vegetation	Medium woodland ZZZA Avon Wheatbelt	Medium woodland; wandoo, yate & river gum	77.07	255.01	0.15				0.05	0.05	**0.83**
9012047	Vegetation	Shrublands Other N Avon Wheatbelt	Shrublands; tamma & dryandra thicket	9.21	14.63	0.15				0.05	0.05	**0.4**
9012048	Vegetation	Shrublands Scrub heath N Avon Wheatbelt	Shrublands; scrub-heath in the Mallee Region	4.28	23.32	0.15		0.65		0.05	0.05	**1**
9012081	Vegetation	Shrublands Bowgada Q Avon Wheatbelt	Shrublands; bowgada and associated spp. scrub	20.09	124.76	0.15				0.05	0.05	**1**
9012093	Vegetation	Succulent steppe with open woodland G Avon Wheatbelt	Succulent steppe with open woodland & scrub; yate over teatree & samphire	45.63	94.17	0.15				0.05	0.05	**0.52**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9013041	Vegetation	Mosaic ZZZG Avon Wheatbelt	Mosaic: low woodland; *Allocasuarina huegeliana* & jam around granite rocks	17.96	63.74	0.15					0.05	**0.71**
9020018	Vegetation	Low woodland A Carnarvon	Low woodland; mulga (*Acacia aneura*)	9.52	9.52	0.15						**0.15**
9020043	Vegetation	Low Forest B Carnarvon	Low forest; mangroves (Kimberley) or thicket; mangroves (Pilbara)	6.64	9.67	0.15					0.05	**0.29**
9020112	Vegetation	Hummock grasslands F Carnarvon	Hummock grasslands, shrub steppe; *Acacia ligulata* over *Triodia plurinervata*	200.12	201.02	0.15						**0.15**
9020127	Vegetation	Bare Areas C Carnarvon	Bare areas; mud flats	16.80	17.73	0.15						**0.16**
9020129	Vegetation	Bare Areas E Carnarvon	Bare areas; drift sand	3.23	3.23	0.15					0.05	**0.2**
9020160	Vegetation	Shrublands Snakewood A Carnarvon	Shrublands; snakewood & *Acacia victoriae* scrub	35.87	35.87	0.15						**0.15**
9020184	Vegetation	Shrublands Mulga C Carnarvon	Shrublands; mulga & bowgada scrub	102.14	102.14	0.15						**0.15**
9020200	Vegetation	Mosaic C Carnarvon	Mosaic: low woodland over scrub; mulga over bowgada scrub/ shrublands; bowgada & grevillea scrub on sandhills	23.31	23.31	0.15					0.05	**0.2**
9020205	Vegetation	Shrublands Acacia D Carnarvon	Shrublands; *Acacia sclerosperma* & bowgada scrub	2415.15	2415.15	0.15						**0.15**
9020206	Vegetation	Shrublands Bowgada A Carnarvon	Shrublands; bowgada & grevillea scrub	102.72	102.72	0.15					0.05	**0.2**
9020208	Vegetation	Mosaic D Carnarvon	Mosaic: shrublands; *Acacia sclerosperma* & bowgada scrub/ shrublands; bowgada & grevillea scrub	284.98	284.98	0.15					0.05	**0.2**
9020209	Vegetation	Shrublands Acacia E Carnarvon	Shrublands; *Acacia sclerosperma* & minnieritchie scrub	140.76	140.76	0.15					0.05	**0.2**
9020221	Vegetation	Succulent steppe A Carnarvon	Succulent steppe; saltbush	154.48	154.60	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9020224	Vegetation	Shrublands Other C Carnarvon	Shrublands; waterwood & *Acacia victoriae* scrub	823.68	823.68	0.15						**0.15**
9020226	Vegetation	Mosaic F Carnarvon	Mosaic: shrublands; *Acacia sclerosperma* & bowgada scrub/ succulent steppe; samphire	60.75	60.75	0.15						**0.15**
9020229	Vegetation	Mosaic G Carnarvon	Mosaic: shrublands; bowgada and associated spp. scrub/shrublands; bowgada & grevillea scrub	80.54	80.54	0.15					0.05	**0.2**
9020242	Vegetation	Succulent steppe with scrub B Carnarvon	Succulent steppe with scrub; snakewood over saltbush	23.96	23.96	0.15					0.05	**0.2**
9020243	Vegetation	Shrublands Bowgada B Carnarvon	Shrublands; bowgada & minnieritchie scrub	1081.97	1081.97	0.15						**0.15**
9020244	Vegetation	Shrublands Acacia G Carnarvon	Shrublands; *Acacia sclerosperma* & *A. victoriae* scrub	43.97	43.97	0.15					0.05	**0.2**
9020245	Vegetation	Mosaic H Carnarvon	Mosaic: shrublands; bowgada & minnieritchie scrub/succulent steppe; saltbush & bluebush	21.57	21.57	0.15						**0.15**
9020246	Vegetation	Hummock grasslands H Carnarvon	Hummock grasslands, low tree steppe; *Eucalyptus dongarraensis* & *E. foecunda* over *Triodia plurinervata*	144.90	144.90	0.15						**0.15**
9020269	Vegetation	Low woodland O Carnarvon	Low woodland over scrub; mulga over bowgada scrub	0.68	0.68	0.15					0.05	**0.2**
9020283	Vegetation	Shrublands Acacia I Carnarvon	Shrublands; *Acacia sclerosperma,* bowgada & *A. victoriae* scrub	470.96	470.96	0.15					0.05	**0.2**
9020342	Vegetation	Mosaic P Carnarvon	Mosaic: low woodland; waterwood/ Shrublands; *Acacia sclerosperma* & bowgada scrub	293.30	293.30	0.15					0.05	**0.2**
9020344	Vegetation	Mosaic Q Carnarvon	Mosaic: shrublands; bowgada scrub and associated spp./shrublands; *Acacia sclerosperma*, bowgada & *A. victoriae* scrub	248.12	248.12	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9020346	Vegetation	Mosaic R Carnarvon	Mosaic: shrublands; *Acacia sclerosperma, A. victoriae* & snakewood scrub/shrublands; patches of low mixed scrub	509.02	509.02	0.15					0.05	**0.2**
9020347	Vegetation	Mosaic S Carnarvon	Mosaic: shrublands; *Acacia sclerosperma, A. victoriae* & snakewood scrub patches/succulent steppe; bluebush	697.95	697.95	0.15						**0.15**
9020349	Vegetation	Mosaic T Carnarvon	Mosaic: shrublands; bowgada scrub with scattered mulga/shrublands; bowgada & grevillea scrub	794.00	794.00	0.15					0.05	**0.2**
9020676	Vegetation	Succulent steppe F Carnarvon	Succulent steppe; samphire	126.91	126.91	0.15					0.05	**0.2**
9021101	Vegetation	Shrublands Acacia Y Carnarvon	Shrublands; *Acacia ligulata x rostellifera* thicket	139.87	139.87	0.15						**0.15**
9021103	Vegetation	Shrublands Acacia Z Carnarvon	Shrublands; acacia & lamarchea thicket	169.49	169.49	0.15						**0.15**
9021105	Vegetation	Hummock grasslands S Carnarvon	Hummock grasslands, grass steppe; spinifex *Triodia plurinervata*	4.26	4.26	0.15					0.05	**0.2**
9021271	Vegetation	Bare Areas F Carnarvon	Bare areas; claypans	55.20	55.20	0.15					0.05	**0.2**
9021322	Vegetation	Shrublands Acacia ZD Carnarvon	Shrublands; *Acacia sclerosperma, A. victoriae* & snakewood scrub	130.88	130.88	0.15					0.05	**0.2**
9022081	Vegetation	Shrublands Bowgada Q Carnarvon	Shrublands; bowgada and associated spp. scrub	8183.27	8184.21	0.15						**0.15**
9023432	Vegetation	Mosaic ZZZH Carnarvon	Mosaic: low woodland; waterwood/ shrublands; *Acacia sclerosperma, A. victoriae* & *A. subtressarogona* scrub	69.11	69.11	0.15				0.05	0.05	**0.25**
9030008	Vegetation	Medium woodland E Coolgardie	Medium woodland; salmon gum & gimlet	2754.93	2801.45	0.15				0.05	0.05	**0.25**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030009	Vegetation	Medium woodland F Coolgardie	Medium woodland; coral gum (*Eucalyptus torquata*) & goldfields blackbutt (*E. le soufii*), (also some e10,11)	2351.62	2405.09	0.15					0.05	**0.2**
9030010	Vegetation	Medium woodland G Coolgardie	Medium woodland red mallee group	329.48	329.48	0.15	0.65				0.05	**0.85**
9030018	Vegetation	Low woodland A Coolgardie	Low woodland; mulga (*Acacia aneura*)	159.74	159.74	0.15					0.05	**0.2**
9030019	Vegetation	Low woodland B Coolgardie	Low woodland; mulga between sandridges	102.20	102.20	0.15					0.05	**0.2**
9030020	Vegetation	Low woodland C Coolgardie	Low woodland; mulga mixed with *Allocasuarina cristata* & *Eucalyptus sp.*	99.17	99.17	0.15					0.05	**0.2**
9030024	Vegetation	Low woodland G Coolgardie	Low woodland; *Allocasuarina cristata*	144.63	144.63	0.15						**0.15**
9030025	Vegetation	Low woodland H Coolgardie	Low woodland; *Allocasuarina huegeliana* & York gum	46.98	46.98	0.15						**0.15**
9030036	Vegetation	Shrublands Thicket A Coolgardie	Shrublands; thicket, acacia-casuarina alliance	8.70	8.70	0.15				0.05		**0.2**
9030039	Vegetation	Shrublands Mulga A Coolgardie	Shrublands; mulga scrub	1.39	1.39	0.15					0.05	**0.2**
9030040	Vegetation	Shrublands Acacia B Coolgardie	Shrublands; acacia scrub, various species	16.75	16.75	0.15					0.05	**0.2**
9030109	Vegetation	Hummock grasslands D Coolgardie	Hummock grasslands, shrub steppe; *Eucalyptus youngiana* over hard spinifex	2647.53	2647.53	0.15					0.05	**0.2**
9030110	Vegetation	Hummock grasslands E Coolgardie	Hummock grasslands, shrub steppe; red mallee over spinifex, *Triodia scariosa*	46.72	46.91	0.15	0.65				0.05	**0.85**
9030123	Vegetation	Succulent steppe with open low woodland C Coolgardie	Succulent steppe with open low woodland; sheoak over saltbush & bluebush	89.02	90.90	0.15				0.05	0.05	**0.26**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030141	Vegetation	Medium woodland I Coolgardie	Medium woodland; York gum, salmon gum & gimlet	8596.00	8836.04	0.15					0.05	**0.21**
9030142	Vegetation	Medium woodland J Coolgardie	Medium woodland; York gum & salmon gum	1158.10	1158.10	0.15						**0.15**
9030144	Vegetation	Medium woodland K Coolgardie	Medium woodland; wandoo, salmon gum, morrel, gimlet & rough-fruited mallee	39.88	39.88	0.15	0.65			0.05	0.05	**0.9**
9030147	Vegetation	Succulent steppe with scrub A Coolgardie	Succulent steppe with scrub; acacia species over saltbush	308.93	311.93	0.15						**0.15**
9030148	Vegetation	Medium woodland L Coolgardie	Medium woodland; gimlet	3.20	3.20	0.15					0.05	**0.2**
9030202	Vegetation	Shrublands Mulga E Coolgardie	Shrublands; mulga & *Acacia quadrimarginea* scrub	60.69	60.69	0.15					0.05	**0.2**
9030214	Vegetation	Mosaic E Coolgardie	Mosaic: medium woodland; goldfield eucalypts/succulent steppe with open low woodland; myoporum over saltbush	156.93	156.93	0.15				0.05	0.05	**0.25**
9030221	Vegetation	Succulent steppe A Coolgardie	Succulent steppe; saltbush	196.32	198.04	0.15						**0.15**
9030256	Vegetation	Low woodland M Coolgardie	Low woodland; York gum, and cypress pine (adjacent to e6pMLi)	35.77	35.77	0.15				0.05		**0.2**
9030314	Vegetation	Succulent steppe with open woodland A Coolgardie	Succulent steppe with open woodland; York gum over saltbush	51.19	51.19	0.15					0.05	**0.2**
9030352	Vegetation	Medium woodland M Coolgardie	Medium woodland; York gum	5.13	5.13	0.15				0.05	0.05	**0.25**
9030435	Vegetation	Shrublands Acacia T Coolgardie	Shrublands; *Acacia neurophylla, A. beauverdiana* & *A. resinomarginea* thicket	7305.80	7385.47	0.15						**0.15**
9030436	Vegetation	Shrublands Mixed B Coolgardie	Shrublands; mixed acacia thickets in thickets of acacia-casuarina-melaleuca alliance	10.59	10.59	0.15				0.05	0.05	**0.25**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030437	Vegetation	Shrublands Mixed C Coolgardie	Shrublands; mixed acacia thicket on sandplain	3143.18	3143.18	0.15						**0.15**
9030441	Vegetation	Succulent steppe with open low woodland F Coolgardie	Succulent steppe with open low woodland; mulga & sheoak over bluebush	22.14	22.14	0.15					0.05	**0.2**
9030460	Vegetation	Succulent steppe E Coolgardie	Succulent steppe; bluebush with saltbush in depressions	30.99	31.58	0.15						**0.15**
9030461	Vegetation	Succulent steppe with open low woodland G Coolgardie	Succulent steppe with open low woodland; *Acacia papyrocarpa* over bluebush	3.56	3.56	0.15					0.05	**0.2**
9030467	Vegetation	Mosaic Z Coolgardie	Mosaic: medium woodland; salmon gum & gimlet/hummock grasslands, mallee steppe; red mallee over spinifex, *Triodia scariosa*	2823.79	2823.79	0.15	0.65				0.05	**0.85**
9030468	Vegetation	Medium woodland N Coolgardie	Medium woodland; salmon gum & goldfields blackbutt	5800.15	5881.35	0.15						**0.15**
9030480	Vegetation	Succulent steppe with open low woodland H Coolgardie	Succulent steppe with open low woodland; mulga & sheoak over saltbush	376.85	376.85	0.15					0.05	**0.2**
9030481	Vegetation	Mosaic ZA Coolgardie	Mosaic: medium woodland; salmon gum & red mallee/hummock grasslands, mallee steppe; red mallee over spinifex, *Triodia scariosa*	8096.99	8096.99	0.15	0.65				0.05	**0.85**
9030482	Vegetation	Medium woodland O Coolgardie	Medium woodland; merrit & red mallee	12915.55	12915.55	0.15	0.65				0.05	**0.85**
9030484	Vegetation	Shrublands Jam C Coolgardie	Shrublands; jam thicket	11.61	11.61	0.15					0.05	**0.2**
9030486	Vegetation	Mosaic ZB Coolgardie	Mosaic: medium woodland; salmon gum & red mallee/shrublands; mallee scrub *Eucalyptus eremophila*	843.64	843.64	0.15		0.65			0.05	**0.85**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030487	Vegetation	Medium woodland P Coolgardie	Medium woodland; redwood & red mallee (*Eucalyptus oleosa*)	4986.11	4986.11	0.15	0.65					**0.8**
9030488	Vegetation	Mosaic ZC Coolgardie	Mosaic: medium woodland; gimlet/ shrublands; mallee scrub, *Eucalyptus eremophila*	379.94	379.94	0.15		0.65			0.05	**0.85**
9030489	Vegetation	Mosaic ZD Coolgardie	Mosaic: medium woodland; goldfields blackbutt & Dundas blackbutt/ shrublands; dodonaea scrub	786.04	786.04	0.15					0.05	**0.2**
9030491	Vegetation	Medium woodland Q Coolgardie	Medium woodland; morrel & Dundas blackbutt (*E. dundasii*)	671.68	671.68	0.15					0.05	**0.2**
9030500	Vegetation	Mosaic ZE Coolgardie	Mosaic: medium woodland; merrit & red mallee/shrublands; dodonaea scrub	989.41	989.41	0.15		0.65			0.05	**0.85**
9030501	Vegetation	Medium woodland T Coolgardie	Medium woodland; goldfields blackbutt	438.06	439.39	0.15					0.05	**0.2**
9030502	Vegetation	Medium woodland U Coolgardie	Medium woodland; goldfields blackbutt & red mallee	327.37	327.95	0.15	0.65					**0.8**
9030504	Vegetation	Low woodland V Coolgardie	Low woodland; mulga & red mallee	401.17	401.30	0.15	0.65					**0.8**
9030505	Vegetation	Low woodland W Coolgardie	Low woodland; *Allocasuarina cristata* & eucalypts	78.47	78.47	0.15					0.05	**0.2**
9030506	Vegetation	Succulent steppe with woodland B Coolgardie	Succulent steppe with woodland; salmon gum & bluebush	981.87	981.87	0.15						**0.15**
9030507	Vegetation	Succulent steppe with woodland C Coolgardie	Succulent steppe with woodland; salmon gum & saltbush	90.83	90.83	0.15					0.05	**0.2**
9030508	Vegetation	Succulent steppe with open scrub K Coolgardie	Succulent steppe with open scrub; scattered mulga over saltbush	186.35	186.35	0.15					0.05	**0.2**
9030509	Vegetation	Succulent steppe with woodland A Coolgardie	Succulent steppe with woodland; gimlet & saltbush	1455.88	1455.88	0.15				0.05	0.05	**0.25**
9030511	Vegetation	Medium woodland V Coolgardie	Medium woodland; salmon gum & morrel	4365.91	4650.22	0.15					0.05	**0.21**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030513	Vegetation	Mosaic ZF Coolgardie	Mosaic: medium woodland; salmon gum & Dundas blackbutt/shrublands; mallee scrub, *Eucalyptus eremophila*	158.86	158.86	0.15		0.65			0.05	**0.85**
9030519	Vegetation	Shrublands Mallee K Coolgardie	Shrublands; mallee scrub, *Eucalyptus eremophila*	1429.99	1429.99	0.15		0.65		0.05	0.05	**0.9**
9030520	Vegetation	Shrublands Acacia V Coolgardie	Shrublands; Acacia quadrimarginea thicket	371.13	371.29	0.15						**0.15**
9030521	Vegetation	Medium woodland W Coolgardie	Medium woodland; salmon gum & red mallee	900.20	900.20	0.15	0.65				0.05	**0.85**
9030522	Vegetation	Medium woodland X Coolgardie	Medium woodland; redwood (*Eucalyptus transcontinentalis*) & merrit (*E. floctoniae*)	6892.10	6896.74	0.15					0.05	**0.2**
9030524	Vegetation	Medium woodland Y Coolgardie	Medium woodland; Dundas blackbutt & red mallee	3257.90	3258.08	0.15	0.65					**0.8**
9030525	Vegetation	Mosaic ZH Coolgardie	Mosaic: medium woodland; salmon gum & gimlet/medium woodland; merrit & red mallee	2363.85	2363.85	0.15	0.65				0.05	**0.85**
9030529	Vegetation	Succulent steppe with open low woodland I Coolgardie	Succulent steppe with open low woodland; mulga & sheoak over bluebush	403.77	403.77	0.15				0.05	0.05	**0.25**
9030535	Vegetation	Medium woodland Z Coolgardie	Medium woodland; rough-fruited mallee on greenstone hills	235.87	243.46	0.15	0.65				0.05	**0.88**
9030536	Vegetation	Medium woodland ZA Coolgardie	Medium woodland; morrell & rough-fruited mallee (*Eucalyptus corrugata*)	17.68	20.07	0.15	0.65			0.05		**0.96**
9030537	Vegetation	Medium woodland ZB Coolgardie	Medium woodland; morrel (*Eucalyptus longicornis*)	5.40	7.01	0.15				0.05	0.05	**0.32**
9030538	Vegetation	Shrublands Acacia W Coolgardie	Shrublands; *Acacia brachystachya* scrub	1249.07	1278.05	0.15					0.05	**0.2**
9030540	Vegetation	Succulent steppe with open low woodland J Coolgardie	Succulent steppe with open low woodland; sheoak over saltbush	734.76	756.57	0.15					0.05	**0.21**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9030542	Vegetation	Shrublands Mallee L Coolgardie	Shrublands; mallee scrub marble gum (*Eucalypus gonglocarpa*)	48.90	48.90	0.15		0.65		0.05	0.05	**0.9**
9030551	Vegetation	Shrublands Allocasuarina A Coolgardie	Shrublands; *Allocasuarina campestris* thicket	267.57	312.63	0.15					0.05	**0.23**
9030552	Vegetation	Shrublands Casuarina A Coolgardie	Shrublands; *Casuarina acutivalvus* & *calothamnus* (also melalueca) thicket on greenstone hills	60.57	60.57	0.15					0.05	**0.2**
9030554	Vegetation	Low woodland Y Coolgardie	Low woodland over scrub; *Allocasuarina cristata* over bowgada scrub	10.17	10.17	0.15					0.05	**0.2**
9030555	Vegetation	Hummock grasslands O Coolgardie	Hummock grasslands, mallee steppe; red mallee over spinifex, *Triodia scariosa*	347.20	348.75	0.15	0.65				0.05	**0.85**
9030676	Vegetation	Succulent steppe F Coolgardie	Succulent steppe; samphire	1170.74	1170.74	0.15					0.05	**0.2**
9030936	Vegetation	Medium woodland ZF Coolgardie	Medium woodland; salmon gum	5843.05	5867.44	0.15					0.05	**0.2**
9030941	Vegetation	Mosaic ZM Coolgardie	Mosaic: medium woodland; salmon gum & morrel/shrublands; mallee scrub, redwood	108.22	108.22	0.15		0.65			0.05	**0.85**
9030946	Vegetation	Medium woodland ZH Coolgardie	Medium woodland; wandoo	7.86	7.86	0.15					0.05	**0.2**
9031024	Vegetation	Shrublands Mallee V Coolgardie	Shrublands; mallee & casuarina thicket	22.52	37.55	0.15		0.65		0.05	0.05	**1**
9031063	Vegetation	Medium-Low woodland A Coolgardie	Medium-low woodland; York gum & cypress pine (*Callitris columellaris*)	1624.18	1721.46	0.15					0.05	**0.21**
9031067	Vegetation	Medium woodland ZZG Coolgardie	Medium woodland; salmon gum, morrel, gimlet & rough-fruited mallee	92.44	92.44	0.15	0.65			0.05	0.05	**0.9**
9031068	Vegetation	Medium woodland ZZH Coolgardie	Medium woodland; salmon gum, morrel, gimlet & *Eucalyptus sheathiana*	1018.98	1935.51	0.15					0.05	**0.38**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9031071	Vegetation	Succulent steppe with scrub E Coolgardie	Succulent steppe with scrub; acacia species over saltbush & bluebush	7.62	7.62	0.15						**0.15**
9031078	Vegetation	Medium woodland ZZK Coolgardie	Medium woodland; salmon gum, redwood, merrit, gimlet & *Eucalyptus sheathiana*	7.57	7.57	0.15				0.05	0.05	**0.25**
9031148	Vegetation	Shrublands Scrub heath K Coolgardie	Shrublands; scrub-heath in the Coolgardie Region	2520.99	2549.49	0.15		0.65			0.05	**0.86**
9031241	Vegetation	Succulent steppe G Coolgardie	Succulent steppe; bluebush	103.89	104.79	0.15				0.05		**0.2**
9031271	Vegetation	Bare Areas F Coolgardie	Bare areas; claypans	0.00	0.52	0.15					0.05	**1**
9031294	Vegetation	Medium woodland ZZZ Coolgardie	Medium woodland; coral gum	60.47	62.96	0.15				0.05	0.05	**0.26**
9031413	Vegetation	Shrublands Acacia ZE Coolgardie	Shrublands; acacia, casuarina & melaleuca thicket	10403.64	10593.18	0.15					0.05	**0.2**
9032009	Vegetation	Medium woodland ZZZB Coolgardie	Medium woodland; redwood & goldfields blackbutt	68.78	70.58	0.15					0.05	**0.21**
9032048	Vegetation	Shrublands Scrub heath N Coolgardie	Shrublands; scrub-heath in the Mallee Region	36.13	36.13	0.15		0.65			0.05	**0.85**
9032901	Vegetation	Mosaic ZZZF Coolgardie	Mosaic: medium woodland; *Allocasuarina cristata* & goldfields blackbutt; shrublands; *Acacia quadrimarginea* thicket	344.51	360.12	0.15				0.05	0.05	**0.26**
9033106	Vegetation	Medium woodland ZZZE Coolgardie	Medium woodland; salmon gum & Dundas blackbutt	515.79	526.61	0.15				0.05	0.05	**0.26**
9040008	Vegetation	Medium woodland E Esperance	Medium woodland; salmon gum & gimlet	0.44	4.59	0.15				0.05	0.05	**1**
9040027	Vegetation	Low woodland I Esperance	Low woodland; paperbark (*Melaleuca sp.*)	6.79	17.26	0.15						**0.38**
9040031	Vegetation	Shrublands Melaeuca A Esperance	Shrublands; *Melaleuca thyoides* thicket with scattered York gum	2.09	2.21	0.15			0.05	0.05		**0.26**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9040038	Vegetation	Shrublands Thicket B Esperance	Shrublands; thicket, mixed	24.44	24.44	0.15			0.05	0.05	0.05	**0.3**
9040041	Vegetation	Shrublands Teatree B Esperance	Shrublands; teatree scrub	22.61	63.07	0.15					0.05	**0.56**
9040050	Vegetation	Shrublands Other B Esperance	Shrublands; dwarf scrub on granite (south coast)	45.21	55.15	0.15					0.05	**0.24**
9040051	Vegetation	Sedgeland A Esperance	Sedgeland; reed swamps, occasionally with heath	5.32	5.80	0.15			0.05	0.05	0.05	**0.33**
9040129	Vegetation	Bare Areas E Esperance	Bare areas; drift sand	183.28	324.53	0.15			0.05	0.05	0.05	**0.53**
9040142	Vegetation	Medium woodland J Esperance	Medium woodland; York gum & salmon gum	3.51	26.82	0.15				0.05	0.05	**1**
9040352	Vegetation	Medium woodland M Esperance	Medium woodland; York gum	68.69	228.17	0.15				0.05	0.05	**0.83**
9040423	Vegetation	Shrublands Acacia P Esperance	Shrublands; acacia scrub-heath (unknown spp.)	29.97	34.83	0.15		0.45	0.05	0.05	0.05	**0.87**
9040468	Vegetation	Medium woodland N Esperance	Medium woodland; salmon gum & goldfields blackbutt	0.00	0.00	0.15						**0.23**
9040479	Vegetation	Shrublands Mallee F Esperance	Shrublands; mallee-heath (Nuytsland)	292.97	296.87	0.15		0.45				**0.61**
9040522	Vegetation	Medium woodland X Esperance	Medium woodland; redwood (*Eucalyptus transcontinentalis*) & merrit (*E. floctoniae*)	0.00	0.00	0.15						**0.15**
9040552	Vegetation	Shrublands Casuarina A Esperance	Shrublands; *Casuarina acutivalvus* & *calothamnus* (also melalueca) thicket on greenstone hills	31.49	32.39	0.15				0.05	0.05	**0.26**
9040676	Vegetation	Succulent steppe F Esperance	Succulent steppe; samphire	0.77	4.27	0.15			0.05	0.05		**1**
9040691	Vegetation	Shrublands Other G Esperance	Shrublands; *Dryandra quercifolia* & *Eucalytpus spp.* thicket	346.94	354.89	0.15				0.05	0.05	**0.26**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9040800	Vegetation	Grasslands B Esperance	Grasslands, high grass savanna woodland; stringybark & woolybutt over (upland) tall grass & curly spinifex	0.49	3.53	0.15				0.05	0.05	**1**
9040929	Vegetation	Low Forest D Esperance	Low forest; moort (*Eucalytpus platypus*)	31.63	41.40	0.15				0.05	0.05	**0.33**
9040931	Vegetation	Medium woodland ZE Esperance	Medium woodland; yate	104.95	214.99	0.15			0.05	0.05	0.05	**0.61**
9040936	Vegetation	Medium woodland ZF Esperance	Medium woodland; salmon gum	2.81	7.30	0.15				0.05	0.05	**0.65**
9040938	Vegetation	Medium woodland ZG Esperance	Medium woodland; York gum & yate	122.47	410.23	0.15			0.05	0.05	0.05	**1**
9040940	Vegetation	Mosaic ZL Esperance	Mosaic: shrublands; mallee scrub, black marlock/shrublands; tallerack mallee-heath	1111.48	2615.93	0.15		0.45	0.05	0.05	0.05	**1**
9040942	Vegetation	Mosaic ZN Esperance	Mosaic: medium woodland; yate/ shrublands; mallee scrub, black marlock	81.40	216.07	0.15		0.45		0.05	0.05	**1**
9040964	Vegetation	Shrublands Mallee Q Esperance	Shrublands; mallee scrub, black marlock & *Eucalyptus decipiens*	15.45	33.59	0.15		0.45	0.05	0.05	0.05	**1**
9040965	Vegetation	Medium woodland ZN Esperance	Medium woodland; jarrah & marri	32.44	68.03	0.15			0.05	0.05	0.05	**0.63**
9040967	Vegetation	Medium woodland ZO Esperance	Medium woodland; wandoo & yate	28.25	80.68	0.15			0.05	0.05	0.05	**0.86**
9040968	Vegetation	Medium woodland ZP Esperance	Medium woodland; jarrah, marri & wandoo	171.07	173.43	0.15			0.05	0.05	0.05	**0.3**
9040970	Vegetation	Low Forest E Esperance	Low forest; jarrah & *Eucalyptus decipiens*	14.00	14.00	0.15			0.05			**0.2**
9040975	Vegetation	Low woodland ZA Esperance	Low woodland; jarrah	115.87	123.80	0.15			0.05	0.05	0.05	**0.32**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9040976	Vegetation	Succulent steppe with low woodland B Esperance	Succulent steppe with low woodland; myoporum over samphire	2.61	4.19	0.15				0.05		**0.32**
9040980	Vegetation	Shrublands Mallee S Esperance	Shrublands; jarrah mallee-heath	704.58	1604.26	0.15		0.45	0.05	0.05	0.05	**1**
9040982	Vegetation	Low woodland ZB Esperance	Low woodland; *Eucalyptus decipiens*	8.15	15.85	0.15				0.05	0.05	**0.49**
9040986	Vegetation	Shrublands Mallee T Esperance	Shrublands; mallee-heath (Stirling Range)	158.96	301.40	0.15		0.45	0.05	0.05	0.05	**1**
9040987	Vegetation	Medium woodland ZT Esperance	Medium woodland; jarrah & wandoo	8.02	8.95	0.15			0.05	0.05	0.05	**0.33**
9040989	Vegetation	Shrublands Other I Esperance	Shrublands; Albany blackbutt, mallee-heath	76.95	90.18	0.15		0.45	0.05	0.05	0.05	**0.88**
9040991	Vegetation	Medium woodland ZU Esperance	Medium woodland; small wandoo patches surrounded by other eucalypt woodlands (e2, 5Mi; e5, 7Mi)	2.71	3.05	0.15			0.05			**0.23**
9040992	Vegetation	Medium forest B Esperance	Medium forest; jarrah & wandoo (*Eucalyptus wandoo*)	6.79	6.79	0.15			0.05			**0.2**
9040995	Vegetation	Shrublands Mallee U Esperance	Shrublands; mallee scrub, bushy yate & Bald Island marlock	30.61	31.17	0.15		0.45	0.05	0.05	0.05	**0.76**
9041047	Vegetation	Shrublands Other J Esperance	Shrublands; *Eucalyptus incrassata* mallee-heath	1862.68	2190.41	0.15		0.45	0.05	0.05	0.05	**0.88**
9042048	Vegetation	Shrublands Scrub heath N Esperance	Shrublands; scrub-heath in the Mallee Region	11.34	12.38	0.15		0.45		0.05	0.05	**0.76**
9044048	Vegetation	Shrublands Scrub heath P Esperance	Shrublands; scrub-heath in the Esperence Plains including Mt Ragged scrub-heath	195.04	392.16	0.15		0.45	0.05	0.05	0.05	**1**
9044801	Vegetation	Shrublands Other O Esperance	Shrublands; heath with scattered *Nuytsia floribunda* on sandplain	63.22	581.96	0.15			0.05	0.05	0.05	**1**
9045048	Vegetation	Shrublands Banksia A Esperance	Shrublands; banksia and lambertia scrub-heath in the Esperence Plains Region	9.51	317.89	0.15		0.45		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9046048	Vegetation	Shrublands Banksia B Esperance	Shrublands; banksia scrub-heath on sandplain in the Esperence Plains Region	151.54	1139.94	0.15		0.45	0.05	0.05	0.05	**1**
9047048	Vegetation	Shrublands Banksia C Esperance	Shrublands; banksia scrub-heath on coastal plain in the Esperence Plains Region	1062.59	1346.24	0.15		0.45	0.05	0.05	0.05	**0.95**
9050004	Vegetation	Medium woodland A Geraldton Sandplains	Medium woodland; marri & wandoo	21.00	53.95	0.15				0.05	0.05	**0.64**
9050007	Vegetation	Medium woodland D Geraldton Sandplains	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	15.27	41.93	0.15				0.05	0.05	**0.69**
9050017	Vegetation	Shrublands Acacia A Geraldton Sandplains	Shrublands; *Acacia rostellifera* thicket	445.96	540.78	0.15			0.05	0.05	0.05	**0.36**
9050035	Vegetation	Shrublands Jam A Geraldton Sandplains	Shrublands; jam scrub with scattered York gum	297.26	1845.02	0.15				0.05	0.05	**1**
9050036	Vegetation	Shrublands Thicket A Geraldton Sandplains	Shrublands; thicket, acacia-casuarina alliance	844.40	1220.27	0.15				0.05	0.05	**0.36**
9050048	Vegetation	Shrublands Scrub heath A Geraldton Sandplains	Shrublands; scrub-heath	0.14	14.44	0.15		0.65		0.05		**1**
9050049	Vegetation	Shrublands Mixed A Geraldton Sandplains	Shrublands; mixed heath	140.99	397.19	0.15				0.05	0.05	**0.7**
9050129	Vegetation	Bare Areas E Geraldton Sandplains	Bare areas; drift sand	27.85	64.74	0.15				0.05	0.05	**0.58**
9050142	Vegetation	Medium woodland J Geraldton Sandplains	Medium woodland; York gum & salmon gum	9.10	82.10	0.15				0.05	0.05	**1**
9050254	Vegetation	Shrublands Melaeuca B Geraldton Sandplains	Shrublands; *Melaleuca uncinata* thicket with scattered wandoo & powderbark wandoo	1.53	3.60	0.15					0.05	**0.47**
9050255	Vegetation	Shrublands Mallee B Geraldton Sandplains	Shrublands; mallee scrub, *Eucalyptus dongarrensis*	30.15	30.64	0.15		0.65			0.05	**0.86**
9050325	Vegetation	Succulent steppe B Geraldton Sandplains	Succulent steppe; saltbush & samphire	10.73	44.55	0.15				0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9050351	Vegetation	Shrublands Mallee C Geraldton Sandplains	Shrublands; mallee & acacia scrub with scattered York gum & red mallee	4.12	84.03	0.15		0.65		0.05	0.05	**1**
9050352	Vegetation	Medium woodland M Geraldton Sandplains	Medium woodland; York gum	40.11	197.27	0.15				0.05	0.05	**1**
9050353	Vegetation	Shrublands Mallee D Geraldton Sandplains	Shrublands; mallee & acacia scrub with scattered York gum	68.44	973.71	0.15		0.65		0.05	0.05	**1**
9050354	Vegetation	Shrublands Jam B Geraldton Sandplains	Shrublands; jam and *Acacia rostellifera* (+hakea) scrub with scattered York gum	0.19	1.46	0.15				0.05	0.05	**1**
9050359	Vegetation	Shrublands Acacia J Geraldton Sandplains	Shrublands; acacia & banksia scrub	104.08	444.18	0.15				0.05	0.05	**1**
9050360	Vegetation	Shrublands Bowgada F Geraldton Sandplains	Shrublands; bowgada scrub with scattered mulga	0.83	0.83	0.15						**0.15**
9050364	Vegetation	Shrublands Bowgada I Geraldton Sandplains	Shrublands; bowgada scrub with scattered eucalypts & cypress pine	9.33	9.33	0.15						**0.15**
9050365	Vegetation	Shrublands Bowgada J Geraldton Sandplains	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	108.63	138.31	0.15		0.65		0.05	0.05	**1**
9050371	Vegetation	Low Forest C Geraldton Sandplains	Low forest; *Acacia rostellifera*	32.00	328.08	0.15				0.05	0.05	**1**
9050372	Vegetation	Mosaic V Geraldton Sandplains	Mosaic: shrublands; scrub-heath on deep sandy flats/shrublands; thicket, acacia-casuarina alliance	317.09	820.84	0.15		0.65		0.05	0.05	**1**
9050377	Vegetation	Mosaic W Geraldton Sandplains	Mosaic: shrublands; scrub-heath on limestone in the northern Swan Region/sparse low woodland; illyarrie	614.94	631.00	0.15		0.65		0.05	0.05	**0.92**
9050378	Vegetation	Shrublands Scrub heath B Geraldton Sandplains	Shrublands; scrub-heath with scattered *Banksia spp, Eucalyptus todtiana* & *Xylomelum angustifolium* on deep sandy flats in the Geraldton Sandplain Region	600.41	951.09	0.15		0.65	0.05	0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9050379	Vegetation	Shrublands Scrub heath C Geraldton Sandplains	Shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region	1275.51	5477.37	0.15		0.65	0.05	0.05	0.05	**1**
9050380	Vegetation	Shrublands Scrub heath D Geraldton Sandplains	Shrublands; scrub-heath on sandplain	3239.09	5111.52	0.15		0.65		0.05	0.05	**1**
9050383	Vegetation	Shrublands Acacia K Geraldton Sandplains	Shrublands; *Acacia rostellifera* scrub-heath	52.94	53.12	0.15		0.65		0.05	0.05	**0.9**
9050385	Vegetation	Shrublands Bowgada L Geraldton Sandplains	Shrublands; bowgada & jam scrub with scattered York gum	22.06	163.77	0.15				0.05	0.05	**1**
9050386	Vegetation	Low woodland R Geraldton Sandplains	Low woodland; York gum	22.62	22.62	0.15						**0.15**
9050387	Vegetation	Shrublands Melaeuca C Geraldton Sandplains	Shrublands; *Melaleuca cardiophylla* thicket	69.11	82.14	0.15					0.05	**0.24**
9050391	Vegetation	Shrublands Melaeuca D Geraldton Sandplains	Shrublands; *Melaeuca uncinata* thicket	16.24	30.63	0.15				0.05	0.05	**0.47**
9050392	Vegetation	Shrublands Melaeuca E Geraldton Sandplains	Shrublands; *Melaeuca thyioides* thicket	13.30	16.78	0.15				0.05	0.05	**0.32**
9050393	Vegetation	Shrublands Melaeuca F Geraldton Sandplains	Shrublands; Melaleuca thyoides thicket with scattered *Casuarina* obesa	45.18	50.05	0.15				0.05	0.05	**0.28**
9050401	Vegetation	Mosaic X Geraldton Sandplains	Mosaic: shrublands; scrub-heath on coastal association on yellow sandplain/shrublands; acacia patchy scrub	327.27	327.27	0.15		0.65				**0.8**
9050402	Vegetation	Shrublands Other D Geraldton Sandplains	Shrublands; heath on coastal limestone	513.64	514.71	0.15				0.05	0.05	**0.25**
9050403	Vegetation	Shrublands Acacia L Geraldton Sandplains	Shrublands; *Acacia ligulata* scrub-heath	111.06	115.37	0.15		0.65				**0.83**
9050405	Vegetation	Shrublands Acacia M Geraldton Sandplains	Shrublands; *Acacia sclerosperma,* bowgada & jam scrub	3.92	4.98	0.15				0.05	0.05	**0.32**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9050407	Vegetation	Low woodland S Geraldton Sandplains	Low woodland over scrub; *Allocasuarina heugeliana* over jam scrub	318.07	318.07	0.15				0.05	0.05	**0.25**
9050408	Vegetation	Shrublands Scrub heath F Geraldton Sandplains	Shrublands; scrub-heath on coastal association, yellow sandplain	1495.77	3285.27	0.15		0.65		0.05	0.05	**1**
9050412	Vegetation	Succulent steppe with scrub D Geraldton Sandplains	Succulent steppe with scrub; teatree (*Melaleuca thyioides*) over samphire	5.20	39.39	0.15				0.05	0.05	**1**
9050413	Vegetation	Shrublands Acacia O Geraldton Sandplains	Shrublands; *Acacia neurophylla* & *A. sp.* thicket	3.69	17.48	0.15				0.05	0.05	**1**
9050420	Vegetation	Shrublands Bowgada O Geraldton Sandplains	Shrublands; bowgada & jam scrub	12.35	17.09	0.15				0.05	0.05	**0.35**
9050424	Vegetation	Shrublands York Gum A Geraldton Sandplains	Shrublands; York gum mallee scrub	27.85	27.85	0.15		0.65		0.05	0.05	**0.9**
9050431	Vegetation	Shrublands Acacia Q Geraldton Sandplains	Shrublands; Acacia rostellifera open scrub	47.09	59.87	0.15				0.05	0.05	**0.32**
9050432	Vegetation	Shrublands Acacia R Geraldton Sandplains	Shrublands; *Acacia rostellifera* & Melaleuca cardiophylla thicket	50.27	56.36	0.15					0.05	**0.22**
9050433	Vegetation	Mosaic Y Geraldton Sandplains	Mosaic: shrublands; *Acacia rostellifera* & *Melaleuca cardiophylla* thicket/sparse low woodland; illyarrie	141.43	324.60	0.15				0.05	0.05	**0.57**
9050440	Vegetation	Shrublands Acacia U Geraldton Sandplains	Shrublands; *Acacia ligulata* open scrub	26.28	39.08	0.15				0.05	0.05	**0.37**
9050551	Vegetation	Shrublands Allocasuarina A Geraldton Sandplains	Shrublands; *Allocasuarina campestris* thicket	15.19	84.54	0.15				0.05	0.05	**1**
9050619	Vegetation	Medium woodland ZC Geraldton Sandplains	Medium woodland; river gum (*Eucalyptus camaldulensis*)	0.82	1.55	0.15				0.05		**0.37**
9050631	Vegetation	Succulent steppe with woodland D Geraldton Sandplains	Succulent steppe with woodland and thicket; York gum over *Melaleuca thyoides* & samphire	18.53	20.32	0.15				0.05	0.05	**0.27**
9050675	Vegetation	Shrublands Mixed D GeraldtonSandPlains	Shrublands; mixed thicket (melaluca & hakea)	133.84	518.51	0.15				0.05	0.05	**0.97**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9050687	Vegetation	Shrublands Bowgada P Geraldton Sandplains	Shrublands; bowgada & jam scrub with scattered *Allocasuarina heugeliana* & York gum	45.45	143.51	0.15				0.05	0.05	**0.79**
9050694	Vegetation	Shrublands Scrub heath G Geraldton Sandplains	Shrublands; scrub-heath on yellow sandplain banksia-xylomelum alliance in the Geraldton Sandplain & Avon Wheatbelt Regions	555.78	1737.44	0.15		0.65		0.05	0.05	**1**
9050696	Vegetation	Shrublands Casuarina C Geraldton Sandplains	Shrublands; casuarina & dryandra thicket with wandoo & powderbark wandoo	2.51	3.96	0.15				0.05	0.05	**0.39**
9050697	Vegetation	Shrublands Scrub heath H GeraldtonSandPlains	Shrublands; scrub-heath on lateritic sandplain in the southern Geraldton Sandplain Region	339.42	674.08	0.15		0.65		0.05	0.05	**1**
9050748	Vegetation	Shrublands Melaeuca G Geraldton Sandplains	Shrublands; *Melaleuca thyoides* thicket with scattered river gum	2.94	3.42	0.15						**0.17**
9050772	Vegetation	Shrublands Acacia X Geraldton Sandplains	Shrublands; *Acacia lasiocarpa* & *Melaleuca acerosa* heath	45.70	48.08	0.15					0.05	**0.21**
9050936	Vegetation	Medium woodland ZF Geraldton Sandplains	Medium woodland; salmon gum	1.67	9.18	0.15				0.05	0.05	**1**
9050946	Vegetation	Medium woodland ZH Geraldton Sandplains	Medium woodland; wandoo	8.01	29.80	0.15				0.05	0.05	**0.93**
9050988	Vegetation	Succulent steppe with thicket B Geraldton Sandplains	Succulent steppe with thicket; *Melaleuca thyoides* over samphire	8.85	8.86	0.15				0.05	0.05	**0.25**
9050999	Vegetation	Medium woodland ZX Geraldton Sandplains	Medium woodland; marri	4.44	9.59	0.15				0.05	0.05	**0.54**
9051026	Vegetation	Mosaic ZZE Geraldton Sandplains	Mosaic: shrublands; *Acacia rostellifera, A. cyclops* (in the south) & *Melaleuca cardiophylla* (in the north) thicket/shrublands; *Acacia lasiocarpa* & *Melaleuca acerosa* heath	105.66	114.01	0.15				0.05	0.05	**0.27**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9051029	Vegetation	Shrublands Scrub heath I Geraldton Sandplains	Shrublands; scrub-heath dryandra-calothamnus association with banksia prionotes on limestone in the northern Swan Region	20.31	25.91	0.15		0.65		0.05	0.05	**1**
9051030	Vegetation	Low woodland ZD Geraldton Sandplains	Low woodland; *Banksia attenuata* & *B. menziesii*	22.68	22.94	0.15				0.05	0.05	**0.25**
9051031	Vegetation	Mosaic ZZG Geraldton Sandplains	Mosaic: shrublands; hakea scrub-heath/shrublands; dryandra heath	838.70	2420.61	0.15		0.65	0.05	0.05	0.05	**1**
9051032	Vegetation	Mosaic ZZH Geraldton Sandplains	Mosaic: medium woodland; marri,wandoo, powderbark/ shrublands; dryandra heath	65.93	83.17	0.15				0.05	0.05	**0.32**
9051034	Vegetation	Medium woodland ZZC Geraldton Sandplains	Medium woodland; marri, wandoo & powderbark	11.05	17.63	0.15				0.05	0.05	**0.4**
9051035	Vegetation	Mosaic ZZI Geraldton Sandplains	Mosaic: medium open woodland; marri/shrublands; dryandra heath	0.91	16.42	0.15					0.05	**1**
9051037	Vegetation	Medium woodland ZZD Geraldton Sandplains	Medium woodland; York gum & river gum (incl e6,18Mr)	23.42	23.83	0.15				0.05		**0.2**
9051044	Vegetation	Mosaic ZZK Geraldton Sandplains	Mosaic: medium woodland; York gum & salmon gum/shrublands; *Melaleuca thyioides* thicket	2.07	6.33	0.15				0.05	0.05	**0.77**
9051141	Vegetation	Shrublands Jam D Geraldton Sandplains	Shrublands; jam, *Acacia rostellifera* & *Melaleuca megacephala* thicket	55.29	109.56	0.15				0.05	0.05	**0.5**
9051142	Vegetation	Shrublands Acacia ZB Geraldton Sandplains	Shrublands; *Acacia ligulata* & *Melaueca uncinata* dominated thicket on dark brown loamy soil	10.27	34.15	0.15				0.05	0.05	**0.83**
9051149	Vegetation	Shrublands Scrub heath L Geraldton Sandplains	Shrublands; scrub-heath acacia-ecdeiocolia association in the south-east Geraldton Sandplain Region	8.37	70.66	0.15		0.65		0.05	0.05	**1**
9060018	Vegetation	Low woodland A Great Victorian Desert	Low woodland; mulga (*Acacia aneura*)	331.55	331.55	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9060019	Vegetation	Low woodland B Great Victorian Desert	Low woodland; mulga between sandridges	70.81	70.81	0.15						**0.15**
9060020	Vegetation	Low woodland C Great Victorian Desert	Low woodland; mulga mixed with *Allocasuarina cristata & Eucalyptus sp.*	50.21	50.21	0.15						**0.15**
9060084	Vegetation	Hummock grasslands A Great Victorian Desert	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex *Triodia basedowii* between sandhills	7523.47	7523.47	0.15						**0.15**
9060085	Vegetation	Hummock grasslands B Great Victorian Desert	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex on sandplain	6077.40	6077.40	0.15						**0.15**
9060109	Vegetation	Hummock grasslands D Great Victorian Desert	Hummock grasslands, shrub steppe; *Eucalyptus youngiana* over hard spinifex	2420.22	2420.22	0.15						**0.15**
9060389	Vegetation	Succulent steppe with open low woodland D Great Victorian Desert	Succulent steppe with open low woodland; mulga over saltbush	143.46	143.46	0.15						**0.15**
9060676	Vegetation	Succulent steppe F Great Victorian Desert	Succulent steppe; samphire	24.44	24.44	0.15						**0.15**
9060936	Vegetation	Medium woodland ZF Great Victorian Desert	Medium woodland; salmon gum	85.87	85.87	0.15						**0.15**
9070042	Vegetation	Shrublands Mallee A Hampton	Shrublands; mallee & acacia scrub on south coastal dunes	1687.97	1710.86	0.15						**0.15**
9070122	Vegetation	Succulent steppe with open low woodland B Hampton	Succulent steppe with open low woodland; *Acacia papyrocarpa* over saltbush & bluebush	2515.40	2515.40	0.15					0.05	**0.2**
9070129	Vegetation	Bare Areas E Hampton	Bare areas; drift sand	11.11	12.84	0.15					0.05	**0.23**
9070515	Vegetation	Shrublands Mallee I Hampton	Shrublands; mallee scrub, blue mallee (*Eucalyptus socialis*)	3545.70	3545.70	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9071515	Vegetation	Shrublands Mallee Z Hampton	Shrublands; mallee scrub (*Eucalyptus gracilis*)	2591.04	2593.88	0.15					0.05	**0.2**
9080001	Vegetation	Tall forest A Jarrah Forest	Tall forest karri	23.91	28.58	0.15			0.05		0.05	**0.3**
9080003	Vegetation	Medium forest A Jarrah Forest	Medium forest; jarrah-marri	16644.62	23868.48	0.15			0.05	0.05	0.05	**0.43**
9080004	Vegetation	Medium woodland A Jarrah Forest	Medium woodland; marri & wandoo	3132.39	10315.90	0.15			0.05	0.05	0.05	**0.99**
9080005	Vegetation	Medium woodland B Jarrah Forest	Medium woodland; wandoo & powderbark (*Eucalytpus accedens*)	193.32	337.80	0.15			0.05	0.05	0.05	**0.52**
9080007	Vegetation	Medium woodland D Jarrah Forest	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	77.18	319.83	0.15				0.05	0.05	**1**
9080013	Vegetation	Medium open woodland A Jarrah Forest	Medium open woodland; wandoo	1.54	1.54	0.15						**0.15**
9080014	Vegetation	Low Forest A Jarrah Forest	Low forest; jarrah	689.59	892.89	0.15			0.05	0.05	0.05	**0.39**
9080022	Vegetation	Low woodland E Jarrah Forest	Low woodland; *Agonis flexuosa*	0.77	1.16	0.15					0.05	**0.3**
9080023	Vegetation	Low woodland F Jarrah Forest	Low woodland; jarrah-banksia	25.91	27.48	0.15			0.05		0.05	**0.27**
9080027	Vegetation	Low woodland I Jarrah Forest	Low woodland; paperbark (*Melaleuca sp.*)	383.01	489.54	0.15			0.05	0.05	0.05	**0.38**
9080037	Vegetation	Shrublands Teatree A Jarrah Forest	Shrublands; teatree thicket	18.71	22.16	0.15			0.05	0.05	0.05	**0.36**
9080047	Vegetation	Shrublands Other A Jarrah Forest	Shrublands; tallerack mallee-heath	8.69	31.37	0.15		0.45	0.05	0.05	0.05	**1**
9080048	Vegetation	Shrublands Scrub heath A Jarrah Forest	Shrublands; scrub-heath	52.87	117.21	0.15		0.45		0.05	0.05	**1**
9080049	Vegetation	Shrublands Mixed A Jarrah Forest	Shrublands; mixed heath	14.20	18.59	0.15			0.05	0.05	0.05	**0.39**
9080051	Vegetation	Sedgeland A Jarrah Forest	Sedgeland; reed swamps, occasionally with heath	81.76	199.59	0.15			0.05	0.05	0.05	**0.73**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9080129	Vegetation	Bare Areas E Jarrah Forest	Bare areas; drift sand	1.64	4.28	0.15			0.05	0.05		**0.65**
9080352	Vegetation	Medium woodland M Jarrah Forest	Medium woodland; York gum	70.18	311.14	0.15				0.05	0.05	**1**
9080423	Vegetation	Shrublands Acacia P Jarrah Forest	Shrublands; acacia scrub-heath (unknown spp.)	29.84	32.53	0.15		0.45	0.05	0.05	0.05	**0.82**
9080697	Vegetation	Shrublands Scrub heath H Jarrah Forest	Shrublands; scrub-heath on lateritic sandplain in the southern Geraldton Sandplain Region	38.46	143.56	0.15		0.45		0.05	0.05	**1**
9080931	Vegetation	Medium woodland ZE Jarrah Forest	Medium woodland; yate	0.47	1.15	0.15			0.05	0.05		**0.61**
9080936	Vegetation	Medium woodland ZF Jarrah Forest	Medium woodland; salmon gum	1.20	3.07	0.15				0.05		**0.51**
9080938	Vegetation	Medium woodland ZG Jarrah Forest	Medium woodland; York gum & yate	4.81	10.67	0.15				0.05	0.05	**0.55**
9080946	Vegetation	Medium woodland ZH Jarrah Forest	Medium woodland; wandoo	43.34	61.38	0.15			0.05	0.05	0.05	**0.42**
9080949	Vegetation	Low woodland Z Jarrah Forest	Low woodland; banksia	5.15	13.32	0.15				0.05	0.05	**0.65**
9080952	Vegetation	Shrublands Other H Jarrah Forest	Shrublands; dryandra heath	1.21	4.15	0.15				0.05	0.05	**0.86**
9080963	Vegetation	Medium woodland ZM Jarrah Forest	Medium woodland; yate & paperbark (*Melaleuca spp.*)	7.54	20.53	0.15				0.05	0.05	**0.68**
9080965	Vegetation	Medium woodland ZN Jarrah Forest	Medium woodland; jarrah & marri	4.60	6.78	0.15			0.05			**0.29**
9080967	Vegetation	Medium woodland ZO Jarrah Forest	Medium woodland; wandoo & yate	39.93	142.49	0.15			0.05	0.05	0.05	**1**
9080968	Vegetation	Medium woodland ZP Jarrah Forest	Medium woodland; jarrah, marri & wandoo	723.44	1411.06	0.15			0.05	0.05	0.05	**0.59**
9080969	Vegetation	Mosaic ZR Jarrah Forest	Mosaic: medium forest; jarrah-marri/ low forest; jarrah	15.41	80.00	0.15			0.05	0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9080971	Vegetation	Shrublands Mallee R Jarrah Forest	Shrublands; mallee scrub, *Eucalyptus decipiens*	2.06	3.30	0.15		0.45		0.05	0.05	**1**
9080972	Vegetation	Medium woodland ZQ Jarrah Forest	Medium woodland; jarrah, marri, wandoo & yate	93.62	232.94	0.15			0.05	0.05	0.05	**0.75**
9080973	Vegetation	Low Forest F Jarrah Forest	Low forest; paperbark (*Melaleuca rhaphiophylla*)	15.80	24.44	0.15			0.05	0.05	0.05	**0.46**
9080975	Vegetation	Low woodland ZA Jarrah Forest	Low woodland; jarrah	18.47	20.51	0.15			0.05	0.05	0.05	**0.33**
9080977	Vegetation	Low Forest G Jarrah Forest	Low forest; teatree & casuarina	1.40	2.64	0.15					0.05	**0.38**
9080978	Vegetation	Low Forest H Jarrah Forest	Low forest; jarrah, *Eucalyptus staeri* & *Allocasuarina fraseriana*	210.66	530.36	0.15			0.05	0.05	0.05	**0.76**
9080979	Vegetation	Mosaic ZS Jarrah Forest	Mosaic: medium forest; jarrah-marri/low forest; jarrah & casuarina (probably *Allocasuarina fraseriana*)	14.81	77.23	0.15			0.05	0.05	0.05	**1**
9080980	Vegetation	Shrublands Mallee S Jarrah Forest	Shrublands; jarrah mallee-heath	15.09	17.27	0.15		0.45	0.05	0.05	0.05	**0.86**
9080987	Vegetation	Medium woodland ZT Jarrah Forest	Medium woodland; jarrah & wandoo	5.86	25.83	0.15				0.05	0.05	**1**
9080990	Vegetation	Low Forest I Jarrah Forest	Low forest: peppermint (*Agonis flexuosa*)	3.04	3.77	0.15			0.05		0.05	**0.31**
9080992	Vegetation	Medium forest B Jarrah Forest	Medium forest; jarrah & wandoo (*Eucalyptus wandoo*)	321.47	1213.70	0.15			0.05	0.05	0.05	**1**
9080994	Vegetation	Low Forest J Jarrah Forest	Low forest; jarrah & casuarina (probably *Allocasuarina fraseriana*)	52.77	169.55	0.15			0.05	0.05	0.05	**0.96**
9080999	Vegetation	Medium woodland ZX Jarrah Forest	Medium woodland; marri	31.55	115.31	0.15			0.05		0.05	**0.91**
9081000	Vegetation	Mosaic ZU Jarrah Forest	Mosaic medium forest jarrah-marri and low woodland banksia and low forest teatree	29.91	48.17	0.15			0.05		0.05	**0.4**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9081002	Vegetation	Medium open woodland B Jarrah Forest	Medium open woodland jarrah	128.63	128.73	0.15			0.05		0.05	**0.25**
9081003	Vegetation	Medium forest C Jarrah Forest	Medium forest jarrah, marri & wandoo	92.07	201.09	0.15			0.05	0.05	0.05	**0.66**
9081004	Vegetation	Mosaic ZV Jarrah Forest	Mosaic medium open woodland, wandoo & shrublands, mixed heath	16.36	16.58	0.15				0.05	0.05	**0.25**
9081005	Vegetation	Low woodland ZC Jarrah Forest	Low woodland *Allocasuarina huegeliana*	1.39	2.56	0.15				0.05		**0.37**
9081006	Vegetation	Medium woodland ZY Jarrah Forest	Medium woodland jarrah, wandoo & powderbark	236.53	449.08	0.15			0.05	0.05	0.05	**0.57**
9081017	Vegetation	Medium open woodland G Jarrah Forest	Medium open woodland; jarrah & marri, with low woodland; banksia	90.65	116.46	0.15			0.05		0.05	**0.32**
9081023	Vegetation	Medium woodland ZZA Jarrah Forest	Medium woodland; York gum, wandoo & salmon gum (Eucalyptus salmonophloia)	35.23	148.18	0.15				0.05	0.05	**1**
9081034	Vegetation	Medium woodland ZZC Jarrah Forest	Medium woodland; marri, wandoo & powderbark	0.38	0.60	0.15						**0.24**
9081036	Vegetation	Low woodland ZE Jarrah Forest	Low woodland; banksia prionotes	1.29	4.56	0.15				0.05	0.05	**0.88**
9081043	Vegetation	Mosaic ZZJ Jarrah Forest	Mosaic: medium open woodland; wandoo & powderbark wandoo/ shrublands; dryandra heath	15.52	50.95	0.15				0.05	0.05	**0.82**
9081051	Vegetation	Shrublands Teatree C Jarrah Forest	Shrublands; teatree thicket with scattered wandoo & yate	0.08	4.22	0.15				0.05	0.05	**1**
9081073	Vegetation	Medium woodland ZZI Jarrah Forest	Medium woodland; wandoo & mallet	10.70	44.93	0.15				0.05	0.05	**1**
9081077	Vegetation	Medium woodland ZZJ Jarrah Forest	Medium woodland; jarrah & river gum	5.36	11.48	0.15				0.05	0.05	**0.54**
9081109	Vegetation	Shrublands Other K Jarrah Forest	Shrublands; peppermint scrub, Agonis flexuosa	5.28	5.36	0.15			0.05		0.05	**0.25**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9081111	Vegetation	Medium woodland ZZR Jarrah Forest	Medium woodland; yate (*Eucalyptus occidentalis*)	0.75	1.61	0.15			0.05		0.05	**0.54**
9081114	Vegetation	Shrublands tree heath B Jarrah Forest	Shrublands tree-heath; paperbark over teatree thickets	131.23	198.36	0.15			0.05	0.05	0.05	**0.45**
9081132	Vegetation	Medium forest I Jarrah Forest	Medium forest; marri	1.45	1.52	0.15			0.05		0.05	**0.26**
9081134	Vegetation	Medium woodland ZZT Jarrah Forest	Medium woodland; jarrah (south coast)	184.40	232.16	0.15			0.05	0.05	0.05	**0.38**
9081144	Vegetation	Tall forest F Jarrah Forest	Tall forest; karri & marri (*Corymbia calophylla*)	0.15	0.15	0.15			0.05		0.05	**0.25**
9081151	Vegetation	Medium forest F Jarrah Forest	Medium forest; jarrah & red tingle	2.18	2.18	0.15						**0.15**
9081153	Vegetation	Medium forest G Jarrah Forest	Medium forest; jarrah & Rate's tingle	2.37	2.37	0.15						**0.15**
9081157	Vegetation	Tall forest H Jarrah Forest	Tall forest; jarrah & marri	2.18	2.18	0.15			0.05			**0.2**
9081180	Vegetation	Shrublands Other M Jarrah Forest	Shrublands; *Calothamnus quadrifidis* & Hakea trifircata (Cape Naturaliste)	18.06	19.11	0.15			0.05		0.05	**0.26**
9081181	Vegetation	Medium woodland ZZV Jarrah Forest	Medium woodland, jarrah & *Eucalyptus haematoxylon* (Whicher Range)	53.78	70.79	0.15			0.05		0.05	**0.33**
9081182	Vegetation	Medium woodland ZZW Jarrah Forest	Medium woodland; *Eucalyptus rudis* & *Melaleuca rhaphiophylla*	50.41	110.23	0.15			0.05		0.05	**0.55**
9081183	Vegetation	Medium woodland ZZX Jarrah Forest	Medium woodland; *Eucalyptus rudis* & blackbutt with some bullich, jarrah & marri (fringing Blackwood River)	77.36	90.62	0.15			0.05		0.05	**0.29**
9081184	Vegetation	Medium woodland-fringing A Jarrah Forest	Medium woodland-fringing; jarrah, marri, *Eucalyptus rudis & Agonis flexuosa*	276.83	635.62	0.15			0.05		0.05	**0.57**
9081185	Vegetation	Medium woodland ZZY Jarrah Forest	Medium woodland; jarrah, marri & blackbutt	138.99	151.69	0.15			0.05		0.05	**0.27**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9082051	Vegetation	Sedgeland B Jarrah Forest	Sedgeland; sedges with low tree savanna woodland; paperbarks over & various sedges	77.90	107.43	0.15			0.05	0.05	0.05	**0.41**
9083003	Vegetation	Medium forest H Jarrah Forest	Medium forest; jarrah & marri on laterite with wandoo in valleys, sandy swamps with teatree and banksia	406.97	664.52	0.15			0.05	0.05	0.05	**0.49**
9090007	Vegetation	Medium woodland D Mallee	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo	1.36	3.43	0.15				0.05	0.05	**0.63**
9090008	Vegetation	Medium woodland E Mallee	Medium woodland; salmon gum & gimlet	193.86	562.06	0.15				0.05	0.05	**0.72**
9090010	Vegetation	Medium woodland G Mallee	Medium woodland red mallee group	448.74	457.57	0.15	0.45			0.05	0.05	**0.71**
9090025	Vegetation	Low woodland H Mallee	Low woodland; Allocasuarina huegeliana & York gum	0.49	1.06	0.15				0.05	0.05	**0.54**
9090027	Vegetation	Low woodland I Mallee	Low woodland; paperbark (*Melaleuca sp.*)	0.37	0.84	0.15				0.05		**0.45**
9090037	Vegetation	Shrublands Teatree A Mallee	Shrublands; teatree thicket	19.22	27.66	0.15				0.05	0.05	**0.36**
9090041	Vegetation	Shrublands Teatree B Mallee	Shrublands; teatree scrub	63.37	188.20	0.15				0.05	0.05	**0.74**
9090048	Vegetation	Shrublands Scrub heath A Mallee	Shrublands; scrub-heath	2.73	6.53	0.15		0.45		0.05	0.05	**1**
9090051	Vegetation	Sedgeland A Mallee	Sedgeland; reed swamps, occasionally with heath	3.54	8.23	0.15					0.05	**0.47**
9090059	Vegetation	Grasslands A Mallee	Grasslands, high grass savanna sparse tree; bauhinia & coolabah over Mitchell, blue & tall upland grasses	0.02	0.25	0.15				0.05	0.05	**1**
9090129	Vegetation	Bare Areas E Mallee	Bare areas; drift sand	0.02	0.37	0.15						**1**
9090131	Vegetation	Mosaic A Mallee	Mosaic: medium woodland; salmon gum & gimlet/shrublands; mallee scrub, redwood & black marlock	88.35	1121.75	0.15		0.45		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9090141	Vegetation	Medium woodland I Mallee	Medium woodland; York gum, salmon gum & gimlet	0.36	1.91	0.15				0.05	0.05	**1**
9090142	Vegetation	Medium woodland J Mallee	Medium woodland; York gum & salmon gum	12.99	122.73	0.15				0.05	0.05	**1**
9090221	Vegetation	Succulent steppe A Mallee	Succulent steppe; saltbush	3.39	3.39	0.15						**0.15**
9090352	Vegetation	Medium woodland M Mallee	Medium woodland; York gum	5.58	29.76	0.15				0.05	0.05	**1**
9090380	Vegetation	Shrublands Scrub heath D Mallee	Shrublands; scrub-heath on sandplain	143.49	343.62	0.15		0.45		0.05	0.05	**1**
9090413	Vegetation	Shrublands Acacia O Mallee	Shrublands; *Acacia neurophylla* & *A. species* thicket	13.51	13.51	0.15				0.05		**0.2**
9090479	Vegetation	Shrublands Mallee F Mallee	Shrublands; mallee-heath (Nuytsland)	270.27	274.52	0.15		0.45				**0.61**
9090494	Vegetation	Medium woodland S Mallee	Medium woodland; salmon gum mixed with merrit & desert bloodwood (*Eucalyptus sp.*)	25.75	25.75	0.15					0.05	**0.2**
9090507	Vegetation	Succulent steppe with woodland C Mallee	Succulent steppe with woodland; salmon gum & saltbush	3.23	3.23	0.15						**0.15**
9090510	Vegetation	Shrublands Other F Mallee	Shrublands; Mt Ragged heath	32.49	32.49	0.15						**0.15**
9090511	Vegetation	Medium woodland V Mallee	Medium woodland; salmon gum & morrel	486.79	1387.38	0.15				0.05	0.05	**0.71**
9090512	Vegetation	Shrublands Mallee G Mallee	Shrublands; mallee scrub, *Eucalyptus eremophila* & Forrest's marlock (*E. forrestianna*)	620.01	2378.86	0.15		0.45		0.05	0.05	**1**
9090514	Vegetation	Shrublands Mallee H Mallee	Shrublands; mallee scrub, white mallee (*Eucalyptus cooperiana*)	1439.83	1439.83	0.15		0.45			0.05	**0.65**
9090515	Vegetation	Shrublands Mallee I Mallee	Shrublands; mallee scrub, blue mallee (*Eucalyptus socialis*)	3705.92	3715.29	0.15		0.45			0.05	**0.65**
9090518	Vegetation	Mosaic ZG Mallee	Mosaic: medium woodland; merrit & coral gum/shrublands; mallee scrub, *Eucalyptus eremophila*	6586.25	6586.25	0.15		0.45		0.05	0.05	**0.7**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9090521	Vegetation	Medium woodland W Mallee	Medium woodland; salmon gum & red mallee	203.26	203.27	0.15	0.45			0.05		**0.65**
9090522	Vegetation	Medium woodland X Mallee	Medium woodland; redwood (*Eucalyptus transcontinentalis*) & merrit (*E. floctoniae*)	200.41	200.41	0.15				0.05	0.05	**0.25**
9090524	Vegetation	Medium woodland Y Mallee	Medium woodland; Dundas blackbutt & red mallee	217.58	217.58	0.15	0.45				0.05	**0.65**
9090551	Vegetation	Shrublands Allocasuarina A Mallee	Shrublands; *Allocasuarina campestris* thicket	2.42	5.21	0.15					0.05	**0.43**
9090552	Vegetation	Shrublands Casuarina A Mallee	Shrublands; *Casuarina acutivalvus* & *calothamnus* (also melalueca) thicket on greenstone hills	113.15	131.49	0.15				0.05	0.05	**0.29**
9090676	Vegetation	Succulent steppe F Mallee	Succulent steppe; samphire	6.16	20.16	0.15				0.05	0.05	**0.82**
9090924	Vegetation	Shrublands Mallee M Mallee	Shrublands; mallee scrub, *Eucalyptus eremophila* & red mallee	600.56	1077.70	0.15		0.45		0.05	0.05	**1**
9090925	Vegetation	Shrublands Mallee N Mallee	Shrublands; mallee scrub, red mallee	37.81	51.53	0.15		0.45		0.05	0.05	**0.95**
9090929	Vegetation	Low Forest D Mallee	Low forest; moort (*Eucalytpus platypus*)	47.14	65.95	0.15				0.05	0.05	**0.35**
9090931	Vegetation	Medium woodland ZE Mallee	Medium woodland; yate	31.15	82.12	0.15				0.05	0.05	**0.66**
9090936	Vegetation	Medium woodland ZF Mallee	Medium woodland; salmon gum	595.90	772.72	0.15				0.05	0.05	**0.32**
9090938	Vegetation	Medium woodland ZG Mallee	Medium woodland; York gum & yate	59.98	354.61	0.15				0.05	0.05	**1**
9090939	Vegetation	Succulent steppe with woodland E Mallee	Succulent steppe with woodland; York gum, sparse teatree scrub & samphire	0.06	1.20	0.15						**1**
9090941	Vegetation	Mosaic ZM Mallee	Mosaic: medium woodland; salmon gum & morrel/shrublands; mallee scrub, redwood	36.94	234.25	0.15		0.45		0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9090942	Vegetation	Mosaic ZN Mallee	Mosaic: medium woodland; yate/ shrublands; mallee scrub, black marlock	23.63	118.39	0.15		0.45		0.05	0.05	**1**
9090945	Vegetation	Mosaic ZO Mallee	Mosaic: medium woodland; salmon gum/shrublands; mallee scrub, redwood & black marlock	202.79	1411.12	0.15		0.45		0.05	0.05	**1**
9090953	Vegetation	Succulent steppe with thicket A Mallee	Succulent steppe with thicket; teatree over samphire (m5)	18.48	75.66	0.15				0.05	0.05	**1**
9090955	Vegetation	Mosaic ZP Mallee	Mosaic: shrublands; scrub-heath (South East Avon)/shrublands; *Allocasuarina campestris* thicket	22.89	181.82	0.15		0.45		0.05	0.05	**1**
9090959	Vegetation	Succulent steppe with sparse woodland and thicket B Mallee	Succulent steppe with sparse woodland & thicket; yorrell & Kondinin blackbutt over teatree & samphire	31.01	82.39	0.15				0.05	0.05	**0.66**
9090960	Vegetation	Shrublands Mallee P Mallee	Shrublands; mallee scrub, redwood & black marlock	264.17	2118.34	0.15		0.45		0.05	0.05	**1**
9090961	Vegetation	Mosaic ZQ Mallee	Mosaic: shrublands; scrub-heath (South East Avon)/shrublands; *Allocasuarina campestris* thicket	45.18	261.38	0.15		0.45		0.05	0.05	**1**
9090966	Vegetation	Succulent steppe with sparse woodland and thicket C Mallee	Succulent steppe with sparse woodland & thicket; salmon gum & morrell over teatree & samphire	14.23	70.87	0.15				0.05	0.05	**1**
9090967	Vegetation	Medium woodland ZO Mallee	Medium woodland; wandoo & yate	8.43	38.01	0.15				0.05	0.05	**1**
9090974	Vegetation	Medium woodland ZR Mallee	Medium woodland; York gum, salmon gum & morrel	8.66	72.18	0.15				0.05	0.05	**1**
9090981	Vegetation	Medium woodland ZS Mallee	Medium woodland; wandoo,York gum & yate	13.21	105.31	0.15				0.05	0.05	**1**
9090993	Vegetation	Medium woodland ZV Mallee	Medium woodland; York gum & *Allocasuarina huegeliana*	7.92	21.19	0.15				0.05	0.05	**0.67**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9091005	Vegetation	Low woodland ZC Mallee	Low woodland *Allocasuarina huegeliana*	0.87	5.31	0.15					0.05	**1**
9091023	Vegetation	Medium woodland ZZA Mallee	Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*)	44.80	613.35	0.15				0.05	0.05	**1**
9091047	Vegetation	Shrublands Other J Mallee	Shrublands; *Eucalyptus incrassata* mallee-heath	3.58	9.32	0.15		0.45		0.05	0.05	**1**
9091075	Vegetation	Shrublands Mallee X Mallee	Shrublands; mallee scrub, *Eucalyptus eremophila* & black marlock (*Eucalyptus redunca*)	785.88	5180.82	0.15		0.45		0.05	0.05	**1**
9091076	Vegetation	Mosaic ZZQ Mallee	Mosaic: medium woodland; salmon gum & morrel/shrublands; mallee scrub *Eucalyptus eremophila* & bloodwood (*E. dichromophloia*)	0.11	0.11	0.15		0.45				**0.6**
9091079	Vegetation	Mosaic ZZR Mallee	Mosaic: medium open woodland; salmon gum & morrel/succulent steppe; saltbush	61.43	101.19	0.15				0.05	0.05	**0.41**
9091093	Vegetation	Succulent steppe with open woodland F Mallee	Succulent steppe with open woodland & thicket; eucalypts & *Allocasuarina obesa* over teatree & samphire	0.15	10.82	0.15				0.05	0.05	**1**
9091094	Vegetation	Mosaic ZZS Mallee	Mosaic: medium woodland; York gum & salmon gum/shrublands; mallee scrub *Eucalyptus eremophila* & black marlock	61.74	652.22	0.15		0.45		0.05	0.05	**1**
9091095	Vegetation	Medium woodland ZZP Mallee	Medium woodland; York gum, yate & salmon gum	3.97	15.67	0.15				0.05	0.05	**0.99**
9091096	Vegetation	Medium woodland ZZQ Mallee	Medium woodland; yate & salmon gum	1.29	3.56	0.15				0.05	0.05	**0.69**
9091098	Vegetation	Mosaic ZZT Mallee	Mosaic: medium sparse woodland; salmon gum & morrel/succulent steppe; samphire	47.07	136.69	0.15				0.05	0.05	**0.73**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9091148	Vegetation	Shrublands Scrub heath K Mallee	Shrublands; scrub-heath in the Coolgardie Region	54.34	54.35	0.15		0.45			0.05	**0.65**
9091200	Vegetation	Mosaic ZZZD Mallee	Mosaic: medium woodland; salmon gum & morrel/shrublands; mallee scrub, *Eucalyptus eremophila* & black marlock (*E. redunca*)	226.86	1627.86	0.15		0.45		0.05	0.05	**1**
9091271	Vegetation	Bare Areas F Mallee	Bare areas; claypans	0.31	2.07	0.15				0.05		**1**
9091413	Vegetation	Shrublands Acacia ZE Mallee	Shrublands; acacia, casuarina & melaleuca thicket	405.77	423.37	0.15				0.05	0.05	**0.26**
9091516	Vegetation	Shrublands Mallee ZA Mallee	Shrublands; mallee scrub, black marlock & Forrest's marlock	580.69	1265.25	0.15		0.45		0.05	0.05	**1**
9091519	Vegetation	Shrublands Mallee ZB Mallee	Shrublands; mallee scrub, *Eucalyptus eremophila* & banksia	32.90	32.90	0.15		0.45				**0.6**
9092048	Vegetation	Shrublands Scrub heath N Mallee	Shrublands; scrub-heath in the Mallee Region	1509.04	3150.37	0.15		0.45		0.05	0.05	**1**
9094048	Vegetation	Shrublands Scrub heath P Mallee	Shrublands; scrub-heath in the Esperence Plains including Mt Ragged scrub-heath	105.65	109.34	0.15		0.45		0.05	0.05	**0.72**
9096048	Vegetation	Shrublands Banksia B Mallee	Shrublands; banksia scrub-heath on sandplain in the Esperence Plains Region	0.31	1.41	0.15		0.45		0.05	0.05	**1**
9100008	Vegetation	Medium woodland E Murchison	Medium woodland; salmon gum & gimlet	9.62	9.62	0.15						**0.15**
9100010	Vegetation	Medium woodland G Murchison	Medium woodland red mallee group	647.57	653.88	0.15					0.05	**0.2**
9100011	Vegetation	Medium woodland H Murchison	Medium woodland; coolabah (*Eucalyptus microtheca*)	3.93	3.93	0.15						**0.15**
9100018	Vegetation	Low woodland A Murchison	Low woodland; mulga (*Acacia aneura*)	34324.29	34335.25	0.15					0.05	**0.2**
9100019	Vegetation	Low woodland B Murchison	Low woodland; mulga between sandridges	957.49	957.49	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100020	Vegetation	Low woodland C Murchison	Low woodland; mulga mixed with *Allocasuarina cristata* & *Eucalyptus sp.*	11741.07	11767.13	0.15					0.05	**0.2**
9100024	Vegetation	Low woodland G Murchison	Low woodland; *Allocasuarina cristata*	170.35	170.54	0.15					0.05	**0.2**
9100028	Vegetation	Open low woodland B Murchison	Open low woodland; mulga	19.55	19.55	0.15					0.05	**0.2**
9100029	Vegetation	Sparse low woodland A Murchison	Sparse low woodland; mulga, discontinuous in scattered groups	3917.07	3917.07	0.15					0.05	**0.2**
9100039	Vegetation	Shrublands Mulga A Murchison	Shrublands; mulga scrub	2584.91	2587.30	0.15					0.05	**0.2**
9100040	Vegetation	Shrublands Acacia B Murchison	Shrublands; acacia scrub, various species	451.83	451.83	0.15					0.05	**0.2**
9100107	Vegetation	Hummock grasslands C Murchison	Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex	298.60	298.60	0.15					0.05	**0.2**
9100109	Vegetation	Hummock grasslands D Murchison	Hummock grasslands, shrub steppe; *Eucalyptus youngiana* over hard spinifex	1519.44	1519.44	0.15						**0.15**
9100110	Vegetation	Hummock grasslands E Murchison	Hummock grasslands, shrub steppe; red mallee over spinifex, *Triodia scariosa*	355.78	355.78	0.15					0.05	**0.2**
9100120	Vegetation	Succulent steppe with open low woodland A Murchison	Succulent steppe with open low woodland; mulga & sheoak	106.92	106.92	0.15					0.05	**0.2**
9100141	Vegetation	Medium woodland I Murchison	Medium woodland; York gum, salmon gum & gimlet	27.34	27.34	0.15						**0.15**
9100160	Vegetation	Shrublands Snakewood A Murchison	Shrublands; snakewood & *Acacia victoriae* scrub	201.93	201.93	0.15					0.05	**0.2**
9100162	Vegetation	Shrublands Snakewood B Murchison	Shrublands; snakewood scrub	0.68	0.68	0.15						**0.15**
9100182	Vegetation	Low woodland J Murchison	Low woodland; mulga & bowgada (*Acacia ramulosa*)	40.18	40.18	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100183	Vegetation	Low woodland K Murchison	Low woodland; mulga, *Acacia victoriae* & snakewood	541.03	541.03	0.15					0.05	**0.2**
9100184	Vegetation	Shrublands Mulga C Murchison	Shrublands; mulga & bowgada scrub	216.31	216.31	0.15					0.05	**0.2**
9100187	Vegetation	Succulent steppe with open scrub A Murchison	Succulent steppe with open scrub; scattered *Acacia victoriae* & snakewood over various species	15.37	15.37	0.15						**0.15**
9100188	Vegetation	Shrublands Mulga D Murchison	Shrublands; mulga & *Acacia sclerosperma* scrub	15.10	15.10	0.15						**0.15**
9100202	Vegetation	Shrublands Mulga E Murchison	Shrublands; mulga & *Acacia quadrimarginea* scrub	1723.91	1724.22	0.15					0.05	**0.2**
9100204	Vegetation	Succulent steppe with open scrub B Murchison	Succulent steppe with open scrub; scattered mulga & *Acacia sclerosperma* over saltbush & bluebush	342.89	342.89	0.15					0.05	**0.2**
9100205	Vegetation	Shrublands Acacia D Murchison	Shrublands; *Acacia sclerosperma* & bowgada scrub	61.17	61.17	0.15						**0.15**
9100207	Vegetation	Hummock grasslands G Murchison	Hummock grasslands, shrub steppe; red mallee over hard spinifex	0.94	0.94	0.15						**0.15**
9100221	Vegetation	Succulent steppe A Murchison	Succulent steppe; saltbush	34.84	34.84	0.15						**0.15**
9100240	Vegetation	Succulent steppe with open scrub C Murchison	Succulent steppe with open scrub; scattered *Acacia sclerosperma* & bowgada over saltbush & bluebush	748.83	748.83	0.15					0.05	**0.2**
9100251	Vegetation	Low woodland L Murchison	Low woodland; mulga & *Allocasuarina cristata*	534.59	536.74	0.15					0.05	**0.2**
9100261	Vegetation	Succulent steppe with low woodland A Murchison	Succulent steppe with low woodland; snakewood over saltbush & bluebush	88.50	88.50	0.15					0.05	**0.2**
9100266	Vegetation	Mosaic J Murchison	Mosaic: shrublands; bowgada scrub/ succulent steppe; saltbush & bluebush	1054.27	1054.27	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100267	Vegetation	Succulent steppe with open scrub D Murchison	Succulent steppe with open scrub; scattered *Acacia sclerosperma* & *A. victoriae* over saltbush & bluebush	156.67	156.67	0.15					0.05	**0.2**
9100268	Vegetation	Succulent steppe with open scrub E Murchison	Succulent steppe with open scrub; scattered *Acacia sclerosperma* over saltbush & bluebush	63.26	63.26	0.15					0.05	**0.2**
9100269	Vegetation	Low woodland O Murchison	Low woodland over scrub; mulga over bowgada scrub	296.90	296.90	0.15					0.05	**0.2**
9100288	Vegetation	Mosaic L Murchison	Mosaic: scattered low trees; mulga/ succulent steppe; sparse saltbush & bluebush on greenstone	60.93	60.93	0.15					0.05	**0.2**
9100300	Vegetation	Mosaic M Murchison	Mosaic: low woodland; mulga/ succulent steppe; saltbush & bluebush	19.31	19.31	0.15					0.05	**0.2**
9100305	Vegetation	Medium woodland over scrub A Murchison	Medium woodland over scrub; coolabah over bowgada	32.35	32.35	0.15					0.05	**0.2**
9100306	Vegetation	Low woodland P Murchison	Low woodland; *Casuarina obesa* (salt lake)	1.62	1.62	0.15						**0.15**
9100312	Vegetation	Succulent steppe with very open shrubs A Murchison	Succulent steppe with very open shrubs; very sparse mulga and *Acacia sclerosperma* over saltbush & bluebush	395.28	415.02	0.15					0.05	**0.21**
9100313	Vegetation	Succulent steppe with open scrub F Murchison	Succulent steppe with open scrub; scattered *Acacia sclerosperma* & *A. victoriae* over bluebush	537.29	564.89	0.15					0.05	**0.21**
9100325	Vegetation	Succulent steppe B Murchison	Succulent steppe; saltbush & samphire	11.54	11.54	0.15						**0.15**
9100326	Vegetation	Low woodland Q Murchison	Low woodland over scrub; mulga over bowgada & minnieritchie scrub	4917.37	4917.37	0.15					0.05	**0.2**
9100327	Vegetation	Shrublands Mulga F Murchison	Shrublands; mulga, bowgada, *Acacia quadrimarginea* & minnieritchie scrub	311.28	311.28	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100338	Vegetation	Hummock grasslands I Murchison	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia basedowii*	984.01	984.04	0.15					0.05	**0.2**
9100339	Vegetation	Hummock grasslands J Murchison	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia scariosa*	236.61	236.62	0.15					0.05	**0.2**
9100340	Vegetation	Succulent steppe with scrub C Murchison	Succulent steppe with scrub; bowgada scrub over various species	12.11	12.11	0.15						**0.15**
9100352	Vegetation	Medium woodland M Murchison	Medium woodland; York gum	3.45	3.45	0.15					0.05	**0.2**
9100358	Vegetation	Shrublands Bowgada E Murchison	Shrublands; bowgada & *Acacia quadrimarginea* on stony ridges	38.23	38.23	0.15						**0.15**
9100361	Vegetation	Shrublands Bowgada G Murchison	Shrublands; bowgada & minnieritchie scrub with scattered mulga	111.30	111.30	0.15					0.05	**0.2**
9100362	Vegetation	Mosaic U Murchison	Mosaic: shrublands; bowgada & minnieritchie scrub with scattered mulga/scattered groups of saltbush/ bluebush	397.83	397.83	0.15						**0.15**
9100385	Vegetation	Shrublands Bowgada L Murchison	Shrublands; bowgada & jam scrub with scattered York gum	55.53	55.53	0.15					0.05	**0.2**
9100389	Vegetation	Succulent steppe with open low woodland D Murchison	Succulent steppe with open low woodland; mulga over saltbush	2513.95	2519.68	0.15					0.05	**0.2**
9100395	Vegetation	Hummock grasslands L Murchison	Hummock grasslands, mixed sandplain; bowgada, mallee, heath & spinifex	1024.88	1024.88	0.15					0.05	**0.2**
9100400	Vegetation	Succulent steppe with open low woodland E Murchison	Succulent steppe with open low woodland; mulga over bluebush	965.10	973.32	0.15					0.05	**0.2**
9100404	Vegetation	Shrublands Bowgada M Murchison	Shrublands; bowgada & *Acacia murrayana* scrub	543.23	543.23	0.15					0.05	**0.2**
9100411	Vegetation	Succulent steppe with open scrub G Murchison	Succulent steppe with open scrub; scattered bowgada & jam over saltbush	318.72	318.72	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100415	Vegetation	Succulent steppe with open scrub I Murchison	Succulent steppe with open scrub; scattered mulga & other wattles over saltbush & bluebush	632.80	632.80	0.15					0.05	**0.2**
9100416	Vegetation	Low woodland T Murchison	Low woodland; mulga mixed with cypress pine & York gum	162.62	162.62	0.15					0.05	**0.2**
9100417	Vegetation	Succulent steppe with open scrub J Murchison	Succulent steppe with open scrub; scattered wattles over saltbush	210.90	210.90	0.15					0.05	**0.2**
9100418	Vegetation	Low woodland U Murchison	Low woodland; mulga, *Casuarina cristata* & cypress pine	43.74	43.74	0.15						**0.15**
9100420	Vegetation	Shrublands Bowgada O Murchison	Shrublands; bowgada & jam scrub	1897.58	1897.58	0.15					0.05	**0.2**
9100437	Vegetation	Shrublands Mixed C Murchison	Shrublands; mixed acacia thicket on sandplain	116.52	116.52	0.15					0.05	**0.2**
9100441	Vegetation	Succulent steppe with open low woodland F Murchison	Succulent steppe with open low woodland; mulga & sheoak over bluebush	0.05	0.05	0.15						**0.15**
9100460	Vegetation	Succulent steppe E Murchison	Succulent steppe; bluebush with saltbush in depressions	16.12	16.12	0.15					0.05	**0.2**
9100468	Vegetation	Medium woodland N Murchison	Medium woodland; salmon gum & goldfields blackbutt	38.75	38.87	0.15					0.05	**0.2**
9100480	Vegetation	Succulent steppe with open low woodland H Murchison	Succulent steppe with open low woodland; mulga & sheoak over salt bush	483.80	484.14	0.15					0.05	**0.2**
9100483	Vegetation	Hummock grasslands K Murchison	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex ; red mallee mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	2052.48	2052.80	0.15					0.05	**0.2**
9100484	Vegetation	Shrublands Jam C Murchison	Shrublands; jam thicket	581.94	581.94	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100485	Vegetation	Hummock grasslands M Murchison	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia basedowii*	2099.72	2099.87	0.15					0.05	**0.2**
9100501	Vegetation	Medium woodland T Murchison	Medium woodland; goldfields blackbutt	40.84	40.84	0.15					0.05	**0.2**
9100502	Vegetation	Medium woodland U Murchison	Medium woodland; goldfields blackbutt & red mallee	134.01	134.01	0.15					0.05	**0.2**
9100504	Vegetation	Low woodland V Murchison	Low woodland; mulga & red mallee	43.27	43.27	0.15					0.05	**0.2**
9100508	Vegetation	Succulent steppe with open scrub K Murchison	Succulent steppe with open scrub; scattered mulga over saltbush	320.29	320.29	0.15						**0.15**
9100520	Vegetation	Shrublands Acacia V Murchison	Shrublands; *Acacia quadrimarginea* thicket	7.94	7.94	0.15						**0.15**
9100521	Vegetation	Medium woodland W Murchison	Medium woodland; salmon gum & red mallee	117.12	117.12	0.15						**0.15**
9100529	Vegetation	Succulent steppe with open low woodland I Murchison	Succulent steppe with open low woodland; mulga & sheoak over bluebush	622.03	622.03	0.15					0.05	**0.2**
9100532	Vegetation	Hummock grasslands N Murchison	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; marble gum & red mallee, mixed dwarf shrubs with *Triodia scariosa* & *Triodia sp.*	205.77	205.77	0.15						**0.15**
9100533	Vegetation	Low woodland X Murchison	Low woodland; mulga & cypress pine	1652.66	1652.66	0.15					0.05	**0.2**
9100538	Vegetation	Shrublands Acacia W Murchison	Shrublands; *Acacia brachystachya* scrub	191.12	192.29	0.15					0.05	**0.2**
9100540	Vegetation	Succulent steppe with open low woodland J Murchison	Succulent steppe with open low woodland; sheoak over saltbush	704.38	705.22	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9100555	Vegetation	Hummock grasslands O Murchison	Hummock grasslands, mallee steppe; red mallee over spinifex, *Triodia scariosa*	225.32	225.45	0.15					0.05	**0.2**
9100676	Vegetation	Succulent steppe F Murchison	Succulent steppe; samphire	579.74	579.74	0.15					0.05	**0.2**
9100862	Vegetation	Hummock grasslands P Murchison	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalytpus kinsmillii*) over hard spinifex, *Triodia basedowii*	94.22	94.22	0.15					0.05	**0.2**
9100863	Vegetation	Hummock grasslands Q Murchison	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & *T. sp.*	196.65	196.65	0.15					0.05	**0.2**
9100865	Vegetation	Hummock grasslands R Murchison	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & *T. sp.*	642.34	642.34	0.15						**0.15**
9100936	Vegetation	Medium woodland ZF Murchison	Medium woodland; salmon gum	204.83	204.83	0.15					0.05	**0.2**
9101125	Vegetation	Succulent steppe with scrub F Murchison	Succulent steppe with scrub; *Acacia victoriae* & snakewood over saltbush & bluebush	652.14	652.14	0.15					0.05	**0.2**
9101127	Vegetation	Mosaic ZZY Murchison	Mosaic: saltbush & bluebush/ samphire	548.65	548.65	0.15					0.05	**0.2**
9101413	Vegetation	Shrublands Acacia ZE Murchison	Shrublands; acacia, casuarina & melaleuca thicket	296.56	296.56	0.15					0.05	**0.2**
9102081	Vegetation	Shrublands Bowgada Q Murchison	Shrublands; bowgada and associated spp. scrub	3001.72	3006.77	0.15					0.05	**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9102121	Vegetation	Mosaic ZZZE Murchison	Mosaic: open low woodland; mulga/ succulent steppe; saltbush & bluebush on greenstone	257.10	257.14	0.15					0.05	**0.2**
9102902	Vegetation	Medium woodland ZZZC Murchison	Medium woodland; *Allocasuarina cristata* & goldfields blackbutt	9.30	9.30	0.15					0.05	**0.2**
9102903	Vegetation	Medium woodland ZZZD Murchison	Medium woodland; salmon gum, goldfields balckbutt, gimlet & *Allocasuarina cristata*	273.31	283.09	0.15					0.05	**0.21**
9110122	Vegetation	Succulent steppe with open low woodland B Nullarbor	Succulent steppe with open low woodland; *Acacia papyrocarpa* over saltbush & bluebush,	3562.16	3562.16	0.15						**0.15**
9110214	Vegetation	Mosaic E Nullarbor	Mosaic: medium woodland; goldfield eucalypts/succulent steppe with open low woodland; myoporum over saltbush	4897.94	4897.94	0.15					0.05	**0.2**
9110441	Vegetation	Succulent steppe with open low woodland F Nullarbor	Succulent steppe with open low woodland; mulga & sheoak over bluebush	3719.61	3719.61	0.15					0.05	**0.2**
9110448	Vegetation	Succulent steppe C Nullarbor	Succulent steppe; bluebush (in dongas)	820.96	820.96	0.15					0.05	**0.2**
9110449	Vegetation	Succulent steppe D Nullarbor	Succulent steppe; bluebush with grassy depressions	12656.47	12656.47	0.15					0.05	**0.2**
9110460	Vegetation	Succulent steppe E Nullarbor	Succulent steppe; bluebush with saltbush in depressions	25357.38	25357.38	0.15					0.05	**0.2**
9110461	Vegetation	Succulent steppe with open low woodland G Nullarbor	Succulent steppe with open low woodland; *Acacia papyrocarpa* over bluebush	10389.62	10389.62	0.15					0.05	**0.2**
9110676	Vegetation	Succulent steppe F Nullarbor	Succulent steppe; samphire	41.39	41.39	0.15						**0.15**
9111271	Vegetation	Bare Areas F Nullarbor	Bare areas; claypans	3.56	3.56	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9114641	Vegetation	Succulent steppe with open woodland H Nullarbor	Succulent steppe with open woodland; salmon gum & gimlet over bluebush	1541.29	1541.29	0.15						**0.15**
9120002	Vegetation	Tall woodland A Swan Coastal Plain	Tall woodland; tuart (*Eucalyptus gomphocephala*)	19.13	31.42	0.15					0.05	**0.33**
9120003	Vegetation	Medium forest A Swan Coastal Plain	Medium forest; jarrah-marri	32.38	191.26	0.15			0.05		0.05	**1**
9120004	Vegetation	Medium woodland A Swan Coastal Plain	Medium woodland; marri & wandoo	27.47	135.32	0.15			0.05	0.05	0.05	**1**
9120006	Vegetation	Medium woodland C Swan CoastaPlain	Medium woodland; tuart & jarrah	152.05	563.43	0.15			0.05		0.05	**0.93**
9120027	Vegetation	Low woodland I Swan Coastal Plain	Low woodland; paperbark (*Melaleuca sp.*)	18.57	59.93	0.15			0.05		0.05	**0.81**
9120031	Vegetation	Shrublands Melaeuca A Swan Coastal Plain	Shrublands; *Melaleuca thyoides* thicket with scattered York gum	11.45	26.58	0.15				0.05	0.05	**0.58**
9120037	Vegetation	Shrublands Teatree A Swan Coastal Plain	Shrublands; teatree thicket	53.23	160.24	0.15			0.05	0.05	0.05	**0.9**
9120048	Vegetation	Shrublands Scrub heath A Swan Coastal Plain	Shrublands; scrub-heath	25.30	33.25	0.15		0.65			0.05	**1**
9120051	Vegetation	Sedgeland A Swan Coastal Plain	Sedgeland; reed swamps, occasionally with heath	7.27	18.39	0.15			0.05		0.05	**0.63**
9120129	Vegetation	Bare Areas E Swan Coastal Plain	Bare areas; drift sand	62.24	103.46	0.15				0.05	0.05	**0.42**
9120142	Vegetation	Medium woodland J Swan Coastal Plain	Medium woodland; York gum & salmon gum	0.32	0.77	0.15				0.05		**0.48**
9120352	Vegetation	Medium woodland M Swan Coastal Plain	Medium woodland; York gum	4.42	14.41	0.15				0.05	0.05	**0.82**
9120676	Vegetation	Succulent steppe F Swan Coastal Plain	Succulent steppe; samphire	3.67	12.55	0.15					0.05	**0.68**
9120949	Vegetation	Low woodland Z Swan Coastal Plain	Low woodland; banksia	1134.27	2101.55	0.15			0.05	0.05	0.05	**0.56**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9120952	Vegetation	Shrublands Other H Swan Coastal Plain	Shrublands; dryandra heath	37.87	392.58	0.15				0.05	0.05	**1**
9120965	Vegetation	Medium woodland ZN Swan Coastal Plain	Medium woodland; jarrah & marri	15.84	18.16	0.15			0.05		0.05	**0.29**
9120968	Vegetation	Medium woodland ZP Swan Coastal Plain	Medium woodland; jarrah, marri & wandoo	98.56	1373.74	0.15			0.05		0.05	**1**
9120973	Vegetation	Low Forest F Swan Coastal Plain	Low forest; paperbark (*Melaleuca rhaphiophylla*)	5.66	25.15	0.15					0.05	**0.89**
9120987	Vegetation	Medium woodland ZT Swan Coastal Plain	Medium woodland; jarrah & wandoo	0.33	1.18	0.15						**0.53**
9120988	Vegetation	Succulent steppe with thicket B Swan Coastal Plain	Succulent steppe with thicket; *Melaleuca thyoides* over samphire	8.22	14.83	0.15				0.05	0.05	**0.45**
9120990	Vegetation	Low Forest I Swan Coastal Plain	Low forest: peppermint (*Agonis flexuosa*)	3.61	19.52	0.15					0.05	**1**
9120997	Vegetation	Shrublands Melaeuca H Swan Coastal Plain	Shrublands; melaleuca heath	24.27	34.44	0.15					0.05	**0.28**
9120998	Vegetation	Medium woodland ZW Swan Coastal Plain	Medium woodland; tuart	201.83	508.68	0.15			0.05	0.05	0.05	**0.76**
9120999	Vegetation	Medium woodland ZX Swan Coastal Plain	Medium woodland; marri	99.00	1030.76	0.15			0.05	0.05	0.05	**1**
9121000	Vegetation	Mosaic ZU Swan Coastal Plain	Mosaic: medium forest jarrah-marri and low woodland banksia & low forest teatree	251.46	947.87	0.15			0.05		0.05	**0.94**
9121001	Vegetation	Medium very sparse woodland A Swan Coastal Plain	Medium very sparse woodland jarrah with low woodland banksia & casuarina	150.10	574.10	0.15			0.05		0.05	**0.96**
9121007	Vegetation	Mosaic ZW Swan Coastal Plain	Mosaic: shrublands; *Acacia lasiocarpa* & *Melaleuca acerosa* heath/ shrublands; *Acacia rostellifera* & *Acacia cyclops* thicket	166.39	297.12	0.15				0.05	0.05	**0.45**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9121008	Vegetation	Medium open woodland C Swan Coastal Plain	Medium open woodland; marri	8.01	45.61	0.15			0.05	0.05	0.05	**1**
9121009	Vegetation	Medium woodland ZZ Swan Coastal Plain	Medium woodland; marri & river gum	27.62	182.03	0.15			0.05	0.05	0.05	**1**
9121010	Vegetation	Medium open woodland D Swan Coastal Plain	Medium open woodland; marri & tuart	0.71	12.10	0.15					0.05	**1**
9121011	Vegetation	Medium open woodland E Swan Coastal Plain	Medium open woodland; tuart	11.13	12.66	0.15					0.05	**0.23**
9121012	Vegetation	Mosaic ZX Swan Coastal Plain	Mosaic: medium open woodland; tuart/low woodland; banksia	1.79	5.08	0.15			0.05		0.05	**0.71**
9121013	Vegetation	Medium open woodland F Swan Coastal Plain	Medium open woodland; eucalypts over teatree	0.74	4.55	0.15					0.05	**1**
9121014	Vegetation	Mosaic ZY Swan Coastal Plain	Mosaic: low woodland; banksia/ shrublands; teatree thicket	214.77	410.64	0.15			0.05		0.05	**0.48**
9121015	Vegetation	Mosaic ZZ Swan Coastal Plain	Mosaic: mixed scrub-heath/ shrublands; dryandra thicket	67.33	195.57	0.15		0.65	0.05	0.05	0.05	**1**
9121016	Vegetation	Mosaic ZZA Swan Coastal Plain	Mosaic: low woodland; banksia/ shrublands; dryandra heath	4.99	15.23	0.15			0.05			**0.61**
9121017	Vegetation	Medium open woodland G Swan Coastal Plain	Medium open woodland; jarrah & marri, with low woodland; banksia	26.21	58.82	0.15				0.05	0.05	**0.56**
9121018	Vegetation	Mosaic ZZB Swan Coastal Plain	Mosaic: medium forest; jarrah-marri/ low woodland; banksia/low forest; teatree/low woodland; casuarina obesa	30.43	140.59	0.15			0.05		0.05	**1**
9121019	Vegetation	Medium sparse woodland A Swan Coastal Plain	Medium sparse woodland; jarrah & marri	4.26	8.04	0.15					0.05	**0.38**
9121020	Vegetation	Mosaic ZZC Swan Coastal Plain	Mosaic: medium forest; jarrah-marri/ medium woodland; marri-wandoo	18.51	56.10	0.15			0.05	0.05	0.05	**0.91**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9121026	Vegetation	Mosaic ZZE Swan Coastal Plain	Mosaic: shrublands; *Acacia rostellifera, A. cyclops* (in the south) & *Melaleuca cardiophylla* (in the north) thicket/shrublands; *Acacia lasiocarpa* & *Melaleuca acerosa heath*	547.22	584.46	0.15				0.05	0.05	**0.27**
9121027	Vegetation	Mosaic ZZF Swan Coastal Plain	Mosaic: medium open woodland; jarrah & marri, with low woodland; banksia/medium sparse woodland; jarrah & marri	235.76	398.09	0.15				0.05	0.05	**0.42**
9121028	Vegetation	Medium woodland ZZB Swan Coastal Plain	Medium woodland; river gum	3.31	7.03	0.15				0.05	0.05	**0.53**
9121029	Vegetation	Shrublands Scrub heath I Swan Coastal Plain	Shrublands; scrub-heath dryandra-calothamnus association with banksia prionotes on limestone in the northern Swan Region	486.33	684.45	0.15		0.65		0.05	0.05	**1**
9121030	Vegetation	Low woodland ZD Swan Coastal Plain	Low woodland; *Banksia attenuata* & *B. menziesii*	879.09	1365.79	0.15			0.05	0.05	0.05	**0.47**
9121031	Vegetation	Mosaic ZZG Swan Coastal Plain	Mosaic: shrublands; hakea scrub-heath/shrublands; dryandra heath	53.63	270.19	0.15		0.65		0.05	0.05	**1**
9121035	Vegetation	Mosaic ZZI Swan Coastal Plain	Mosaic: medium open woodland; marri/shrublands; dryandra heath	3.29	33.77	0.15					0.05	**1**
9121036	Vegetation	Low woodland ZE Swan Coastal Plain	Low woodland; banksia prionotes	321.90	858.64	0.15				0.05	0.05	**0.67**
9121038	Vegetation	Medium open woodland H Swan Coastal Plain	Medium open woodland; eucalypts (e2), with low woodland; *Banksia attenuata* & *B. menziesii*	3.98	17.15	0.15					0.05	**0.86**
9121039	Vegetation	Shrublands Mallee W Swan Coastal Plain	Shrublands; mallee with scattered York gum	14.11	20.60	0.15		0.65		0.05	0.05	**1**
9121040	Vegetation	Medium woodland ZZE Swan Coastal Plain	Medium woodland; York gum & *Casuarina obesa*	7.89	27.77	0.15				0.05	0.05	**0.88**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9121136	Vegetation	Medium woodland ZZU Swan Coastal Plain	Medium woodland; marri with some jarrah, wandoo, river gum & casuarina	38.46	481.25	0.15			0.05		0.05	**1**
9121181	Vegetation	Medium woodland ZZV Swan Coastal Plain	Medium woodland, jarrah & *Eucalyptus haematoxylon* (Whicher Range)	37.52	121.39	0.15			0.05		0.05	**0.81**
9121182	Vegetation	Medium woodland ZZW Swan Coastal Plain	Medium woodland; *Eucalyptus rudis* & *Melaleuca rhaphiophylla*	15.08	124.14	0.15			0.05		0.05	**1**
9123048	Vegetation	Shrublands Scrub heath O Swan Coastal Plain	Shrublands; scrub-heath on the Swan Coastal Plain	33.45	104.18	0.15		0.65			0.05	**1**
9130001	Vegetation	Tall forest A Warren	Tall forest karri	557.49	693.26	0.15			0.05	0.05	0.05	**0.37**
9130002	Vegetation	Tall woodland A Warren	Tall woodland; tuart (*Eucalyptus gomphocephala*)	0.02	0.07	0.15						**0.52**
9130003	Vegetation	Medium forest A Warren	Medium forest; jarrah-marri	2038.11	2526.65	0.15			0.05	0.05	0.05	**0.37**
9130014	Vegetation	Low Forest A Warren	Low forest; jarrah	33.25	50.96	0.15			0.05	0.05	0.05	**0.46**
9130022	Vegetation	Low woodland E Warren	Low woodland; *Agonis flexuosa*	29.69	33.30	0.15			0.05		0.05	**0.28**
9130023	Vegetation	Low woodland F Warren	Low woodland; jarrah-banksia	284.80	380.79	0.15			0.05		0.05	**0.33**
9130027	Vegetation	Low woodland I Warren	Low woodland; paperbark (*Melaleuca sp.*)	540.99	710.24	0.15			0.05	0.05	0.05	**0.39**
9130037	Vegetation	Shrublands Teatree A Warren	Shrublands; teatree thicket	8.87	9.58	0.15			0.05		0.05	**0.27**
9130038	Vegetation	Shrublands Thicket B Warren	Shrublands; thicket, mixed	0.30	0.30	0.15			0.05		0.05	**0.25**
9130049	Vegetation	Shrublands Mixed A Warren	Shrublands; mixed heath	91.82	96.97	0.15			0.05		0.05	**0.26**
9130051	Vegetation	Sedgeland A Warren	Sedgeland; reed swamps, occasionally with heath	247.13	358.67	0.15			0.05		0.05	**0.36**
9130129	Vegetation	Bare Areas E Warren	Bare areas; drift sand	81.32	121.90	0.15			0.05		0.05	**0.37**
9130423	Vegetation	Shrublands Acacia P Warren	Shrublands; acacia scrub-heath (unknown spp.)	124.92	154.06	0.15			0.05		0.05	**0.31**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9130949	Vegetation	Low woodland Z Warren	Low woodland; banksia	10.28	17.34	0.15			0.05		0.05	**0.42**
9130965	Vegetation	Medium woodland ZN Warren	Medium woodland; jarrah & marri	0.59	0.59	0.15			0.05			**0.2**
9130969	Vegetation	Mosaic ZR Warren	Mosaic: medium forest; jarrah-marri/ low forest; jarrah	92.74	197.12	0.15			0.05	0.05	0.05	**0.64**
9130973	Vegetation	Low Forest F Warren	Low forest; paperbark (*Melaleuca rhaphiophylla*)	0.09	0.29	0.15						**0.48**
9130975	Vegetation	Low woodland ZA Warren	Low woodland; jarrah	22.67	28.44	0.15			0.05		0.05	**0.31**
9130978	Vegetation	Low Forest H Warren	Low forest; jarrah, *Eucalyptus staeri* & *Allocasuarina fraseriana*	0.84	0.91	0.15					0.05	**0.22**
9130990	Vegetation	Low Forest I Warren	Low forest: peppermint (*Agonis flexuosa*)	133.66	150.32	0.15			0.05		0.05	**0.28**
9130999	Vegetation	Medium woodland ZX Warren	Medium woodland; marri	1.38	1.41	0.15						**0.15**
9131000	Vegetation	Mosaic ZU Warren	Mosaic medium forest, jarrah-marri and low woodland banksia and low forest teatree	1.13	1.97	0.15			0.05		0.05	**0.43**
9131002	Vegetation	Medium open woodland B Warren	Medium open woodland; jarrah	26.62	30.74	0.15			0.05		0.05	**0.29**
9131008	Vegetation	Medium open woodland C Warren	Medium open woodland; marri	0.06	0.31	0.15						**0.85**
9131009	Vegetation	Medium woodland ZZ Warren	Medium woodland; marri & river gum	0.22	0.23	0.15					0.05	**0.21**
9131030	Vegetation	Low woodland ZD Warren	Low woodland; *Banksia attenuata* & *B. menziesii*	1.24	1.40	0.15			0.05		0.05	**0.28**
9131108	Vegetation	Shrublands Acacia ZA Warren	Shrublands; *Acacia decipiens*	82.32	87.69	0.15			0.05		0.05	**0.27**
9131109	Vegetation	Shrublands Other K Warren	Shrublands; peppermint scrub, *Agonis flexuosa*	318.54	333.65	0.15			0.05		0.05	**0.26**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9131111	Vegetation	Medium woodland ZZR Warren	Medium woodland; yate (*Eucalyptus occidentalis*)	6.41	6.41	0.15						**0.15**
9131112	Vegetation	Mosaic ZZX Warren	Mosaic: tall forest; karri/tall forest; jarrah & marri	104.74	111.90	0.15			0.05	0.05	0.05	**0.32**
9131113	Vegetation	Shrublands Other L Warren	Shrublands; *Jacksonia horrida* heath	69.00	71.93	0.15			0.05		0.05	**0.26**
9131115	Vegetation	Medium woodland ZZS Warren	Medium woodland; marri & yate	12.25	12.69	0.15			0.05			**0.21**
9131116	Vegetation	Tall forest B Warren	Tall forest; jarrah (*Eucalyptus marginata*)	41.24	46.33	0.15			0.05		0.05	**0.28**
9131130	Vegetation	Tall forest C Warren	Tall forest; karri & red tingle (*Eucalyptus jacksonii*)	9.90	10.96	0.15					0.05	**0.22**
9131131	Vegetation	Medium forest D Warren	Medium forest; bushy yate (*Eucalyptus cornuta*)	2.82	2.82	0.15						**0.15**
9131132	Vegetation	Medium forest I Warren	Medium forest; marri	1.14	1.56	0.15			0.05			**0.27**
9131134	Vegetation	Medium woodland ZZT Warren	Medium woodland; jarrah (south coast)	127.24	142.73	0.15			0.05		0.05	**0.28**
9131137	Vegetation	Shrublands Melaeuca J Warren	Shrublands; *Melaueca incana, Hakea tuberculata, Viminaria juncea* scrub on ironstone, south coast	3.32	10.80	0.15					0.05	**0.65**
9131138	Vegetation	Low Forest K Warren	Low forest; jarrah & marri	5.05	6.46	0.15			0.05		0.05	**0.32**
9131139	Vegetation	Tall forest D Warren	Tall forest; karri & yellow tingle (*Eucalyptus guilfoyleii*)	143.17	152.54	0.15			0.05		0.05	**0.27**
9131140	Vegetation	Tall forest E Warren	Tall forest; karri & Rate's tingle (*Eucalyptus brevostylis*)	7.85	7.85	0.15						**0.15**
9131144	Vegetation	Tall forest F Warren	Tall forest; karri & marri (*Corymbia calophylla*)	1276.87	1603.15	0.15			0.05	0.05	0.05	**0.38**
9131150	Vegetation	Tall forest G Warren	Tall forest; karri, red tingle & yellow tingle	51.53	53.94	0.15					0.05	**0.21**
9131151	Vegetation	Medium forest F Warren	Medium forest; jarrah & red tingle	18.41	20.19	0.15					0.05	**0.22**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9131152	Vegetation	Medium forest E Warren	Medium forest; jarrah & yellow tingle	72.92	73.79	0.15			0.05		0.05	**0.25**
9131153	Vegetation	Medium forest G Warren	Medium forest; jarrah & Rate's tingle	8.02	9.39	0.15					0.05	**0.23**
9131157	Vegetation	Tall forest H Warren	Tall forest; jarrah & marri	9.91	10.40	0.15			0.05		0.05	**0.26**
9131158	Vegetation	Mosaic ZZZA Warren	Mosaic: medium forest; jarrah & yellow tingle/medium forest; jarrah & Rate's tingle	0.93	0.95	0.15					0.05	**0.2**
9131180	Vegetation	Shrublands Other M Warren	Shrublands; *Calothamnus quadrifidis* & *Hakea trifircata* (Cape Naturaliste)	6.48	7.93	0.15					0.05	**0.24**
9140010	Vegetation	Medium woodland G Yalgoo	Medium woodland red mallee group	15.84	15.84	0.15					0.05	**0.2**
9140017	Vegetation	Shrublands Acacia A Yalgoo	Shrublands; *Acacia rostellifera* thicket	221.67	221.67	0.15					0.05	**0.2**
9140018	Vegetation	Low woodland A Yalgoo	Low woodland; mulga (*Acacia aneura*)	1002.80	1002.80	0.15				0.05	0.05	**0.25**
9140019	Vegetation	Low woodland B Yalgoo	Low woodland; mulga between sandridges	81.16	81.16	0.15						**0.15**
9140036	Vegetation	Shrublands Thicket A Yalgoo	Shrublands; thicket, acacia-casuarina alliance	694.09	750.18	0.15				0.05	0.05	**0.27**
9140039	Vegetation	Shrublands Mulga A Yalgoo	Shrublands; mulga scrub	95.75	95.75	0.15					0.05	**0.2**
9140040	Vegetation	Shrublands Acacia B Yalgoo	Shrublands; acacia scrub, various species	2846.43	3027.14	0.15				0.05	0.05	**0.27**
9140041	Vegetation	Shrublands Teatree B Yalgoo	Shrublands; teatree scrub	2.87	2.87	0.15						**0.15**
9140049	Vegetation	Shrublands Mixed A Yalgoo	Shrublands; mixed heath	6.64	6.64	0.15						**0.15**
9140112	Vegetation	Hummock grasslands F Yalgoo	Hummock grasslands, shrub steppe; *Acacia ligulata* over *Triodia plurinervata*	50.47	50.50	0.15						**0.15**
9140120	Vegetation	Succulent steppe with open low woodland A Yalgoo	Succulent steppe with open low woodland; mulga & sheoak	108.10	108.10	0.15					0.05	**0.2**
9140129	Vegetation	Bare Areas E Yalgoo	Bare areas; drift sand	43.51	43.51	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9140141	Vegetation	Medium woodland I Yalgoo	Medium woodland; York gum, salmon gum & gimlet	208.57	208.57	0.15					0.05	**0.2**
9140142	Vegetation	Medium woodland J Yalgoo	Medium woodland; York gum & salmon gum	92.59	92.59	0.15						**0.15**
9140169	Vegetation	Shrublands Mulga B Yalgoo	Shrublands; mulga & minnieritchie scrub	0.43	0.43	0.15					0.05	**0.2**
9140202	Vegetation	Shrublands Mulga E Yalgoo	Shrublands; mulga & *Acacia quadrimarginea* scrub	450.01	450.85	0.15					0.05	**0.2**
9140204	Vegetation	Succulent steppe with open scrub B Yalgoo	Succulent steppe with open scrub; scattered mulga & *Acacia sclerosperma* over saltbush & bluebush	118.45	118.45	0.15					0.05	**0.2**
9140205	Vegetation	Shrublands Acacia D Yalgoo	Shrublands; *Acacia sclerosperma* & bowgada scrub	76.97	76.97	0.15					0.05	**0.2**
9140206	Vegetation	Shrublands Bowgada A Yalgoo	Shrublands; bowgada & grevillea scrub	115.85	115.85	0.15						**0.15**
9140221	Vegetation	Succulent steppe A Yalgoo	Succulent steppe; saltbush	189.44	189.44	0.15				0.05	0.05	**0.25**
9140228	Vegetation	Shrublands Acacia F Yalgoo	Shrublands; *Acacia quadrimarginea* scrub	35.86	35.86	0.15						**0.15**
9140240	Vegetation	Succulent steppe with open scrub C Yalgoo	Succulent steppe with open scrub; scattered *Acaica sclerosperma* & bowgada over saltbush & bluebush	121.59	121.59	0.15					0.05	**0.2**
9140243	Vegetation	Shrublands Bowgada B Yalgoo	Shrublands; bowgada & minnieritchie scrub	401.71	401.78	0.15					0.05	**0.2**
9140248	Vegetation	Shrublands Bowgada C Yalgoo	Shrublands; bowgada scrub with scattered red mallee & *Eucalyptus sp.*	373.23	373.23	0.15					0.05	**0.2**
9140256	Vegetation	Low woodland M Yalgoo	Low woodland; York gum & cypress pine (adjacent to e6pMLi)	640.89	640.89	0.15				0.05		**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9140260	Vegetation	Mosaic I Yalgoo	Mosaic: shrublands tree-heath between sandhills; *Banksia ashbyi, Grevillea gordoniana, Acacia spp.,* melaleuca and mallee/shrublands; scrub-heath	191.79	191.79	0.15						**0.15**
9140266	Vegetation	Mosaic J Yalgoo	Mosaic: shrublands; bowgada scrub/ succulent steppe; saltbush & bluebush	49.03	49.03	0.15				0.05	0.05	**0.25**
9140268	Vegetation	Succulent steppe with open scrub E Yalgoo	Succulent steppe with open scrub; scattered *Acacia sclerosperma* over saltbush & bluebush	70.93	70.93	0.15					0.05	**0.2**
9140269	Vegetation	Low woodland O Yalgoo	Low woodland over scrub; mulga over bowgada scrub	375.89	375.89	0.15					0.05	**0.2**
9140314	Vegetation	Succulent steppe with open woodland A Yalgoo	Succulent steppe with open woodland; York gum over saltbush	10.48	10.48	0.15					0.05	**0.2**
9140321	Vegetation	Mosaic N Yalgoo	Mosaic: shrublands; *Acacia sclerosperma* & bowgada scrub/ succulent steppe; saltbush & bluebush	13.67	13.67	0.15					0.05	**0.2**
9140326	Vegetation	Low woodland Q Yalgoo	Low woodland over scrub; mulga over bowgada & minnieritchie scrub	5425.91	5425.91	0.15					0.05	**0.2**
9140337	Vegetation	Mosaic O Yalgoo	Mosaic: shrublands; bowgada scrub/ hummock grasslands, mixed sandplain - open red mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	27.85	27.85	0.15						**0.15**
9140352	Vegetation	Medium woodland M Yalgoo	Medium woodland; York gum	135.56	135.79	0.15					0.05	**0.2**
9140355	Vegetation	Shrublands Bowgada D Yalgoo	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	540.93	550.25	0.15					0.05	**0.2**
9140357	Vegetation	Medium woodland over scrub B Yalgoo	Medium woodland over scrub; York gum over bowgada & jam (*Acacia acuminata*)	370.03	370.03	0.15				0.05		**0.2**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9140358	Vegetation	Shrublands Bowgada E Yalgoo	Shrublands; bowgada & *Acacia quadrimarginea* on stony ridges	556.09	556.22	0.15					0.05	**0.2**
9140361	Vegetation	Shrublands Bowgada G Yalgoo	Shrublands; bowgada & minnieritchie scrub with scattered mulga	763.81	763.81	0.15					0.05	**0.2**
9140362	Vegetation	Mosaic U Yalgoo	Mosaic: shrublands; bowgada & minnieritchie scrub with scattered mulga/scattered groups of saltbush/ bluebush	0.69	0.69	0.15						**0.15**
9140363	Vegetation	Shrublands Bowgada H Yalgoo	Shrublands; bowgada scrub with scattered cypress pine	2476.55	2476.55	0.15					0.05	**0.2**
9140364	Vegetation	Shrublands Bowgada I Yalgoo	Shrublands; bowgada scrub with scattered eucalypts & cypress pine	5054.45	5100.52	0.15				0.05	0.05	**0.25**
9140365	Vegetation	Shrublands Bowgada J Yalgoo	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	407.87	417.35	0.15				0.05	0.05	**0.26**
9140368	Vegetation	Shrublands tree heath A Yalgoo	Shrublands tree-heath between sandhills; *Banksia ashbyi*, *Grevillea gordoniana*, *Acacia spp.*, melaleuca and mallee	3293.84	3293.84	0.15					0.05	**0.2**
9140380	Vegetation	Shrublands Scrub heath D Yalgoo	Shrublands; scrub-heath on sandplain	119.96	120.46	0.15				0.05	0.05	**0.25**
9140383	Vegetation	Shrublands Acacia K Yalgoo	Shrublands; *Acacia rostellifera* scrub-heath	77.61	77.61	0.15						**0.15**
9140384	Vegetation	Shrublands Mallee E Yalgoo	Shrublands; mallee & acacia thicket on coastal dunes (central west)	39.59	39.59	0.15					0.05	**0.2**
9140385	Vegetation	Shrublands Bowgada L Yalgoo	Shrublands; bowgada & jam scrub with scattered York gum	163.38	163.38	0.15					0.05	**0.2**
9140387	Vegetation	Shrublands Melaeuca C Yalgoo	Shrublands; *Melaleuca cardiophylla* thicket	65.97	66.54	0.15						**0.15**
9140389	Vegetation	Succulent steppe with open low woodland D Yalgoo	Succulent steppe with open low woodland; mulga over saltbush	7.09	7.09	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9140404	Vegetation	Shrublands Bowgada M Yalgoo	Shrublands; bowgada & *Acacia murrayana* scrub	1446.93	1519.03	0.15				0.05	0.05	**0.26**
9140405	Vegetation	Shrublands Acacia M Yalgoo	Shrublands; *Acacia sclerosperma*, bowgada & jam scrub	248.66	251.14	0.15				0.05	0.05	**0.25**
9140406	Vegetation	Shrublands Acacia N Yalgoo	Shrublands; acacia, casuarina, *Eucalyptus eudesmioides, Banksia ashbyi* & other mixed species thicket	1518.60	1529.97	0.15				0.05	0.05	**0.25**
9140411	Vegetation	Succulent steppe with open scrub G Yalgoo	Succulent steppe with open scrub; scattered bowgada & jam over saltbush	121.63	121.63	0.15						**0.15**
9140412	Vegetation	Succulent steppe with scrub D Yalgoo	Succulent steppe with scrub; teatree (*Melaleuca thyioides*) over samphire	50.87	50.87	0.15					0.05	**0.2**
9140414	Vegetation	Succulent steppe with open scrub H Yalgoo	Succulent steppe with open scrub; scattered bowgada & jam over saltbush & bluebush	303.89	303.89	0.15					0.05	**0.2**
9140415	Vegetation	Succulent steppe with open scrub I Yalgoo	Succulent steppe with open scrub; scattered mulga & other wattles over saltbush & bluebush	321.80	321.80	0.15					0.05	**0.2**
9140416	Vegetation	Low woodland T Yalgoo	Low woodland; mulga mixed with cypress pine & York gum	2240.69	2240.69	0.15					0.05	**0.2**
9140419	Vegetation	Shrublands Bowgada N Yalgoo	Shrublands; bowgada, jam and *Melaleuca uncinata* thicket	2904.60	3030.41	0.15				0.05	0.05	**0.26**
9140420	Vegetation	Shrublands Bowgada O Yalgoo	Shrublands; bowgada & jam scrub	6217.67	6230.86	0.15				0.05	0.05	**0.25**
9140423	Vegetation	Shrublands Acacia P Yalgoo	Shrublands; acacia scrub-heath (unknown spp.)	37.27	37.27	0.15						**0.15**
9140434	Vegetation	Shrublands Acacia S Yalgoo	Shrublands; *Acacia quadrimarginea* & jam scrub with scattered York gum & *Allocasuarina huegeliana*	13.87	13.87	0.15						**0.15**
9140437	Vegetation	Shrublands Mixed C Yalgoo	Shrublands; mixed acacia thicket on sandplain	43.02	43.03	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9140483	Vegetation	Hummock grasslands K Yalgoo	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex ; red mallee mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	2025.87	2025.87	0.15					0.05	**0.2**
9140485	Vegetation	Hummock grasslands M Yalgoo	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia basedowii*	59.77	59.77	0.15						**0.15**
9140533	Vegetation	Low woodland X Yalgoo	Low woodland; mulga & cypress pine	71.28	71.28	0.15					0.05	**0.2**
9140551	Vegetation	Shrublands Allocasuarina A Yalgoo	Shrublands; *Allocasuarina campestris* thicket	40.16	40.16	0.15						**0.15**
9140676	Vegetation	Succulent steppe F Yalgoo	Succulent steppe; samphire	284.17	284.17	0.15				0.05	0.05	**0.25**
9140683	Vegetation	Succulent steppe with open scrub L Yalgoo	Succulent steppe with open scrub; scattered *Acacia sclerosperma* & snakewood over samphire	503.19	503.19	0.15					0.05	**0.2**
9140686	Vegetation	Medium woodland ZD Yalgoo	Medium woodland; York gum & red mallee	40.65	40.65	0.15					0.05	**0.2**
9140687	Vegetation	Shrublands Bowgada P Yalgoo	Shrublands; bowgada & jam scrub with scattered *Allocasuarina heugeliana* & York gum	4.61	7.72	0.15					0.05	**0.34**
9140936	Vegetation	Medium woodland ZF Yalgoo	Medium woodland; salmon gum	17.70	17.70	0.15					0.05	**0.2**
9140984	Vegetation	Mosaic ZT Yalgoo	Mosaic: shrublands; acacia & melaleuca scrub/succulent steppe; saltbush	174.02	174.02	0.15					0.05	**0.2**
9141100	Vegetation	Hummock grasslands T Yalgoo	Hummock grassland; dwarf shrub/ steppe; mixed ericoid shrubs & spinifex	241.93	241.94	0.15						**0.15**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9141102	Vegetation	Mosaic ZZU Yalgoo	Mosaic: shrublands; mixed heath/ shrublands; acacia patchy scrub	36.51	36.51	0.15						**0.15**
9141104	Vegetation	Mosaic ZZV Yalgoo	Mosaic: shrublands; scrub-heath/ shrublands; *Acacia rostellifera* & *Melaleuca cardiophylla* thickets	128.46	129.53	0.15						**0.15**
9141106	Vegetation	Mosaic ZZW Yalgoo	Mosaic: shrublands; scrub-heath/ shrublands; acacia various species scrub	27.31	27.31	0.15					0.05	**0.2**
9141107	Vegetation	Open low woodland A Yalgoo	Open low woodland; *Eucalyptus oraria*	7.17	7.17	0.15						**0.15**
9141198	Vegetation	Mosaic ZZZC Yalgoo	Mosaic: succulent steppe with thicket; *Melaleuca thyiodes* over samphire/ shrublands; bowgada open scrub	104.82	120.69	0.15					0.05	**0.23**
9141423	Vegetation	Shrublands Scrub heath M Yalgoo	Shrublands; scrub-heath in Shark Bay area, mainly *Acacia spp.*	277.58	277.79	0.15					0.05	**0.2**
9142081	Vegetation	Shrublands Bowgada Q Yalgoo	Shrublands; bowgada and associated species, scrub	380.40	380.40	0.15						**0.15**
9142685	Vegetation	Shrublands Acacia H Yalgoo	Shrublands; *Acacia quadrimarginea* & jam scrub on greenstone	179.24	179.24	0.15					0.05	**0.2**
9400042	Vegetation	Shrublands Mallee A EsperanceF	Shrublands; mallee & acacia scrub on south coastal dunes	228.13	265.24	0.15		0.45		0.05	0.05	**0.81**
9400047	Vegetation	Shrublands Other A Esperance F	Shrublands; tallerack mallee-heath	2761.63	5480.58	0.15		0.45	0.05	0.05	0.05	**1**
9400048	Vegetation	Shrublands Scrub heath A Esperance F	Shrublands; scrub-heath	21.61	93.73	0.15		0.45	0.05	0.05	0.05	**1**
9400516	Vegetation	Shrublands Mallee J Esperance F	Shrublands; mallee scrub, black marlock	1834.66	2198.45	0.15		0.45		0.05	0.05	**0.84**
9400519	Vegetation	Shrublands Mallee K Esperance F	Shrublands; mallee scrub, *Eucalyptus eremophila*	346.22	675.15	0.15		0.45		0.05	0.05	**1**
9400934	Vegetation	Shrublands Mallee O Esperance F	Shrublands; mallee scrub (*Eucalyptus nutans*)	39.66	83.20	0.15		0.45	0.05	0.05	0.05	**1**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9410042	Vegetation	Shrublands Mallee A Esperance R	Shrublands; mallee & acacia scrub on south coastal dunes	1031.22	1088.95	0.15		0.45	0.05	0.05	0.05	**0.79**
9410047	Vegetation	Shrublands Other A Esperance R	Shrublands; tallerack mallee-heath	607.57	4170.06	0.15		0.45	0.05	0.05	0.05	**1**
9410048	Vegetation	Shrublands Scrub heath A Esperance R	Shrublands; scrub-heath	8.80	8.82	0.15		0.45				**0.6**
9410516	Vegetation	Shrublands Mallee J Esperance R	Shrublands; mallee scrub, black marlock	337.31	958.49	0.15		0.45	0.05	0.05	0.05	**1**
9410519	Vegetation	Shrublands Mallee K Esperance R	Shrublands; mallee scrub, *Eucalyptus eremophila*	20.15	42.30	0.15		0.45		0.05	0.05	**1**
9410934	Vegetation	Shrublands Mallee O Esperance R	Shrublands; mallee scrub (*Eucalyptus nutans*)	0.06	0.22	0.15		0.45		0.05		**1**
9900047	Vegetation	Shrublands Other A Mallee WM	Shrublands; tallerack mallee-heath	151.35	309.33	0.15		0.45		0.05	0.05	**1**
9900482	Vegetation	Medium woodland O WM	Medium woodland; merrit & red mallee	29.08	29.08	0.15	0.45					**0.6**
9900486	Vegetation	Mosaic ZB Mallee WM	Mosaic: medium woodland; salmon gum & red mallee/shrublands; mallee scrub, *Eucalyptus eremophila*	639.68	639.68	0.15		0.45			0.05	**0.65**
9900493	Vegetation	Medium woodland R WM	Medium woodland; salmon gum mixed with merrit & red mallee	7.31	7.31	0.15	0.45				0.05	**0.65**
9900516	Vegetation	Shrublands Mallee J Mallee WM	Shrublands; mallee scrub, black marlock	66.44	676.19	0.15		0.45		0.05	0.05	**1**
9900519	Vegetation	Shrublands Mallee K Mallee WM	Shrublands; mallee scrub, *Eucalyptus eremophila*	7608.46	15711.05	0.15		0.45		0.05	0.05	**1**
9900934	Vegetation	Shrublands Mallee O Mallee WM	Shrublands; mallee scrub (*Eucalyptus nutans*)	2.74	7.77	0.15		0.45		0.05	0.05	**1**
9910047	Vegetation	Shrublands Other A Mallee EM	Shrublands; tallerack mallee-heath	140.32	299.95	0.15		0.45		0.05	0.05	**1**
9910482	Vegetation	Medium woodland O EM	Medium woodland; merrit & red mallee	3180.35	3340.02	0.15	0.45			0.05	0.05	**0.74**

Marxan ID	Category	Name	Description	Remnant Veg (sq km)	Pre-Europe (sq km)	Initial base	Mallee	Kwongan	Dieback	Salinity	Urbanisation	Target
9910486	Vegetation	Mosaic ZB Mallee EM	Mosaic: medium woodland; salmon gum & red mallee/shrublands; mallee scrub, *Eucalyptus eremophila*	1059.53	2877.98	0.15		0.45		0.05	0.05	**1**
9910493	Vegetation	Medium woodland R EM	Medium woodland; salmon gum mixed with merrit & red mallee	187.60	187.60	0.15	0.45				0.05	**0.65**
9910516	Vegetation	Shrublands Mallee J Mallee EM	Shrublands; mallee scrub, black marlock	1090.68	2238.50	0.15		0.45		0.05	0.05	**1**
9910519	Vegetation	Shrublands Mallee K Mallee EM	Shrublands; mallee scrub, *Eucalyptus eremophila*	4640.40	5358.01	0.15		0.45		0.05	0.05	**0.81**
9910934	Vegetation	Shrublands Mallee O Mallee EM	Shrublands; mallee scrub (*Eucalyptus nutans*)	1.05	1.63	0.15		0.45		0.05		**1**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
Non-vegetation									
1001	Birds	*Acanthiza inornata*	Western thornbill	Endemic, Process limited (fire), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
1002	Birds	*Acanthiza iredalei iredalei*	Slender-billed thornbill	Vulnerable (Federal), Process limited (grazing)	0.15	0.15	0.45	0.00	**0.75**
1003	Birds	*Acanthorhynchus superciliosus*	Western spinebill	Endemic, Resource limited (nectarivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
1096	Birds	*Amytornis striatus striatus*	Striated grasswren	Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1004	Birds	*Amytornis textilis textilis*	Thick-billed grasswren	Endemic, Resource limited (ground-foraging insectivore), Process limited (fire), Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
1100	Birds	*Anas rhynchotis*	Australasian shoveler	Expert recommendation (indicator of ecosystem health)	0.15	0.15	0.00	0.00	**0.3**
1102	Birds	*Anas superciliosa*	Pacific black duck	Expert recommendation (indicator of ecosystem health, salinisation)	0.15	0.15	0.00	0.00	**0.3**
1005	Birds	*Anthochaera lunulata*	Western little wattlebird	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
1006	Birds	*Aphelocephala leucopsis*	Southern whiteface	Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.00	**0.3**
1007	Birds	*Aquila morphnoides (Hieraaetus morphnoides)*	Little eagle	Area limited (fragmentation), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1087	Birds	*Ardea pacifica*	White-necked heron	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1008	Birds	*Ardeotis australis*	Australian bustard	Expert recommendation (possible decliner, locally extinct in Wheatbelt), Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1009	Birds	*Artamus cyanopterus*	Dusky woodswallow	Resource limited (insectivore)	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1011	Birds	*Artamus minor*	Little woodswallow	Resource limited (insectivore)	0.15	0.15	0.00	0.00	**0.3**
1012	Birds	*Artamus personatus*	Masked woodswallow	Resource limited (insectivore)	0.15	0.15	0.00	0.00	**0.3**
1013	Birds	*Atrichornis clamosus*	Noisy scrub-bird	Endemic, Rare (State), Vulnerable (Federal), Endangered (State), Process limited (fire)	0.15	0.15	0.45	0.15	**0.9**
1014	Birds	*Biziura lobata*	Musk duck	Area limited (deep permanent water)	0.15	0.15	0.00	0.00	**0.3**
1015	Birds	*Botaurus poiciloptilus*	Australasian bittern	Rare (State), Vulnerable (State)	0.15	0	0.45	0.00	**0.6**
1016	Birds	*Burhinus grallarius*	Bush stone-curlew	Expert recommendation (locally extinct in Wheatbelt), Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1017	Birds	*Cacatua leadbeateri*	Major Mitchell's cockatoo	Resource limited (nesting hollows), Other specially protected (State)	0.15	0.15	0.45	0.00	**0.75**
1094	Birds	*Cacatua pastinator butleri (derbyi)*	Western long-billed corella (northern sp.)	Endemic, Resource limited (nesting hollows), Process limited (slow breeding rate)	0.15	0.15	0.00	0.15	**0.45**
1093	Birds	*Cacatua pastinator pastinator*	Muir's corella (southern sp.)	Endemic, Rare (State), Vulnerable (Federal), Endangered (State), Resource limited (nesting hollows), Process limited (slow breeding rate)	0.15	0.15	0.45	0.15	**0.9**
1019	Birds	*Calamanthus campestris montanellus*	Rufous fieldwren (Western Wheatbelt sp.)	Endemic, Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
1085	Birds	*Calidris ferruginea*	Curlew sandpiper	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1020	Birds	*Calyptorhynchus banksii naso*	Forest red-tailed black-cockatoo	Endemic, Rare (State), Vulnerable (Federal), Resource limited (nesting hollows)	0.15	0.15	0.45	0.15	**0.9**
1021	Birds	*Calyptorhynchus baudinii*	Baudin's black-cockatoo (long-billed black cockatoo)	Endemic, Rare (State), Vulnerable (Federal), Resource limited (nesting hollows)	0.15	0.15	0.45	0.15	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1010	Birds	*Calyptorhynchus latirostris SCP*	Carnaby's black-cockatoo (feeding areas Swan Coastal Plain)	Vegetation feeding surrogate, expert recommendation (threatened habitat)	0.35	0.15	0.00	0.00	**0.5**
1018	Birds	*Calyptorhynchus latirostris OTHER*	Carnaby's black-cockatoo (feeding areas Wheatbelt and other areas)	Vegetation feeding surrogate	0.35	0.15	0.00	0.00	**0.5**
1098	Birds	*Calyptorhynchus latirostris SCP*	Carnaby's black-cockatoo (breeding/ roosting areas Swan Coastal Plain)	Endemic, Rare (State), Endangered (Federal), Resource limited (food, nesting hollows)	0.15	0.15	0.45	0.15	**0.9**
1099	Birds	*Calyptorhynchus latirostris OTHER*	Carnaby's black-cockatoo (breeding/ roosting areas Wheatbelt and other areas)	Endemic, Rare (State), Endangered (Federal), Resource limited (food, nesting hollows)	0.15	0.15	0.45	0.15	**0.9**
1022	Birds	*Calyptorhynchus latirostris SCP*	Carnaby's black-cockatoo (Swan Coastal Plain)	Non-action specific	0.15	0.15	0.00	0.00	**0.3**
1023	Birds	*Calyptorhynchus latirostris OTHER*	Carnaby's black-cockatoo (Wheatbelt and other regions)	Non-action specific	0.15	0.15	0.00	0.00	**0.3**
1024	Birds	*Cereopsis novaehollandiae grisea*	Cape Barren goose (south-western sp.), Recherche Cape Barren goose	Endemic, Rare (State), Vulnerable (Federal)	0.15	0	0.45	0.15	**0.75**
1025	Birds	*Charadrius rubricollis (Thinornis rubricollis)*	Hooded plover	Area limited (breeding, feeding), Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1026	Birds	*Cinclosoma alisteri (Cinclosoma cinnamomeum)*	Nullabor quail-thrush (or cinnamon quail thrush)	Process limited (grazing), Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1027	Birds	*Cinclosoma castanotus*	Chestnut quail-thrush	Area limited (fragmentation), Expert recommendation (locally extinct in Wheatbelt)	0.15	0.15	0.00	0.00	**0.3**
1028	Birds	*Cladorhynchus leucocephalus*	Banded stilts	Area limited (breeding)	0.15	0.15	0.00	0.00	**0.3**
1029	Birds	*Climacteris affinis*	White-browed treecreeper	Area limited (fragmentation), Process limited (fire)	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1030	Birds	*Climacteris rufa*	Rufous treecreeper	Resource limited (insectivore), Process limited (fire), Expert recommendation (locally extinct in Wheatbelt)	0.15	0.15	0.00	0.00	**0.3**
1031	Birds	*Colluricincla harmonica*	Grey shrike-thrush	Area limited (fragmentation), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1032	Birds	*Dasyornis longirostris*	Western bristlebird	Endemic, Rare (State), Vulnerable (Federal), Process limited (fire), Resource limited (ground-foraging Insectivore)	0.15	0.15	0.45	0.15	**0.9**
1033	Birds	*Dromaius novaehollandiae*	Emu	Resource limited (large seed disperser), Expert recommendation (locally extinct in Wheatbelt)	0.15	0.15	0.00	0.00	**0.3**
1035	Birds	*Eopsaltria georgiana*	White-breasted robin	Endemic, Resource limited (ground-foraging Insectivore)	0.15	0.15	0.00	0.15	**0.45**
1034	Birds	*Eopsaltria griseogularis*	Western yellow robin	Area limited (fragmentation), Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.00	**0.3**
1089	Birds	*Erythrogonys cinctus*	Red-kneed dotterel	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1036	Birds	*Falco hypoleucos*	Grey falcon	Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1037	Birds	*Falco peregrinus*	Peregrine Falcon	Other specially protected (State)	0.15	0	0.45	0.00	**0.6**
1038	Birds	*Falcunculus frontatus leucogaster*	Crested shrike-tit	Endemic, Area limited (fragmentation), Expert recommendation (numbers possibly declining), Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
1039	Birds	*Glossopsitta porphyrocephala*	Purple-crowned lorikeet	Resource limited (pollinator)	0.15	0.15	0.00	0.00	**0.3**
1091	Birds	*Hirundo nigricans*	Tree martin	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1040	Birds	*Hylacola cauta whitlocki*	Shy heathwren (western sp.)	Endemic, Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
1041	Birds	*Ixobrychus flavicollis australis*	Black bittern	Priority 3 (DEC), Area limited (fragmentation)	0.15	0.15	0.45	0.00	**0.75**
1042	Birds	*Ixobrychus minutus*	Little bittern	Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1043	Birds	*Lalage tricolor (Lalage sueurii)*	White-winged triller	Resource limited (insectivore)	0.15	0.15	0.00	0.00	**0.3**
1044	Birds	*Leipoa ocellata*	Malleefowl	Rare (State), Vulnerable (Federal), Area limited (fragmentation), Expert recommendation (locally extinct in Wheatbelt)	0.15	0.15	0.45	0.00	**0.75**
1045	Birds	*Lichenostomus cratitius*	Purple-gaped honeyeater	Resource limited (nectarivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1046	Birds	*Lichenostomus ornatus*	Yellow-plumed honeyeater	Resource limited (nectarivore)	0.15	0.15	0.00	0.00	**0.3**
1084	Birds	*Limosa limosa*	Black-tailed godwit	Possible decliner (Swan Coastal Plain)	0.15	0.15	0.00	0.00	**0.3**
1047	Birds	*Malurus elegans*	Red-winged fairy-wren	Endemic, Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.15	**0.45**
1048	Birds	*Malurus lamberti*	Variegated fairy-wren	Resource limited (ground-foraging insectivore),	0.15	0.15	0.00	0.00	**0.3**
1049	Birds	*Malurus leucopterus*	White-winged fairy-wren	Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.00	**0.3**
1050	Birds	*Malurus pulcherrimus*	Blue-breasted fairy-wren	Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.00	**0.3**
1051	Birds	*Malurus splendens*	Splendid fairy-wren	Resource limited (ground-foraging insectivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1052	Birds	*Melithreptus chloropsis (Melithreptus lunatus)*	White-naped honeyeater	Expert recommendation (Endemic), Resource limited (nectarivore), Expert recommendation (locally extinct in Wheatbelt)	0.15	0.15	0.00	0.15	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1054	Birds	*Microeca fascinans*	Jacky winter	Area limited (fragmentation), Resource limited (ground-foraging insectivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1055	Birds	*Myiagra inquieta*	Restless flycatcher	Area limited (fragmentation)	0.15	0.15	0.00	0.00	**0.3**
1056	Birds	*Ninox connivens connivens*	Barking owl	Area limited (edge species), Resource limited (hollows), Priority 2 (DEC)	0.15	0.15	0.45	0.00	**0.75**
1057	Birds	*Numenius madagascariensis*	Eastern curlew	Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1059	Birds	*Oreoica gutturalis gutturalis*	Crested bellbird (southern sp.)	Area limited (fragmentation), Priority 4 (DEC)	0.15	0.15	0.00	0.00	**0.3**
1060	Birds	*Oxyura australis*	Blue-billed duck	Area limited (deep permanent water), Expert recommendation (indicator of ecosystem health, salinisation)	0.15	0.15	0.00	0.00	**0.3**
1061	Birds	*Pachycephala inornata*	Gilbert's whistler	Area limited (fragmentation)	0.15	0.15	0.00	0.00	**0.3**
1062	Birds	*Pachycephala rufiventris*	Rufous whistler	Resource limited (insectivore)	0.15	0.15	0.00	0.00	**0.3**
1063	Birds	*Pardalotus punctatus*	Spotted pardalote	Expert recommendation (Endemic), Resource limited (water courses, instectivore), Area limited (habitat fragmentation, loss of large trees, ground disturbance)	0.15	0.15	0.00	0.15	**0.45**
1097	Birds	*Pardalotus rubricatus*	Red browed pardalote	Resource limited (water courses, instectivore), Area limited (habitat fragmentation, loss of large trees, ground disturbance)	0.15	0.15	0.00	0.00	**0.3**
1064	Birds	*Pardalotus striatus*	Striated pardalote	Resource limited (leaf gleaner, water courses, insectivore), Area limited (habitat fragmentation, loss of large trees, ground disturbance)	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1065	Birds	*Pelecanus conspicillatus*	Australian pelican	Area limited (breeding)	0.15	0.15	0.00	0.00	**0.3**
1066	Birds	*Petroica cucullata (Melanodryas cucullata)*	Hooded robin	Area limited (fragmentation), Expert recommendation (locally extinct in Wheatbelt), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1067	Birds	*Petroica multicolor*	Scarlet robin	Resource limited (ground-foraging insectivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1068	Birds	*Pezoporus occidentalis*	Night parrot	Rare (State)	0.15	0	0.45	0.00	**0.6**
1069	Birds	*Pezoporus wallicus flaviventris*	Western ground parrot	Endemic, Rare (State), Endangered (Federal), Process limited (fire), Critically Endangered (State)	0.15	0.15	0.45	0.15	**0.9**
1070	Birds	*Phaps chalcoptera*	Common bronzewing	Resource limited (ground-foraging)	0.15	0.15	0.00	0.00	**0.3**
1071	Birds	*Phaps elegans*	Brush bronzewing	Resource limited (ground-foraging)	0.15	0.15	0.00	0.00	**0.3**
1072	Birds	*Phylidonyris melanops*	Tawny-crowned honeyeater	Resource limited (nectarivore), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1088	Birds	*Platalea flavipes*	Yellow-billed spoonbill	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1073	Birds	*Platycercus haematogaster narethae*	Naretha blue bonnett	Endemic, Other specially protected (State)	0.15	0	0.45	0.15	**0.75**
1095	Birds	*Platycercus icterotis icterotis*	Western rosella (southern sp.)	Endemic, Resource limited	0.15	0.15	0.00	0.15	**0.45**
1074	Birds	*Platycercus icterotis xanthogenys*	Western rosella (Mallee sp.)	Endemic, Rare (State), Resource limited (nesting hollows), Vulnerable (State)	0.15	0.15	0.45	0.15	**0.9**
1075	Birds	*Platycercus spurius*	Red-capped parrot	Endemic, Resource limited (nesting hollows)	0.15	0.15	0.00	0.15	**0.45**
1086	Birds	*Pluvialis fulva*	Pacific golden plover	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
1076	Birds	*Polytelis alexandrae*	Princess parrot	Vulnerable (Federal), Priority 4 (DEC)	0.15	0.15	0.45	0.00	**0.75**
1077	Birds	*Pomatostomus superciliosus ashbyi*	White-browed babbler (Western wheatbelt)	Endemic, Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
1079	Birds	*Psophodes nigrogularis nigrogularis*	Western whipbird (western heath sp.)	Endemic, Rare (State), Endangered (Federal), Process limited (fire)	0.15	0.15	0.45	0.15	**0.9**
1078	Birds	*Psophodes nigrogularis oberon*	Western whipbird (southern WA subsp.)	Endemic, Priority 4 (DEC), Process limited (fire)	0.15	0.15	0.00	0.15	**0.45**
1080	Birds	*Stagonopleura oculata*	Red-eared firetail	Endemic, Area limited (Swan Coastal Plain only)	0.15	0.15	0.00	0.15	**0.45**
1101	Birds	*Stictonetta naevosa*	Freckled duck	Expert recommendation (indicator of ecosystem health)	0.15	0.15	0.00	0.00	**0.3**
1081	Birds	*Stipiturus malachurus*	Southern emu-wren	Resource limited (ground-foraging insectivore)	0.15	0.15	0.00	0.00	**0.3**
1082	Birds	*Strepera versicolor*	Grey currawong	Area limited (fragmentation)	0.15	0.15	0.00	0.00	**0.3**
1092	Birds	*Tringa cinerea (Xenus cinereus)*	Terek sandpiper	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
1083	Birds	*Tyto novaehollandiae novaehollandiae*	Masked owl	Endemic, Priority 3 (DEC), Resource limited (nesting hollows)	0.15	0.15	0.45	0.15	**0.9**
1090	Birds	*Vanellus tricolor*	Banded lapwing	Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
2009	Mammals	*Bettongia lesueur lesueur*	Burrowing bettong (or boodie; Shark Bay sp.)	Endemic, Vulnerable (Federal), Rare (State), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2010	Mammals	*Bettongia pencillata ogilbyi*	Brush-tailed bettong (woylie)	Endemic, Rare (State), Endangered (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2011	Mammals	*Dasycercus cristicauda*	Mulgara (crest-tailed mulgara, minyiminyi)	Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.00	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
2012	Mammals	*Dasyurus geoffroii*	Western quoll (chuditch)	Endemic, Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2007	Mammals	*Falsistrellus mckenziei*	Western false pipistrelle	Endemic, Priority 4 (DEC), Expert recommendation (threatened)	0.15	0.15	0.00	0.15	**0.45**
2035	Mammals	*Hydromys chrysogaster*	Water-rat (rakali)	Priority 4 (DEC), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.00	**0.3**
2033	Mammals	*Isoodon obesulus fusciventer*	Quenda	Endemic, Priority 5 (DEC), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2036	Mammals	*Lagostrophus fasciatus fasciatus*	Banded hare-wallaby (mernine)	Endemic, Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
2034	Mammals	*Macropus eugenii derbianus*	Tammar wallaby	Endemic, Priority 5 (DEC), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2031	Mammals	*Macropus irma*	Western brush wallaby	Endemic, Priority 4 (DEC), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2013	Mammals	*Macrotis lagotis*	Bilby (dalgyte, ninu)	Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.00	**0.75**
2030	Mammals	*Mormopterus planiceps*	South-western free-tailed bat	Endemic, Expert recommendation (AB)	0.15	0.15	0.00	0.15	**0.45**
2003	Mammals	*Myrmecobius fasciatus*	Numbat	Endemic, Vulnerable (Federal), Rare (State), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2014	Mammals	*Notoryctes typhlops*	Southern marsupial mole (itjaritjari)	Rare (State), Endangered (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.00	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
2008	Mammals	*Nyctophilus timoriensis sp.*	Greater long-eared bat	Endemic, Priority 4 (DEC), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2015	Mammals	*Parantechinus apicalis*	Dibbler	Endemic, Rare (State), Endangered (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2017	Mammals	*Petrogale lateralis lateralis*	Black-flanked rock-wallaby	Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.00	**0.75**
2018	Mammals	*Phascogale calura*	Red-tailed phascogale	Endemic, Rare (State), Endangered (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2019	Mammals	*Phascogale tapoatafa (sp.. WAM M434)*	Brush-tailed phascogale	Endemic, Expert recommendation (numbers possibly declining), Rare (State), Vulnerable (DEC)	0.15	0.15	0.45	0.15	**0.9**
2004	Mammals	*Potorous gilberti*	Gilbert's potoroo	Endemic, Critically Endangered (Federal), Rare (State), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2020	Mammals	*Pseudocheirus occidentalis*	Western ringtail possum	Endemic, Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2029	Mammals	*Pseudomys albocinereus*	Ash-grey mouse	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2028	Mammals	*Pseudomys fieldi*	Djoongari	Endemic, Rare (State), Vulnerable (Federal), Expert recommendation (threatened), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.15	**0.9**
2027	Mammals	*Pseudomys shortridgei*	Heath rat	Rare (State), Vulnerable (Federal), Expert recommendation (numbers possibly declining)	0.15	0.15	0.45	0.00	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
2032	Mammals	*Pseydomys occidentalis*	Western mouse	Endemic, Priority 4 (DEC), Endemic, Expert recommendation (rare), Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2002	Mammals	*Setonix brachyurus*	Quokka	Endemic, Expert recommendation (numbers possibly declining), Vulnerable (Federal), Rare (State)	0.15	0.15	0.45	0.15	**0.9**
2021	Mammals	*Sminthopsis gilberti*	Gilbert's dunnart	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2022	Mammals	*Sminthopsis granulipes*	White-tailed dunnart	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2023	Mammals	*Sminthopsis griseoventer*	Grey-bellied dunnart	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
2024	Mammals	*Sminthopsis psammophila*	Sandhill dunnart	Rare (State), Endangered (Federal), Process limited (fire)	0.15	0.15	0.45	0.00	**0.75**
2001	Mammals	*Tarsipes rostratus*	Honey possum	Endemic, Expert recommendation (numbers possibly declining)	0.15	0.15	0.00	0.15	**0.45**
3001	Reptiles	*Acanthophis antarcticus*	Southern death adder	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
3002	Reptiles	*Antaresia stimsoni stimsoni*	Stimpson's python	Expert recommendation (threatening process)	0.15	0.15	0.00	0.00	**0.3**
3003	Reptiles	*Aprasia haroldi*	Shark Bay worm-lizard	Endemic, Expert recommendation (restricted distribution), Priority 1 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3004	Reptiles	*Aspidites ramsayi*	Woma	Expert recommendation (almost extinct), Priority 1 (DEC), Other specially protected (State)	0.15	0.15	0.45	0.00	**0.75**
3005	Reptiles	*Ctenophorus mckenziei*	Mckenzie's dragon	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3006	Reptiles	*Ctenophorus ornatus*	Ornate rock dragon	Endemic, Expert recommendation (confined to granite outcrops)	0.15	0.15	0.00	0.15	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
3007	Reptiles	*Ctenotus alleni*	Skink	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3008	Reptiles	*Ctenotus delli*	Dell's skink	Endemic, Expert recommendation (restricted distribution), Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
3009	Reptiles	*Ctenotus gemmula OTHER*	Jewelled sandplain skink (non-Swan Coastal Plain sp.)	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3010	Reptiles	*Ctenotus gemmula SCP*	Jewelled sandplain skink (Swan Coastal Plain sp.)	Endemic, Priority 3 (DEC), Expert recommendation (restricted distribution)	0.15	0.15	0.45	0.15	**0.9**
3011	Reptiles	*Ctenotus xenopleura*	Wide-striped skink	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3012	Reptiles	*Ctenotus youngsoni*	Shark Bay south-west skink	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3013	Reptiles	*Ctenotus zastictus*	Hamelin ctenotus	Endemic, Rare (State), Vulnerable (Federal), Expert recommendation (restricted distribution)	0.15	0.15	0.45	0.15	**0.9**
3014	Reptiles	*Cyclodomorphus branchialis*	Gilled slender blue-tongue	Endemic, Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
3015	Reptiles	*Delma concinna major*	Javelin legless lizard	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3034	Reptiles	*Delma concinna major (Aclys concinna major)*	Javelin legless lizard	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
3016	Reptiles	*Egernia luctuosa*	Mourning skink	Endemic, Area limited (confined to wetlands)	0.15	0.15	0.00	0.15	**0.45**
3017	Reptiles	*Egernia stokesii badia*	Western spiny-tailed skink	Endemic, Rare (State), Endangered (Federal), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
3035	Reptiles	*Egernia stokesii stokesii*	Houtman Abrolhos spiny-tailed skink	Endemic, Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
3018	Reptiles	*Elapognathus minor*	Little brown snake	Endemic, Expert recommendation (restricted distribution), Priority 2 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3019	Reptiles	*Lerista arenicola*	Bight slider	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3020	Reptiles	*Lerista axillaris*	Two-toed earless skink	Endemic, Expert recommendation (restricted distribution), Priority 2 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3021	Reptiles	*Lerista eupoda*	Skink	Endemic, Expert recommendation (restricted distribution), Priority 1 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3022	Reptiles	*Lerista humphriesi*	Taper-tailed west-coast slider	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3023	Reptiles	*Lerista lineata*	Lined skink	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3024	Reptiles	*Lerista macropisthopus galea*	Skink	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
3025	Reptiles	*Lerista puncticauda*	Dotty-tailed robust slider	Endemic, Expert recommendation (restricted distribution), Priority 2 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3026	Reptiles	*Lerista viduata*	Ravensthorpe Range slider	Endemic, Expert recommendation (restricted distribution), Priority 1 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3027	Reptiles	*Lerista yuna*	Yuna broad-blazed slider	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
3028	Reptiles	*Morelia spilota imbricata*	Carpet python	Endemic, Expert recommendation (restricted distribution), Priority 4 (DEC), Other specially protected (State)	0.15	0.15	0.45	0.15	**0.9**
3029	Reptiles	*Neelaps calonotos*	Black-striped snake	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3030	Reptiles	*Parasuta spectabilis bushi*	Spectacled hooded snake	Endemic, Expert recommendation (restricted distribution), Priority 1 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3031	Reptiles	*Paroplocephalus atriceps*	Lake Cronin snake	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3032	Reptiles	*Pletholax gracilis edelensis*	Slender slider	Endemic, Expert recommendation (restricted distribution), Priority 3 (DEC)	0.15	0.15	0.45	0.15	**0.9**
3033	Reptiles	*Pseudemydura umbrina*	Western swamp tortoise	Endemic, Rare (State), Critically Endangered (Federal)	0.15	0	0.45	0.15	**0.75**
4006	Amphibians	*Arenophryne rotunda*	Northern sandhill frog	Endemic, Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
4001	Amphibians	*Geocrinia alba*	White-bellied frog	Endemic, Rare (State), Endangered (Federal), Expert recommendation (Workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
4007	Amphibians	*Geocrinia lutea*	Nornalup frog (Walpole Frog)	Endemic, Priority 4 (DEC), Expert recommendation (restricted distribution)	0.15	0.15	0.00	0.15	**0.45**
4002	Amphibians	*Geocrinia vitellina*	Orange-bellied frog (yellow-bellied frog)	Endemic, Rare (State), Vulnerable (Federal), Area limited (habitat surrounded by farm land), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	0.9

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
4005	Amphibians	*Heleioporus albopunctatus*	Western spotted froglet	Endemic, Expert recommendation (workshop 2009), area limited (endangered habitat)	0.15	0.15	0.00	0.15	**0.45**
4004	Amphibians	*Myobatrachus gouldii*	Turtle frog	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
4003	Amphibians	*Spicospina flammocaerulea*	Sunset frog	Endemic, Rare (State), Endangered (Federal), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5051	Inland Water Species	*Abelaioscia troglogytes*	Pannikin Plains cave isopod	Endemic (DEC listing), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
5001	Inland Water Species	*Afurcagobius suppositus*	Long headed goby (or big headed goby)	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5033	Inland Water Species	*Amphibromus nervosus*	Wallaby grass	Endemic (FloraBase), Expert recommendation (surrogate for freshwater claypans)	0.15	0.15	0.00	0.15	**0.45**
5028	Inland Water Species	*Baumea articulata*		Endemic (FloraBase), Expert recommendation (surrogate)	0.15	0.15	0.00	0.15	**0.45**
5002	Inland Water Species	*Bostockia porosa*	Nightfish	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5044	Inland Water Species	*Bothriembryon bradshawi*	Land snail	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5045	Inland Water Species	*Bothriembryon brazieri*	Land snail	Expert recommendation (endemic), Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
5046	Inland Water Species	*Bothriembryon glauerti*	Land snail	Expert recommendation (endemic), Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
5047	Inland Water Species	*Bothriembryon irvineanus*	Land snail	Expert recommendation (endemic), Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
5048	Inland Water Species	*Bothriembryon perobesus*	Land snail	Expert recommendation (endemic), Priority 1 (DEC) (NOTE: On DEC "Presumed to be extinct" list)	0.15	0	0.45	0.15	**0.75**
5040	Inland Water Species	*Branchinella basispina*	Fairy shrimp	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5041	Inland Water Species	*Branchinella denticulata*	Fairy shrimp	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5042	Inland Water Species	*Branchinella simplex*	Fairy shrimp	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5043	Inland Water Species	*Branchinella wellardi*	Fairy shrimp	Priority 1 (DEC)	0.15	0	0.45	0.00	**0.6**
5037	Inland Water Species	*Calamoecia elongata*	Crustacean	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5020	Inland Water Species	*Cherax crassimanus*	Freshwater crayfish (Gilgie)	Endemic, Indicator species (healthy ecosystem)	0.15	0.15	0.00	0.15	**0.45**
5022	Inland Water Species	*Cherax glaber*	Freshwater crayfish (Koonac)	Endemic, Indicator species (healthy ecosystem)	0.15	0.15	0.00	0.15	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
5023	Inland Water Species	*Cherax plebejus (preissii)*	Freshwater Crayfish (Koonac)	Endemic, Indicator species (healthy ecosystem)	0.15	0.15	0.00	0.15	**0.45**
5025	Inland Water Species	*Cherax quinquecarinatus*	Freshwater Crayfish (Gilgie)	Endemic, Indicator species (healthy ecosystem)	0.15	0.15	0.00	0.15	**0.45**
5015	Inland Water Species	*Cherax tenuimanus*	Margaret River marron (or hairy marron)	Endemic, Rare (State), Critically Endangered (Federal), Indicator species (healthy ecosystem)	0.15	0.15	0.45	0.15	**0.9**
5003	Inland Water Species	*Craterocephalus cuneiceps*	Deep hardyhead	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5038	Inland Water Species	*Daphnia jollyi*	Planktonic crustaceans (rockpools sp.)	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5039	Inland Water Species	*Daphnia occidentalis*	Planktonic crustaceans	Expert recommendation (endemic), Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
5004	Inland Water Species	*Edelia vittata*	Western pygmy perch	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5016	Inland Water Species	*Engaewa pseudoreducta*	Margaret River burrowing crayfish	Endemic, Rare (State), Critically Endangered (Federal), Indicator species (healthy ecosystem)	0.15	0.15	0.45	0.15	**0.9**
5017	Inland Water Species	*Engaewa reducta*	Dunsborough burrowing crayfish	Endemic, Rare (State), Critically Endangered (Federal), Indicator species (healthy ecosystem)	0.15	0.15	0.45	0.15	**0.9**
5018	Inland Water Species	*Engaewa walpolea*	Walpole burrowing crayfish	Endemic, Rare (State), Vulnerable (State), Endangered (Federal), Indicator species (healthy ecosystem)	0.15	0.15	0.45	0.15	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
5032	Inland Water Species	*Eragrostis australasica*	Cane grass	Expert recommendation (surrogate for freshwater claypans in Northern Wheatbelt)	0.15	0.15	0.00	0.00	**0.3**
5030	Inland Water Species	*Eucalyptus occidentalis*		Endemic (FloraBase), Expert recommendation (surrogate)	0.15	0.15	0.00	0.15	**0.45**
5036	Inland Water Species	*Fibulacamptus bisetosus*	Crustacean	Priority 2 (DEC)	0.15	0	0.45	0.00	**0.6**
5005	Inland Water Species	*Galaxias maculatus*	Common jollytail	Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.00	**0.3**
5006	Inland Water Species	*Galaxias occidentalis*	Western minnow	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5007	Inland Water Species	*Galaxias truttaceus hesperius*	Trout minnow (spotted minnow)	Endemic, Rare (State), Critically Endangered (Federal), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5008	Inland Water Species	*Galaxiella munda*	Mud minnow	Endemic, Rare (State), Vulnerable (State), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5009	Inland Water Species	*Galaxiella nigrostriata*	Black stripe minnow	Endemic, Priority 3 (DEC), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5026	Inland Water Species	*Geotria australis*	Pouched lamprey	Area Limited (breeding), Priority 1 (DEC)	0.15	0.15	0.45	0.00	**0.75**
5049	Inland Water Species	*Glacidorbis occidentalis*	Freshwater snail	Endemic (DEC listing), Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
5052	Inland Water Species	*Hurleya sp (WAM642-97)*	Crystal Cave crangonyctoid	Endemic (DEC listing), Critically Endangered (State)	0.15	0	0.45	0.15	**0.75**
5010	Inland Water Species	*Hypseleotris aurea*	Golden carp gudgeon	Endemic, Priority 2 (DEC), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5011	Inland Water Species	*Lepidogalaxias salamandroides*	Salamanderfish	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5029	Inland Water Species	*Melaleuca strobophylla*		Endemic (DEC FloraBase), Expert recommendation (surrogate)	0.15	0.15	0.00	0.15	**0.45**
5034	Inland Water Species	*Myriophyllum*	Water milfoil	Expert recommendation (surrogate for fresh water and granite outcrops)	0.15	0.15	0.00	0.00	**0.3**
5012	Inland Water Species	*Nannatherina balstoni*	Balston's pygmy perch	Endemic, Rare (State), Vulnerable (Federal), Expert recommendation (workshop 2009)	0.15	0.15	0.45	0.15	**0.9**
5035	Inland Water Species	*Parartemia contracta*	Salt brine shrimp (inland sp.)	Endemic (expert opinion - AP), Priority 1 (DEC), Process limited (salinity)	0.15	0.15	0.45	0.15	**0.9**
5014	Inland Water Species	*Pseudogobius olorum*	Swan River goby	Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.00	**0.3**
5013	Inland Water Species	*Tandanus bostocki*	Freshwater cobbler	Endemic, Expert recommendation (workshop 2009)	0.15	0.15	0.00	0.15	**0.45**
5031	Inland Water Species	*Triglochin huegelii* (last name was incorrect and spelt huegelli - changed as per FloraBase listing)		Endemic (DEC FloraBase), Expert recommendation (surrogate)	0.15	0.15	0.00	0.15	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
5050	Inland Water Species	*Westralunio carteri*	Freshwater mussel	Priority 4 (DEC)	0.15	0.15	0.00	0.15	**0.45**
6025	Invertebrates	*Acercella poorginup*	Poorginup Swamp watermite	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6001	Invertebrates	*Aganippe castellum*	Tree-stem trapdoor spider	Expert recommendation (endemic), Rare (State), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6026	Invertebrates	*Arbanitis inornatus*	Trapdoor spider	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6002	Invertebrates	*Austrarchaea mainae*	Western archaeid spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6003	Invertebrates	*Austroassiminea letha*	Cape Leeuwin freshwater snail	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6027	Invertebrates	*Austromerope poultoni*	Scorpionfly	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6028	Invertebrates	*Austrosaga spinifer*	Cricket	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
5053	Invertebrates	*Bothriembryon ()*	Snails	Expert recommendation (surrogates for good habitat)	0.15	0.15	0.00	0.00	**0.3**
6024	Invertebrates	*Budginmaya eulae*	Eula's planthopper	Endemic, Expert recommendation (species request), Priority 1 (DEC)	0.15	0.15	0.45	0.15	**0.9**
6004	Invertebrates	*Cynotelopus notabilis*	Western Australian pill millipede	Expert recommendation (endemic), Rare (State), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6005	Invertebrates	*Epicyliosoma sarahae*	Sarah's pill millipede	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6029	Invertebrates	*Hemisaga lucifer*	Cricket	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6030	Invertebrates	*Hemisaga vepreculae*	Cricket	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
6031	Invertebrates	*Hylaeus globuliferus*	Bee	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
6006	Invertebrates	*Idiosoma nigrum*	Shield-backed trapdoor spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6032	Invertebrates	*Ixalodectes flectocercus*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6033	Invertebrates	*Jalmenus aridus*	Butterfly	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6034	Invertebrates	*Kawaniphila pachomai*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
6007	Invertebrates	*Kwonkan eboracum*	Yorkrakine trapdoor spider	Expert recommendation (endemic), Rare (State), Critically Endangered (State)	0.15	0	0.45	0.15	**0.75**
6035	Invertebrates	*Leioproctus bilobatus*	Bee	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6036	Invertebrates	*Leioproctus contrarius*	Bee	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
6008	Invertebrates	*Leioproctus douglasiellus*	Bee	Expert recommendation (endemic), Rare (State), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6009	Invertebrates	*Moggridgea sp.*	Stirling Range trapdoor spider	Expert recommendation (endemic), Rare (State), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6010	Invertebrates	*Moggridgea tingle*	Tingle trapdoor spider	Expert recommendation (endemic), Rare (State), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6011	Invertebrates	*Neopasiphae simplicior*	Bee	Expert recommendation (endemic), Rare (State), Critically Endangered (Federal), Endangered (State)	0.15	0	0.45	0.15	**0.75**
6012	Invertebrates	*Ogyris subterrestris petrina*	Arid bronze azure butterfly	Expert recommendation (endemic), Rare (State), Critically Endangered (State)	0.15	0	0.45	0.15	**0.75**
6037	Invertebrates	*Pachysaga munggai*	Cricket	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
6038	Invertebrates	*Pachysaga strobila*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6039	Invertebrates	*Phasmodes jeeba*	Cricket	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6040	Invertebrates	*Psacadonotus seriatus*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6041	Invertebrates	*Pseudohydraphantes doegi*	Doeg's watermite	Endemic, Priority 2 (DEC)	0.15	0	0.45	0.15	**0.75**
6020	Invertebrates	*Rhytidid species (WAM 2295-69)*	Stirling Range rhytidid snail	Expert recommendation (endemic), Rare (State), Critically Endangered (State)	0.15	0	0.45	0.15	**0.75**
6023	Invertebrates	*South facing slopes*		Expert recommendation (refugia)	0.15	0.15	0.00	0.00	**0.3**
6013	Invertebrates	*Synemon gratiosa*	Graceful sun moth	Expert recommendation (endemic), Rare (State), Endangered (Federal)	0.15	0	0.45	0.15	**0.75**
6014	Invertebrates	*Tartarus mullamullangensis*	Mullamullang cave spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
6015	Invertebrates	*Tartarus murdochensis*	Murdoch Sink cave spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6016	Invertebrates	*Tartarus nurinensis*	Nurina cave spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6017	Invertebrates	*Tartarus thampannensis*	Thampanna cave spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6018	Invertebrates	*Teyl sp. (By Main 953/2683, 1984/13)*	Minnivale trapdoor spider	Expert recommendation (endemic), Rare (State), Critically Endangered (State)	0.15	0	0.45	0.15	**0.75**
6042	Invertebrates	*Throscodectes xederoides*	Mogumber bush cricket	Endemic, Priority 3 (DEC)	0.15	0	0.45	0.15	**0.75**
6043	Invertebrates	*Throscodectes xiphos*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6044	Invertebrates	*Trichosternus relictus*	Beetle	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
6019	Invertebrates	*Troglodiplura lowryi*	Nullarbor Cave trapdoor spider	Expert recommendation (endemic), Rare (State), Vulnerable (State)	0.15	0	0.45	0.15	**0.75**
6045	Invertebrates	*Windbalea viride*	Cricket	Endemic, Priority 1 (DEC)	0.15	0	0.45	0.15	**0.75**
7092	Inland Water Bodies	Channels Areas (listed)	Channels Areas (listed) All	Expert recommendation	0.4	0.15	0.45	0	**1**
7023	Inland Water Bodies	Channels Areas (non-listed) Avon		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7024	Inland Water Bodies	Channels Areas (non-listed) Coolgardie		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7025	Inland Water Bodies	Channels Areas (non-listed) Esperance		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7026	Inland Water Bodies	Channels Areas (non-listed) Jarrah		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7027	Inland Water Bodies	Channels Areas (non-listed) Mallee		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7028	Inland Water Bodies	Channels Areas (non-listed) Swan Coastal Plain		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7093	Inland Water Bodies	Channels Major Rivers (listed)	Channels Major Rivers (listed) All	Expert recommendation	0.4	0.15	0.45	0	**1**
7029	Inland Water Bodies	Channels Major Rivers (non-listed) Avon		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7030	Inland Water Bodies	Channels Major Rivers (non-listed) Carnarvon		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7031	Inland Water Bodies	Channels Major Rivers (non-listed) Coolgardie		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7032	Inland Water Bodies	Channels Major Rivers (non-listed) Esperance		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7033	Inland Water Bodies	Channels Major Rivers (non-listed) Geraldton		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7034	Inland Water Bodies	Channels Major Rivers (non-listed) Jarrah		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7035	Inland Water Bodies	Channels Major Rivers (non-listed) Mallee		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7036	Inland Water Bodies	Channels Major Rivers (non-listed) Murchison		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7037	Inland Water Bodies	Channels Major Rivers (non-listed) Nullarbor		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7038	Inland Water Bodies	Channels Major Rivers (non-listed) Swan Coastal Plain		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7039	Inland Water Bodies	Channels Major Rivers (non-listed) Warren		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7040	Inland Water Bodies	Channels Major Rivers (non-listed) Yalgoo		Expert recommendation	0.65	0.15	0.00	0.00	**0.8**
7094	Inland Water Bodies	Channels Minor Rivers (listed)	Channels Minor Rivers (listed) All	Expert recommendation	0.4	0.15	0.45	0	**1**
7043	Inland Water Bodies	Channels Minor Rivers (non-listed) Avon		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7044	Inland Water Bodies	Channels Minor Rivers (non-listed) Coolgardie		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7045	Inland Water Bodies	Channels Minor Rivers (non-listed) Esperance		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7046	Inland Water Bodies	Channels Minor Rivers (non-listed) Geraldton		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7047	Inland Water Bodies	Channels Minor Rivers (non-listed) Jarrah		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7048	Inland Water Bodies	Channels Minor Rivers (non-listed) Mallee		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7049	Inland Water Bodies	Channels Minor Rivers (non-listed) Murchison		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7050	Inland Water Bodies	Channels Minor Rivers (non-listed) Nullarbor		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7051	Inland Water Bodies	Channels Minor Rivers (non-listed) Swan Coastal Plain		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7052	Inland Water Bodies	Channels Minor Rivers (non-listed) Warren		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7053	Inland Water Bodies	Channels Minor Rivers (non-listed) Yalgoo		Expert recommendation	0.15	0.15	0.00	0.00	**0.3**
7095	Inland Water Bodies	Estuaries (listed)	Estuaries (listed) All	Expert recommendation	0.4	0.15	0.45	0	**1**
7055	Inland Water Bodies	Estuaries (non-listed) Esperance		Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7056	Inland Water Bodies	Estuaries (non-listed) Geraldton		Expert recommendation	0.75	0.15	0.00	0.00	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7057	Inland Water Bodies	Estuaries (non-listed) Jarrah		Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7058	Inland Water Bodies	Estuaries (non-listed) Swan Coastal Plain		Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7059	Inland Water Bodies	Estuaries (non-listed) Warren		Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7083	Inland Water Bodies	Other Caves (non-listed) Coolgardie		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7084	Inland Water Bodies	Other Caves (non-listed) Geraldton		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7085	Inland Water Bodies	Other Caves (non-listed) Hampton		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7086	Inland Water Bodies	Other Caves (non-listed) Jarrah		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7087	Inland Water Bodies	Other Caves (non-listed) Mallee		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7088	Inland Water Bodies	Other Caves (non-listed) Nullarbor		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7089	Inland Water Bodies	Other Caves (non-listed) Swan Coastal Plain		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7090	Inland Water Bodies	Other Caves (non-listed) Warren		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7069	Inland Water Bodies	Other Water Bodies (non-listed) Avon	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7070	Inland Water Bodies	Other Water Bodies (non-listed) Carnarvon	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7071	Inland Water Bodies	Other Water Bodies (non-listed) Coolgardie	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7072	Inland Water Bodies	Other Water Bodies (non-listed) Esperance	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7073	Inland Water Bodies	Other Water Bodies (non-listed) Geraldton	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7074	Inland Water Bodies	Other Water Bodies (non-listed) Great Victoria Desert	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7075	Inland Water Bodies	Other Water Bodies (non-listed) Hampton	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7076	Inland Water Bodies	Other Water Bodies (non-listed) Jarrah	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7077	Inland Water Bodies	Other Water Bodies (non-listed) Mallee	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7078	Inland Water Bodies	Other Water Bodies (non-listed) Murchison	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7079	Inland Water Bodies	Other Water Bodies (non-listed) Nullarbor	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7080	Inland Water Bodies	Other Water Bodies (non-listed) Swan Coastal Plain	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7081	Inland Water Bodies	Other Water Bodies (non-listed) Warren	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7082	Inland Water Bodies	Other Water Bodies (non-listed) Yalgoo	Includes springs, waterholes and water points	Expert recommendation	0.75	0.15	0.00	0.00	**0.9**
7091	Inland Water Bodies	Wetlands (listed)	Wetlands (listed) All	Expert recommendation	0.4	0.15	0.45	0	**1**
7008	Inland Water Bodies	Wetlands (non-listed) Avon		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7009	Inland Water Bodies	Wetlands (non-listed) Carnarvon		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7010	Inland Water Bodies	Wetlands (non-listed) Coolgardie		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7011	Inland Water Bodies	Wetlands (non-listed) Esperance		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7012	Inland Water Bodies	Wetlands (non-listed) Geraldton		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7013	Inland Water Bodies	Wetlands (non-listed) Great Victoria Desert		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7014	Inland Water Bodies	Wetlands (non-listed) Hampton		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7015	Inland Water Bodies	Wetlands (non-listed) Jarrah		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7016	Inland Water Bodies	Wetlands (non-listed) Mallee		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7017	Inland Water Bodies	Wetlands (non-listed) Murchison		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7018	Inland Water Bodies	Wetlands (non-listed) Nullarbor		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7019	Inland Water Bodies	Wetlands (non-listed) Swan Coastal Plain		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7020	Inland Water Bodies	Wetlands (non-listed) Warren		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**
7021	Inland Water Bodies	Wetlands (non-listed) Yalgoo		Expert recommendation	0.3	0.15	0.00	0.00	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
7001	Inland Water Bodies	Wild Rivers Coolgardie		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7002	Inland Water Bodies	Wild Rivers Esperance		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7003	Inland Water Bodies	Wild Rivers Great Victoria Desert		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7004	Inland Water Bodies	Wild Rivers Jarrah		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7005	Inland Water Bodies	Wild Rivers Murchison		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7006	Inland Water Bodies	Wild Rivers Nullarbor		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
7007	Inland Water Bodies	Wild Rivers Warren		Expert recommendation (surrogate for biodiversity)	0.3	0.15	0.00	0.00	**0.45**
8001	Flora	*Acacia aprica*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8002	Flora	*Acacia cochlocarpa subsp. cochlocarpa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8003	Flora	*Acacia cochlocarpa subsp. velutinosa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8004	Flora	*Acacia imitans*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8005	Flora	*Acacia pharangites*		DEC RPF (Rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8006	Flora	*Acacia sciophanes*		DEC RPF (Rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8007	Flora	*Acacia subflexuosa subsp. capillata*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8008	Flora	*Acacia unguicula*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8009	Flora	*Acacia vassalii*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8010	Flora	*Acacia volubilis*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8011	Flora	*Adenanthos pungens subsp. effusus*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8012	Flora	*Andersonia annelsii*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8013	Flora	*Andersonia axilliflora*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8014	Flora	*Banksia anatona*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8135	Flora	*Banksia attenuata*	Candlestick banksia	Expert recommendation (Endemic), Indicator species (valuable habitat - banksia woodland)	0.15	0.15	0.00	0.15	**0.45**
8015	Flora	*Banksia brownii*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8016	Flora	*Banksia fuscobractea*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8017	Flora	*Banksia ionthocarpa subsp. chrysophoenix*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8018	Flora	*Banksia ionthocarpa subsp. ionthocarpa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8019	Flora	*Banksia montana*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8020	Flora	*Banksia mucronulata subsp. retrorsa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8134	Flora	*Boronia megastigma*	Brown boronia	Expert recommendation (Endemic), Indicator species (condition), Process limited (fire)	0.15	0.15	0.00	0.15	**0.45**
8021	Flora	*Brachyscias verecundus*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8022	Flora	*Caladenia busselliana*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8023	Flora	*Caladenia caesarea subsp. maritima*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8024	Flora	*Caladenia drakeoides*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8025	Flora	*Caladenia elegans*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8026	Flora	*Caladenia graniticola*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8027	Flora	*Caladenia huegelii*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8028	Flora	*Caladenia melanema*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8029	Flora	*Caladenia procera*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8030	Flora	*Caladenia viridescens*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8031	Flora	*Caladenia williamsiae*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8032	Flora	*Calytrix breviseta subsp. breviseta*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8033	Flora	*Chorizema humile*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8034	Flora	*Conostylis setigera subsp. dasys*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8035	Flora	*Cyphanthera odgersii subsp. occidentalis*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8036	Flora	*Darwinia carnea*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8037	Flora	*Darwinia sp. Williamson* (G.J. Keighery 12717)		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8038	Flora	*Daviesia bursarioides*		DEC RPF (Rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8039	Flora	*Daviesia cunderdin*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8040	Flora	*Daviesia euphorbioides*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8041	Flora	*Daviesia glossosema*		DEC RPF (Rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8042	Flora	*Daviesia microcarpa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8043	Flora	*Daviesia ovata*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8044	Flora	*Daviesia pseudaphylla*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8045	Flora	*Drakaea confluens*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8046	Flora	*Drakaea elastica*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8047	Flora	*Drakaea isolata*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8048	Flora	*Epiblema grandiflorum var. cyaneum*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8049	Flora	*Eremophila ciliata*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8050	Flora	*Eremophila glabra subsp. chlorella*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8051	Flora	*Eremophila koobabbiensis*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8052	Flora	*Eremophila lactea*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8053	Flora	*Eremophila nivea*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8054	Flora	*Eremophila pinnatifida*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8055	Flora	*Eremophila rostrata subsp. trifida*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8056	Flora	*Eremophila scaberula*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8057	Flora	*Eremophila subteretifolia*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8058	Flora	*Eremophila verticillata*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8059	Flora	*Eucalyptus absita*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8060	Flora	*Eucalyptus balanites*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8061	Flora	*Eucalyptus cuprea*		DEC RPF (Rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8062	Flora	*Eucalyptus dolorosa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8063	Flora	*Eucalyptus impensa*		DEC RPF (Rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8137	Flora	*Eucalyptus loxophleba*	York gum	Expert recommendation (iconic species), Indicator species (agriculture-rich soils), Area limited (high turnover)	0.15	0.15	0.00	0.00	**0.3**
8136	Flora	*Eucalyptus occidentalis*	Flat-topped yate	Expert Recommendation (endemic), Expert recommendation (iconic species), Area limited (agriculture, dieback, flooding, weeds)	0.15	0.15	0.00	0.15	**0.45**
8064	Flora	*Eucalyptus phylacis*		DEC RPF (rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8065	Flora	*Gastrolobium diabolophyllum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8066	Flora	*Gastrolobium glaucum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8067	Flora	*Gastrolobium hamulosum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8068	Flora	*Gastrolobium luteifolium*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8069	Flora	*Gastrolobium papilio*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8070	Flora	*Grevillea acropogon*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8071	Flora	*Grevillea althoferorum subsp. althoferorum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8072	Flora	*Grevillea althoferorum subsp. fragilis*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8073	Flora	*Grevillea batrachioides*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8074	Flora	*Grevillea brachystylis subsp.* Busselton (G.J. Kei)		DEC RPF (rare); Expert Recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8075	Flora	*Grevillea bracteosa subsp. howatharra*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8076	Flora	*Grevillea calliantha*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8077	Flora	*Grevillea curviloba subsp. curviloba*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8078	Flora	*Grevillea dryandroides subsp. dryandroides*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8079	Flora	*Grevillea humifusa*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8080	Flora	*Grevillea maccutcheonii*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8081	Flora	*Grevillea maxwellii*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8082	Flora	*Grevillea phanerophlebia*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8083	Flora	*Grevillea pythara*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8084	Flora	*Grevillea scapigera*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8085	Flora	*Guichenotia seorsiflora*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8086	Flora	*Gyrostemon reticulatus*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8087	Flora	*Haloragis platycarpa*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8088	Flora	*Hemiandra gardneri*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8089	Flora	*Hemiandra rutilans*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8090	Flora	*Hemigenia ramosissima*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8091	Flora	*Hybanthus cymulosus*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8092	Flora	*Isopogon robustus*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8093	Flora	*Isopogon uncinatus*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8094	Flora	*Jacksonia pungens*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8095	Flora	*Lambertia echinata subsp. echinata*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8096	Flora	*Lambertia echinata subsp. occidentalis*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8097	Flora	*Lambertia fairallii*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8098	Flora	*Lambertia orbifolia subsp. orbifolia*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8099	Flora	*Lasiopetalum pterocarpum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8100	Flora	*Latrobea colophona*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8101	Flora	*Leucopogon gnaphalioides*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8102	Flora	*Leucopogon spectabilis*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8103	Flora	*Lysiosepalum abollatum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8104	Flora	*Marianthus paralius*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8105	Flora	*Marianthus sp. Bremer* (N. Gibson & M. Lyons 1776)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8106	Flora	*Myoporum turbinatum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8107	Flora	*Persoonia micranthera*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8108	Flora	*Petrophile latericola*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8109	Flora	*Philotheca basistyla*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8110	Flora	*Pityrodia axillaris*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8111	Flora	*Pityrodia scabra*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8112	Flora	*Pterostylis sp. Northampton* (S.D. Hopper 3349)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8113	Flora	*Rhacocarpus rehmannianus var. webbianus*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8114	Flora	*Rhizanthella gardneri*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8115	Flora	*Ricinocarpos brevis*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8116	Flora	*Rulingia sp.Trigwell Bridge* (R.Smith s.n. 20.6.89)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8117	Flora	*Scaevola macrophylla*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8118	Flora	*Stylidium amabile*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8119	Flora	*Stylidium semaphorum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8120	Flora	*Symonanthus bancroftii*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8121	Flora	*Synaphea sp.* Fairbridge Farm (D. Papenfus 696)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8122	Flora	*Synaphea sp.* Pinjarra (R. Davis 6578)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8123	Flora	*Synaphea stenoloba*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8124	Flora	*Tetratheca deltoidea*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8125	Flora	*Tetratheca paynterae subsp. paynterae*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8126	Flora	*Thelymitra dedmaniarum*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8127	Flora	*Thomasia sp.* Green Hill (S. Paust 1322)		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8128	Flora	*Verticordia albida*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8129	Flora	*Verticordia apecta*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8130	Flora	*Verticordia plumosa var. ananeotes*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8131	Flora	*Verticordia spicata subsp. squamosa*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
8132	Flora	*Verticordia staminosa subsp. staminosa*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
8133	Others	*Verticordia staminosa var. erecta*		DEC RPF (rare); Expert recommendation (endemic)	0.15	0	0.45	0.15	**0.75**
9017	Others	Granite outcrops Avon Wheatbelt		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9003	Others	Connectivity Avon Wheatbelt	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9004	Others	Connectivity Carnarvon	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9005	Others	Connectivity Coolgardie	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9006	Others	Connectivity Esperance	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9007	Others	Connectivity Geraldton	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9008	Others	Connectivity Great Victoria Desert	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9009	Others	Connectivity Hampton	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9010	Others	Connectivity Jarrah Forest	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9011	Others	Connectivity Mallee	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9012	Others	Connectivity Murchison	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9013	Others	Connectivity Nullarbor	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9014	Others	Connectivity Swan Coastal Plain	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9015	Others	Connectivity Warren	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
9016	Others	Connectivity Yalgoo	Vegetation Connectivity	Expert recommendation (healthy ecosystem)	0.05	0.15	0.00	0.00	**0.2**
9018	Others	Granite outcrops Coolgardie		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9019	Others	Granite outcrops Esperance		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9020	Others	Granite outcrops Geraldton		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9021	Others	Granite outcrops Jarrah Forest		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9022	Others	Granite outcrops Mallee		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9023	Others	Granite outcrops Murchison		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9024	Others	Granite outcrops Nullarbor		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9025	Others	Granite outcrops Swan Coastal Plain		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9026	Others	Granite outcrops Warren		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
9027	Others	Granite outcrops Yalgoo		Expert recommendation (refugia, unique biodiversity, water source, Indigenous significance)	0.3	0.15	0.00	0.00	**0.45**
9029	Others	PEC A Avon Wheatbelt	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9030	Others	PEC A Coolgardie	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9031	Others	PEC A Esperance	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9032	Others	PEC A Geraldton	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9033	Others	PEC A Great Victoria Desert	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9034	Others	PEC A Hampton	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9035	Others	PEC A Jarrah	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9036	Others	PEC A Mallee	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9037	Others	PEC A Murchison	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**

Marxan ID	Category	Species Name	Common Name	Reasoning for target	Base	AOR	Listed	Endemic	Target
9038	Others	PEC A Nullarbor	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9039	Others	PEC A Swan Coastal Plain	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9040	Others	PEC A Warren	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9041	Others	PEC A Yalgoo	Priority Ecological Communities (PEC) 1, 2, 3	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.45	0.00	**0.9**
9044	Others	PEC B AvonWheatbelt	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9042	Others	PEC B Carnarvon	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9045	Others	PEC B Coolgardie	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9043	Others	PEC B Esperance	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9046	Others	PEC B Jarrah	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9047	Others	PEC B Swan Coastal Plain	Priority Ecological Communities (PEC) 4,5	Threatened communities (State), Expert recommendation (threatened)	0.3	0.15	0.00	0.00	**0.45**
9028	Others	TEC ALL	Threatened Ecological Communities (TEC)	Threatened communities (State), Expert recommendation (threatened)	0.4	0.15	0.45	0.00	**1**