The South Coast Regional Invasive Species Framework

Prepared for South Coast NRM and the regional community
September 2014

Chris Gunby

CONTENTS

INTRODUCTION

The Invasive Species Framework (ISF) has been developed for South Coast NRM to assist in its role in leading, assisting and at times funding invasive species management in the South Coast region. The ISF provides a follow up and builds on the foundational work of the Invasive Species Strategy 2013. The ISF provides strategic direction on invasive species management, at a broad cross theme and regional level.

The ISF links invasive species management with known NRM values and priority assets. For each combination of value and asset it lists, the ISF categorises the importance of invasive species as a threatening process. In doing so, it provides a means of ranking invasive species management, based on its importance for NRM values and assets.

The management rankings contained in the ISF are based on the principle that priority should be placed to those threatening processing with the greatest potential impact on the highest valued assets.

This is a normal principle for NRM management, but it is accepted there will be other factors that will determine final priorities, such as community capacity and funding opportunities. As such the ISF is not put forward as a means of determining priorities for invasive species management. Rather, it is a tool to assist in this process and encourages a strategic approach by identifying where actions can have the greatest benefit for NRM values and priority assets.

The values, priority assets and threats contained in the ISF are based on existing information and as such the ISF reveals rather than sets priorities. In some areas there are major information gaps and these are noted.

As a framework the ISF can readily take on board new information as planning and management of the region advances. The ISF uses value, asset and threat categories and rankings that can be applied to any NRM theme and as such provides a means of comparing invasive species management across sectors.

The ISF is shown in full in Appendix 1, while Section 2 provides an explanation of the terms and rankings used in the ISF, and Section 3 provides a simplified list of the priority value, asset and invasive species combination.

1.1 DEVELOPMENT OF THE INVASIVE SPECIES FRAMEWORK

- The development of the ISF required the following steps:
- Clarification of NRM values to be protected/enhanced.
- Identification of priority assets for each value
- Identification of priority threats to these value/asset combinations.
- Ranking of invasive species threat to these value/threat combinations.
- Ranking of invasive species management based on value/asset/IS threat combo
- Assessment of existing management.
- Identification of gaps or recommendations for management.
-

Identification of NRM values to be protected/enhanced

It was agreed in consultation with South Coast NRM that the broad NRM themes to be used should be based on *Southern Prospects 2011 – 2016.*

The specific values chosen are those that could be identified using existing documentation. Cultural priority assets have yet to be identified so are not included in the ISF. Again, it is important to emphasise that new values or categories can be added as new research or planning is undertaken.

Identification of priority assets to be protected

Water resource and waterway assets having high economic and high amenity values were used as identified in 2003 using a state wide waterways assessment method. Waterways having high ecological values were identified referring to Ramsar, the Directory of Important Wetlands, the Regional Wetland Studies, the Wild River designations and previous work undertaken by the Centre of Excellence in NRM.

All this information enabled identification of 114 priority assets, noting that the same asset can be listed several times under the different values used.
For the land theme, ABS information was used to rank livestock, broad acre cropping, plantation, nursery, fruit and nut, vegetable and viticulture land use assets. It was agreed, in consultation with South Coast NRM, to not include urban land uses at this stage.

For coastal and marine waters, high economic and high ecological values were used, but division into priority assets was not possible due to a lack of previous planning.

For biodiversity, flora diversity density mapping, threatened species mapping and connectivity planning were used to identify more than 60 priority assets.

Again, there is considerable overlap in these assets, but the areas and titles of these assets were not altered to ensure linkages to previous work were retained. This reference material, along with engagement with key technical officers, enabled the ranking of these assets into categories of international, national, regional and local importance.

The reference material used in the identification of values and assets is shown in the ISF and is also listed in the later section on key source material.

Identification of priority threats to these values/assets

The above documentation in most cases contained information on the most significant threats to these values and threats, and these are detailed in the ISF. This provides a context against which to consider the significance of invasive species.

Identification of importance of invasive species as a threat to this value/asset

The threat posed by invasive species was ranked using the above information, local management plans or expert opinion. The source of information used to justify the level is shown in the ISF. Rankings of ***Very High*** were given to invasive species likely to destroy the assets value, with ***Low*** being given to situations where the invasive species are not likely to impact on the value/asset combination. Ranking definitions are explained in Section 2.

Categorising invasive species management based on value/asset and invasive species threat combinations

The importance of invasive species management has been categorised based on value of the asset and the level of threat posed by the invasive species. For example, an asset of international importance for a particular value (such as the Stirling Range for biodiversity-diversity) with *a Very* High invasive species threatening process (phytophthora) is categorised ***Extreme***. An asset of local importance for a particular value (such as groundwater resource providing a local potable water supply), with a Low level of threat from invasive species, would have a ***Low*** ranking.

It is important to stress the management categories are for specific combinations of value, asset and invasive species threat. A particular asset (such as a river, area of land or marine waters) can have various values and therefore be listed several times, sometimes with very different resulting management categories. **The ISF categories the combinations of value, asset and threat, not the asset in isolation.**

The overall significance of invasive species management is shown in the ISF (Appendix 1) and a more detailed explanation of how the categories are worked out is shown in Section 2.

The priority combinations of asset, value and invasive species threat (without any explanation or supporting information) are listed in Section 3. **It is important Section 3 is not distributed or used without the context and explanation found in the other documents.**

Assessment of existing management

The ISF also includes reference to the level of existing management of invasive species for a particular value and asset combination (see columns L and M, Appendix 1). The level of management was ranked with reference to the level of planning, on-ground works and community capacity. An explanation of the rankings is contained in Section 3.
Existing documentation and expert opinion was sought to determine the level of existing management, but often there was insufficient information or knowledge. More consultation is recommended to complete this assessment.

Identification of gaps or recommendations for management

The assessment of invasive species management for particular value and asset combinations referred to above reveals some common observations and these are discussed next.

1.2 WHAT THE INVASIVE SPECIES FRAMEWORK REVEALS

Priority value/asset/threat combinations

Biodiversity based combinations of value-asset-invasive species dominate the highest priority categories of the ISF (see Section 3). All six assets contained in the Extreme management category are biodiversity based, not surprising, given the biodiversity values of the region are recognised as of international value. Within the Extreme category, biodiversity uniqueness/rarity is the most common value, a reflection of the fact invasive species can pose a very high risk to the species' survival.

Stirling Range and Lake Muir are also included for their biodiversity – diversity value (as well as uniqueness/rarity value), given phytophthora and feral pigs respectively pose a very high risk to these values. The assets are located generally in the west of the region, a reflection of the diversity and rarity hotspots and severity of invasive species impacts, as well as better information that exists for this part of the region. Biodiversity also dominates the Very High management category, but the values are more evenly spread over diversity, rarity/uniqueness and connectivity. The 25 assets in this category cover a larger portion of the region, including Lake Warden and Cape Le Grand in the east of the region and offshore islands.

Although biodiversity dominates both Extreme and Very High management categories, agricultural production is also listed in the Very High category. Broadacre cropping and livestock farming are listed in this category, given their international value and the high threat posed by new crop or livestock diseases, as well as predation by foxes/dogs (for the later).

Water assets tended to dominate the Medium to Low management categories, a reflection of their lower values (relative to biodiversity) and the fact invasive species are frequently low or medium threats to these values. Again, it is important to emphasise these rankings are based on specific value/asset/invasive species combinations, and many waterways would be located in important biodiversity areas and so have a greater value and priority for invasive species management.

Management gaps and priorities

The ISF provides comments on the management of each specific value-asset-invasive species combination, where information is available. General observations from these comments are listed below, but for comments at a specific value/asset/invasive species combination see the ISF (Appendix 1).

In most cases invasive species are being managed at a low or medium level, with either a management plan in place and limited implementation, or no plan in place and limited and uncoordinated implementation. The highest level of management was generally in very specific areas (particularly national parks and nature reserves) although even in such areas long term implementation was not secure.

For many value-asset combinations there is limited knowledge of invasive species impacts. For example, although wild rivers are designated based on their low level of human interference (including invasive species impacts), there is no ongoing monitoring of the impacts of invasive species. There is a low level of understanding of the impacts of invasive species on many priority assets, despite their very high value.

Monitoring of invasive species is limited, with most assets having no ongoing monitoring program, despite the severe impacts such invasive species may have.

Examples include no ongoing monitoring of exotic fish in river systems having threatened fish populations and no ongoing monitoring of algae or ruppia in priority estuaries.

Most assets have no defined monitoring program, but where such monitoring programs have been assisted by planning exercises that have defined targets, there is still a need to devise

effective and sustainable means of monitoring invasive species in the long term. Gondwana Link is seeking to assist groups in establishing such monitoring in several areas.

Most assets have no management plans, or have plans that do not specifically address the threat posed by invasive species.

Again, national parks and nature reserves are the main exception, and many local government reserves are also subject to strategic invasive species guidance, although in this case attention is normally focused on environmental weeds.

In almost all cases, funding to undertake works is a major impediment and for most areas outside national parks and reserves, capacity of groups to be engaged is limited through limited catchment officer time. As catchment support is decreased this coordination and leadership role will be a significant management gap.

It needs to be widely recognised that there is considerable agency and community action on invasive species, as shown in the ISF. The management of invasive species in national parks and nature reserves by DPaW, the management of environmental weeds by local governments and catchment groups, the management of weeds and feral animals on farms by landowners, and the containment of new agricultural diseases by DAFWA are notable examples. Areas that merit greater attention based on the findings of the ISF are listed below.

For agricultural land, the risk posed by foxes and wild dogs to livestock from off-farm reserves need ongoing community support and action. On- farm support is needed for the management of invasive species from non-cultivated land (such as riparian reserves). Plantations also provide areas where environmental weeds need greater attention.

For priority high economic potable water resource assets, the risks posed to these values by invasive species is considered low and as such there is limited management. External assistance is needed to address environmental weeds and other invasive species in such areas. Planning to guide management is required for most water resource priority assets, particularly the wetlands included in this ISF, and investigations are needed to assess the invasive species risks and distributions, particularly for the ecologically important water resource assets.

For biodiversity, the level of management within national parks and nature reserves needs to be complemented by similar work on adjacent land and especially on ecologically important linkages.

Planning, governance and on–ground works all need supporting in such areas. Similar support is needed for high biodiversity areas outside the national estate, with an example being the Ravensthorpe Range. In such areas invasive species management is minimal, yet could seriously impact on internationally recognised biodiversity values.

The management of foxes and feral cats close to towns is a further gap impacting on biodiversity-connectivity across the region. Managing environmental weeds within and near the urban centres is a big issue requiring sustained community participation. For coastal waters, ongoing surveillance of both values and threats is required, in estuaries, offshore waters and Islands. Detailed planning is needed to better detail values and threats. Ongoing support for weed control on priority islands is needed.

1.3 LIMITATIONS OF THE INVASIVE SPECIES FRAMEWORK

When using the ISF be aware of its benefits and its limitations. Firstly, the ISF focuses attention on highly valued and highly threatened assets. Such an approach is needed, but as stated before, there may be reasons to focus on other assets (such as when a priority is to increase community capacity, protect previous investment or maximise funding opportunities). The ISF should be utilised with other information and criteria when agreeing on invasive species priorities.

The ISF is also dependent on good information on NRM values, assets and threats. For some NRM themes, particularly water and biodiversity, there has been strategic planning that has identified values, priority areas (assets) and threats. For other areas, particularly agricultural productive land, marine waters and cultural areas, the values and assets have not been identified or mapped.

Of the assets identified, very few have local management plans that have prioritised threats, let alone invasive species threats. The consequence of the information available is that the many values and threats can only be described in broad terms and some asset areas (such as marine waters and broad acre cropping) are extremely large. As new work and further management planning is undertaken, so the level of detail will increase.

The scope of this project did not allow mapping of the assets and instead the geographic label given to the asset by the reference material is retained.

In many cases there is overlap – for example the Stirling's to Fitzgerald biodiversity – connectivity link will overlap with the Pallinup-Corackerup biodiversity- uniqueness/rarity

asset and the Fitzgerald-Stirling biodiversity - diversity asset. The author has retained original labels provided in the reference material or from expert opinion to ensure transparency of process. A further step to map and agree on asset names and boundaries would assist the priority setting process.

As a final caution, it needs to be remembered most of the assets listed in the ISF have been identified high value by previous strategic planning exercises. As such the use of terms low, medium and high priority are only relative – we are categorising high value assets and all need attention.

SECTION 2. EXPLANATION OF TERMS USED IN THE INVASIVE SPECIES FRAMEWORK

Theme

Broad NRM themes used to classify values, based on Southern Prospects 2011 - 2016 - Water, Land, Biodiversity, Cultural Heritage, Coastal and Marine. No specific values and assets have been identified for Cultural theme, given no information provided on this theme.

Value Category

The specific value being used to determine the asset. Within the Water theme there are categories for assets with high economic, amenity and ecological value. For biodiversity there are categories of assets with diversity, uniqueness and connectivity value. There are various other value categories used for the other themes, based on existing information. It is expected that other value categories will be added as new studies are completed.

Asset

A priority area with a name and is able to be mapped, relating to that specific value. It is important to note assets can be listed several times, against different value categories. The assets are based on existing documentation as far as possible. It is important to note assets are named based on the documentation that has identified this asset-this means various asset names are used in the ISF, at times for the same or similar area. At some future stage these asset names could be reduced in number and simplified by standardising the names of assets.

Ranking

Assets are assigned a ranking for this particular value. Each asset is ranked at International, National/State, Regional or Local level.

Justification of ranking

This column explains the reason for the ranking used, referring to the documentation, strategic document or expert opinion used. This ranking is based on existing information/advice, e.g. Ramsar wetlands have been assigned an International ranking for ecological value, while National Register of Important wetlands are ranked national.

Wetlands identified as regionally significant are listed as of Regional importance. In some cases there is interpretation of existing information and this is explained. For example, biodiversity uniqueness has been ranked at International level for assets with more than 10

threatened species, while assets with few threatened species is given National status. Biodiversity diversity is given an International ranking where flora species density is above the 300 species/unit shown in Hopper (2003).

This reflects a distinction in the supporting information, and teases out differences, for example with a few sites having many threatened species and a large number with a small number. Any such interpretations are explained in the ISF value column. Where there is no existing literature to support a ranking, expert opinion is used instead and referenced in the ISF.

Most significant threats

This column identifies the main threats to this asset that have been identified for this particular value/asset combination. For example, the Denmark River's value as a potable water supply would be threatened by vegetation clearing, removal of plantations, climate change and pollution.

Justification

This explains the source of information used to explain the above (F) and can be existing literature or expert opinion.

Significance of Invasive Species as threat to this asset's value

This column ranks the significance of invasive species to that asset for this value, using the categories listed below:

VH –	Very High. Without abatement the invasive species will likely destroy this asset's value.
H -	High, without abatement the invasive species is likely to heavily impact on this asset's value.
M -	Medium. Without abatement the invasive species is likely to have some impacts on this asset's value.
L -	Low, without abatement the invasive species is not likely to have significant impacts on this asset's value.
These rankings consider both the likelihood of the Invasive Species occurring and the severity of the impact (e.g. dieback has only a low likelihood of occurring on offshore islands, but the potential impact on biodiversity - diversity could be considerable, while environmental weeds may have a less significant impact but higher likelihood of occurring. With this example both are likely to score a high ranking.	

Justification

The literature or expert opinion used to rank the importance of invasive species is detailed here, along with mention of the type of invasive species on which the ranking is based (as invasive species will have different impacts). For example, Phytophthora dieback could be judged to be a very high risk to biodiversity- diversity in the Stirling Range (based on existing documentation), while predation could be judged to have a high impact, rabbits a medium threat and pigs a low threat. Generally, the ranking used would be based on the highest threat (Phytophthora in this particular case) and this threat is named in this column.

Overall significance of invasive species management for this value/asset

The importance of invasive species management for this value/asset combination is listed in this column, and is worked out based on the following table:

VALUE RANKING	INTERNATIONAL	EXTREME	VERY HIGH	HIGH	MEDIUM
	NATIONAL	VERY HIGH	HIGH	MEDIUM HIGH	MEDIUM
	REGIONAL	HIGH	MEDIUM-HIGH	MEDIUM	LOW
	LOCAL	MEDIUM	MEDIUM	LOW	LOW
		VERY HIGH	HIGH	MEDIUM	LOW
		INVASIVE SPECIES THREAT RANKING			

Explanation

Notes to support or clarify column above, if required. This column gives some guidance on key invasive species used in the above ranking.

Existing level of management

This column describes the level of management for this particular value/asset/invasive species combination (not just the asset on its own). The ranking to describe the level of management is detailed below:

Very High	Strategy/policy/plan exists, is being implemented fully. Invasive species being controlled and reduced. Long-term funding guaranteed.
High	Strategy/policy/plan exists, is generally being implemented. Invasive species being controlled. Longer term funding/implementation not certain.
Medium	Plan/strategy/policy exists, implementation is only partial.
Low	Plan/strategy/policy exists but is not being implemented, or implementation works occur without plan/strategy/policy. Invasive species not controlled or impact not known.

Lead agencies

Agencies considered having a lead responsibility for this particular value/asset/invasive species combination.

Note and recommendations

Brief notes to highlight any gaps or priorities for further work

SECTION 3 - INVASIVE SPECIES MANAGEMENT: REGIONAL PRIORITIES BASED ON ASSET/VALUE ASSESSMENT.

Notes:

1) Asset names based on supporting reference material – see ISF for more detail.

2) There is overlap in asset areas.

3) Assets can be listed several times due to having different values.

4) For explanation of rankings see Section 2.

5) For justified caption of rankings see ISF (Appendix 1).

6) Priority invasive species threat is the single most dominant threat on which overall ranking is based. Several threats may be included if they are equally significant. It is acknowledged there are other threats.

EXTREME PRIORITY - Asset, value and invasive species threat combinations

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Stirling Range	Biodiversity-Uniqueness Biodiversity-Diversity Biodiversity-Refugia	Phytophthora Phytophthora Phytophthora
Many Peaks/Two Peoples Bay	Biodiversity-Uniqueness	Fox/Feral cat Predation
Mt Lindesay	Biodiversity-Uniqueness	Fox/Feral cat Predation
Fitzgerald	Biodiversity-Uniqueness	Fox/Feral cat Predation, Phytophthora
Walpole	Biodiversity-Uniqueness	Fox/Feral cat Predation
Muir-Unicup	Biodiversity-Diversity Biodiversity-Uniqueness Water-Ecological	Pigs, Phytophthora, Fox/Feral cat Predation Pigs, Phytophthora, Fox/Feral cat Predation Pigs, Phytophthora, Fox/Feral cat Predation

VERY HIGH PRIORITY – Asset, value and invasive species threat combinations

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Lake Gore	Water-High Ecological	Fox/Feral cat Predation
Lake Warden	Water-High Ecological	Fox/Feral cat Predation
Byenup Lagoon	Water-High Ecological	Fox/Feral cat Predation
Moats Lake system	Water-High Ecological	Exotic Fish, Fox/Feral cat Predation
Livestock and Products	Land -Productive Agricultural Land	New animal disease, Wild dog/ Fox predation
Broad acre Cropping	Land -Productive Agricultural Land	New crop disease
Offshore Islands	Coastal-High Ecological	Introduced feral animal predation, Phytophthora
Pallinup-Corackerup	Biodiversity-Diversity	Phytophthora
Fitzgerald-Stirling's	Biodiversity-Uniqueness Biodiversity-Connectivity	Phytophthora Phytophthora, Fox/Feral cat Predation
Porongurup	Biodiversity-Uniqueness Biodiversity-Diversity Biodiversity-Connectivity Biodiversity-Refugia	Weeds Weeds Weeds, Fox/Feral cat Predation Weeds, Fox/Feral cat Predation
Cranbrook area	Biodiversity-Uniqueness	Phytophthora
Ravensthorpe Range	Biodiversity-Diversity Biodiversity-Uniqueness	Phytophthora Phytophthora
Denbarker	Biodiversity-Uniqueness	Phytophthora
Cape Le Grand	Biodiversity-Uniqueness Biodiversity-Connectivity	Phytophthora Phytophthora, Fox/Feral cat Predation
Fitzgerald	Biodiversity-Diversity	Phytophthora, Fox/Feral cat Predation
Manypeaks/Two Peoples Bay	Biodiversity-Diversity Biodiversity-Connectivity	Fox/Feral cat Predation, Phytophthora Fox/Feral cat Predation, Phytophthora
Mount Lindesay	Biodiversity-Diversity	Fox/Feral cat Predation, Phytophthora
Walpole area	Biodiversity-Diversity	Fox/feral cat predation, pigs
Lindesay Link	Biodiversity-Connectivity	Feral Animal Predation
Forest to Stirlings	Biodiversity-Connectivity Biodiversity Diversity	Phytophthora
Ranges Link	Biodiversity-Connectivity	Phytophthora, Weeds, Fox/Feral cat Predation
Kalgan River Link	Biodiversity-Connectivity	No information

HIGH PRIORITY - Asset, value and invasive species threat combinations

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Balicup	Water-High Ecological	Foxes/Feral cats
Mortijinup Lake	Water-High Ecological	Foxes/Feral cats
Yelilup Yate Swamp	Water-High Ecological	Foxes/Feral cats
Lake Pleasant View	Water-High Ecological	Foxes/Feral cats
Mt Soho Swamps	Water-High Ecological	Feral Pigs
Owingup Swamp	Water-High Ecological	Exotic Fish, Foxes/Feral cats
Culham Inlet System	Water-High Ecological	Foxes/Feral cats
Fitzgerald Inlet System	Water-High Ecological	Foxes/Feral cats
Oyster Harbour System	Water-High Ecological	Algae, Introduced Marine Pests, Foxes/Feral cats
Oldfield	Biodiversity-Uniqueness	Foxes/Feral cats
Beaumont	Biodiversity-Uniqueness	No information
Cape Arid	Biodiversity-Uniqueness	No information
Frank Hann	Biodiversity-Uniqueness	No information
Grass Patch	Biodiversity-Uniqueness	No information
Esperance area	Biodiversity-Uniqueness	No information
Recherche	Biodiversity-Uniqueness	No information
Nuytsland	Biodiversity-Uniqueness	No information
Lake Shaster	Biodiversity-Uniqueness	No information
Russel Range	Biodiversity-Uniqueness	No information
Dundas	Biodiversity-Uniqueness	No information
Munglinup	Biodiversity-Uniqueness	No information
Esperance Mallee Corridor	Biodiversity-Connectivity	No information
Fitzgerald River Corridor	Biodiversity-Connectivity	No information
Gordon/Frankland River Corridor	Biodiversity-Connectivity	No information

HIGH PRIORITY - Asset, value and invasive species threat combinations (continued)

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Hassell Corridor	Biodiversity-Connectivity	No information
Jerdacuttup River Corridor	Biodiversity-Connectivity	No information
Lake Magenta Link	Biodiversity-Connectivity	No information
Munglinup River Corridor	Biodiversity-Connectivity	No information
Oldfield River Corridor	Biodiversity-Connectivity	No information
Philips River Corridor	Biodiversity-Connectivity	No information
Ravensthorpe Ranges Corridor	Biodiversity-Connectivity	No information
Salmon Gums Corridor	Biodiversity-Connectivity	No information
South Stirlings Link	Biodiversity-Connectivity	No information
Young River Corridor	Biodiversity-Connectivity	No information

MEDIUM-HIGH PRIORITY - Asset, value and invasive species threat combinations

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Princess Royal Harbour	Water –Economic	Macro algae
Pink Lake	Water –Ecological	Algae, Foreshore Weeds
Corackerup Suite	Water –Ecological	Fox/Feral cat Predation
Moingungup Suite	Water –Ecological	Fox/Feral cat Predation
Cordingup Suite	Water –Ecological	Fox/Feral cat Predation
Cobumup Suite	Water –Ecological	Fox/Feral cat Predation
Many Peaks Suite	Water –Ecological	Fox/Feral cat Predation
Pabelup Suite	Water –Ecological	Fox/Feral cat Predation
Kojaneerup Suite	Water –Ecological	Fox/Feral cat Predation
Ujicup Suite	Water –Ecological	Fox/Feral cat Predation

MEDIUM HIGH PRIORITY - Asset, value and invasive species threat combinations (cont.)

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Malimup Suite	Water –Ecological	Fox/Feral cat Predation
Frenchman Bay Suite	Water –Ecological	Fox/Feral cat Predation
Mt Bland Suite	Water –Ecological	Fox/Feral cat Predation
Coyanarup Suite	Water –Ecological	Fox/Feral cat Predation
Corimup Suite	Water –Ecological	Fox/Feral cat Predation
Boronia Road Suite	Water –Ecological	Fox/Feral cat Predation
Blue Lagoon Suite	Water –Ecological	Fox/Feral cat Predation
Swan lake Suite	Water –Ecological	Fox/Feral cat Predation
Gardner Lake Suite	Water –Ecological	Fox/Feral cat Predation
Cascade East Suite	Water –Ecological	Predation, Weeds, Phytophthora
Cascade West Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lort River Mid Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lort River Upper-Mid Suite	Water –Ecological	Predation, Weeds, Phytophthora
Reserve Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Peak Charles Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Native Dog Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Roberts Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lake Shooter System	Water –Ecological	Predation, Weeds, Phytophthora
Single Winds Suite	Water –Ecological	Predation, Weeds, Phytophthora
Oldfield Estuary Suite	Water –Ecological	Predation, Weeds, Phytophthora
Munglinup River Suite	Water –Ecological	Predation, Weeds, Phytophthora
Cheadanup Suite	Water –Ecological	Predation, Weeds, Phytophthora
Benelong West Suite	Water –Ecological	Predation, Weeds, Phytophthora
Jerdacuttup Lakes Suite	Water –Ecological	Predation, Weeds, Phytophthora

MEDIUM-HIGH PRIORITY - Asset, value and invasive species threat combinations (cont.)

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Cascade East Suite	Water –Ecological	Predation, Weeds, Phytophthora
Cascade West Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lort River Mid Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lort River Upper-Mid Suite	Water –Ecological	Predation, Weeds, Phytophthora
Reserve Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Peak Charles Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Native Dog Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Roberts Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lake Shooter System	Water –Ecological	Predation, Weeds, Phytophthora
Single Winds Suite	Water –Ecological	Predation, Weeds, Phytophthora
Oldfield Estuary Suite	Water –Ecological	Predation, Weeds, Phytophthora
Munglinup River Suite	Water –Ecological	Predation, Weeds, Phytophthora
Cheadanup Suite	Water –Ecological	Predation, Weeds, Phytophthora
Benelong West Suite	Water –Ecological	Predation, Weeds, Phytophthora
Jerdacuttup Lakes Suite	Water –Ecological	Predation, Weeds, Phytophthora
Jerdacuttup Lakes East Suite	Water –Ecological	Predation, Weeds, Phytophthora
Dunns Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora
Coujinup Swamp	Water –Ecological	Predation, Weeds, Phytophthora
Clark Road Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lake Chidnup	Water –Ecological	Predation, Weeds, Phytophthora
Coujinup Swamp	Water –Ecological	Predation, Weeds, Phytophthora
Clark Road Suite	Water –Ecological	Predation, Weeds, Phytophthora
Lake Chidnup	Water –Ecological	Predation, Weeds, Phytophthora
Bundara Suite	Water –Ecological	Predation, Weeds, Phytophthora

MEDIUM-HIGH PRIORITY - Asset, value and invasive species threat combinations (cont.)

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Dempster River	Water –Ecological	Not known
Inlet River	Water –Ecological	Not Known
Viticulture	Land - Productive Agriculture	New disease
Plantations	Land- productive agriculture	New disease
Fruit and Nuts	Land - Productive Agriculture	New disease
Vegetables	Land -Productive Agriculture	New disease
State Coastal Waters	Coastal-Ecological	Introduced marine pests
State Coastal Waters	Coastal-Economic	Introduced marine pests
Qualimup Suite	Water –Ecological	Fox/Feral cat Predation
Deep River	Water –Ecological	Not known
St Mary River	Water –Ecological	Not known
Gordon River Floodplain	Water –Ecological	Fox/Feral cat Predation
Madjenapurdo Suite	Water –Ecological	Fox/Feral cat Predation
Dunns Swamp Suite	Water –Ecological	Predation, Weeds, Phytophthora

MEDIUM PRIORITY - Asset, value and invasive species threat combinations

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Lower Denmark River	Water-Economic	Weeds, Algae
Lower Kalgan River	Water-Amenity	Weeds, Algae
	Water-Economic	Weeds
Wilson Inlet	Water-Amenity	Ruppia in Inlet, Weeds on Foreshore
	Water-Economic	
Oyster Harbour	Water-Amenity	Ruppia, Weeds
	Water-Economic	Exotic Marine Pests, Algae

MEDIUM PRIORITY - Asset, value and invasive species threat combinations (cont.)

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Frankland River	Water-Amenity	Algae, Weeds
King River	Water-Amenity	Weeds, Algal Blooms

LOW PRIORITY - Asset, value and invasive species threat combinations Note: Invasive species not detailed as no significant impact on this value.

ASSET	VALUE	PRIORITY INVASIVE SPECIES THREAT
Upper Denmark River	Water –Economic-Water Supply	N/A
Quickup River	Water –Economic-Water Supply	N/A
Marbellup Brook	Water –Economic-Water Supply	N/A
Angove Creek	Water –Economic-Water Supply	N/A
Coastal Groundwater	Water –Economic-Water Supply	N/A
Bandy Creek	Water –Economic	N/A

ACKNOWLEDGEMENTS

The author would like to thank the following for discussing and contributing to the ISF:

Karl Hansom, Matt Kennewell, Dylan Gleave, Penni Hewitt (South Coast NRM)
Keith Bradby, Amanda Keesing (Gondwana Link)
John Moore, Miriam Lang (Department of Agriculture and Food WA)
Deon Utber, Sarah Comer (Department of Parks and Wildlife)
Kevin Hopkinson (Department of Water)
Bruce McKie (Department of Fisheries)
Duane Schouten (Great Southern Development Commission)
Mark Ford (City of Albany)
Annette Harbron, Donna Sampey (Shire of Denmark)
Klaus and Lisa Braun (Oyster Harbour Catchment Group)
Gavin Ellis, Land Reference Group

REFERENCES

Biodiversity

South Coast Threatened Species and Ecological Communities Strategic Management Plan, (2009) Gilfillan, S, Mitchell, P, Newell J, Danks, A and Comer, S, Department of Environment and Conservation, Albany.

An Overview of Biodiversity Values, Threats and Conservation in the South Coast Region (2013) Danks, A et al, Department of Parks and Wildlife, Albany.

Average Isoflor Map and Hotspot Associations (2003) Hopper, S. D and Gioia, P, provided by Department of Parks and Wildlife, Albany.

The Western Australian South Cost Macro-corridor Network (2006) Wilkins P, Gilfillan, S, Watson, J and Sanders J, Department of Conservation and Land Management and South Coast Regional Initiative Planning Team , Albany.

Phytophthora Dieback Management Plan for the South Coast Region 2008-2015 Read, V, from South Coast NRM, Albany.

Nature Conservation Plans for the Forest to Stirling, Range (Stirling to Porongurup), Fitzgerald- Stirling and Lindesay links –and notes of Workshop for Manypeaks Link provided by Gondwana Link.

South Coast Regional Management Plan 1992-2002. (1991) Management plan no. 24. Department of Conservation and Land Management for the National Parks and Nature Conservation Authority and the lands and forest commission WA.

Western Trout Minnow Recovery Plan (2008), Western Australian wildlife management program no.47. Fisheries WA, Department of Environment and Conservation, South Coast NRM and Australian Government.
Lake Gore and Coobidge Creek Wetlands Management Plan (2001), A report prepared by Kevin Hopkinson, Greenskills for the NHT and Water and Rivers Commission.

Esperance Lakes Nature Reserve Management Plan 1999-2009 (1999), Management Plan no. 39, Department of Conservation and Land Management and National Parks and Nature Authority.

Esperance and Recherche Parks and reserves draft management plan (2012), Department of Environment and Conservation and Conservation Commission WA.

Fitzgerald River National Park Management Plan 1991-2001 (1991), Management Plan no. 15, Department of Conservation and Land Management.

Two Peoples Bay Nature Reserve management plan 1995-2005 (1995), Department of Conservation and Land Management and National Parks and Nature Conservancy Authority

Walpole Wilderness and Adjacent Parks and Reserves Management Plan (2008), Department of Conservation and Land Management and Conservation Council of WA.

Water

Water Resources in the South Coast Region, Background Paper no. 4 (2004) Gunby, C, Arrowsmith, N and Bryant J, Department of Environment and South Coast Regional Initiative Team.

Wild Rivers in Western Australia. Water Notes WN37 (Jan 2009), Department of Water.

Commonwealth Government Website (www.environment.gov.au). Information on Directory of Important Wetlands.

Preliminary Delineation of Consanguineous Wetland Suites Between Walpole and Fitzgerald Inlet, Southern Western Australia. V and C Semeniuk Research Group (1998). Report commissioned by Water and Rivers Commission.

Preliminary Delineation of Consanguineous Wetland Suites in the Pallinup-North Stirling Region, South Western Australia, V & C Semeniuk Research Group (1999). Report commissioned by Water and Rivers Commission.

A Preliminary Evaluation of Wetlands in the Esperance Water Resource Region, Ecologia Environmental Consultants (March 2000. Report commissioned by the Water and Rivers Commission.

Ecological Values of Waterways in the South Coast Region, Western Australia (Nov 2008) Cook, B, Janicke, G and Maughan J. Centre of Excellence in NRM. Report prepared for the Dept of Water.

Coastal and Marine

Southern Shores, 2009-2030. A strategy to guide coastal zone planning and management in the south coast region of Western Australia.(2009) South Coast Natural Resource Management, Albany.
Oceans of Opportunity. A proposed strategic framework for marine waters of Western Australia's South Coast. Report to the Minister for Environment Aug 2010.

Land (agricultural productivity)

Australian Bureau of Statistics, Commonwealth of Australia (2013), provided by Great Southern Development Commission.
Fresh Thinking 2013-2015, Fazakerley, V and Winsor, D (May 2013) Department of Agriculture and Food, WA.

Distribution and Abundance of Pest Animals in Western Australia. A Survey of Institutional Knowledge. Misc. publication 30/2005, Department of Agriculture and Food.

Land (wheat yield potential and land management constraints)

Australian plantation statistics 2013 update (2013), Gavran, M, Research by the Australian Bureau of Agricultural and Resource Economics and Science. Technical Report 13.3. May 2013.

General

Southern Prospects 2011-2016, (2011) South Coast Natural Resource Management.