



Improved land management using perennials.

PHOTO: South Coast NRM.



# SOUTHERN PROSPECTS 2011-2016

5  
*Land*

# LAND

This section describes the importance of our land based assets in relation to the management of natural resources. The main components of the Land theme are described and factors affecting this asset are discussed. Aspirations (25+ years), Goals (10+ years) and Outcomes (one to five years) are outlined in a Program Logic Summary (See section 5.6).

**ASPIRATION:** *Improved and protected land resources through sustainable land use, matched to land capability.*

## 5.1 Principles

The principles which guide our approach to land management include:

- natural resource management may seem costly but it is inexpensive 'insurance' against accelerated decline of precious assets
- use of land should be within its capabilities so that degrading processes are minimised, managed or avoided
- an intergenerational approach to land use and planning
- actions taken to mitigate threats need to benefit the community.

## 5.2 What we know – values and threats

The South Coast region covers approximately 8.6 million hectares, of which most is classified as agricultural. However, there is also a significant pastoral/rangelands area which extends north of Salmon Gums in the eastern portion of the region.

Healthy soils support the region's biodiversity and its land-based primary production. Soil health also

contributes to sustainable waterways and marine environments by avoiding erosion, nutrient export and sedimentation.

Primary production, including agriculture and forestry, contributes strongly to the region's economy and social fabric but faces some significant threats if major efforts are not made to develop and manage more sustainable farming systems. In addition, without effective management, agricultural assets such as soil and water will suffer accelerated decline which will in turn affect other theme areas. This means that while agricultural practitioners may desire a short to medium term return from NRM investment, consideration also needs to be given to the medium to long term ramifications of not acting, where decline of resource conditions is the likely outcome. This intrinsically links all NRM practitioners to have an interest in sustainable land use practices.

### 5.2.1 Threats

Negative impacts of agricultural activities (e.g. sedimentation, acidification, erosion and nitrification) affect all other theme areas directly or indirectly, so working and communicating across and

*Negative impacts of agricultural activities affect all other theme areas.*



PHOTO: South Coast NRM.

between these areas is essential. The achievements of farmers who actively engage in NRM is applauded and acknowledged. The need for other agricultural practitioners to follow suit is essential to ensure improvements across the landscape. The link between best practice land management and productivity needs to be continuously promoted across the South Coast region.

One of the threats to sustainable land use is hydrological change resulting from clearing of native vegetation and replacement of deep-rooted perennials with lower water-using (mostly annual) species. In parts of the region this is associated with a significant salinity risk. Hydrological change and salinity are significant threats to biodiversity and to the region's water resources as well as to agricultural production. They are discussed in this section as they are largely a result of past land management

practices. Moreover, the most effective responses to manage changes in hydrology are likely to be through the development and widespread uptake of sustainable primary production practices, together with more specific revegetation and surface water management or drainage where feasible. (Salinity mapping for the region is shown in the Western Australian Land Information Service (WALIS) Atlas at [www.walis.wa.gov.au](http://www.walis.wa.gov.au).)

The other major risks to soils in the region are subsurface acidity, water repellence and phosphorous export (Table 5). Wind erosion, waterlogging, structural decline and subsurface compaction are also risks but are rated lower at a regional scale. This does not imply that these risks are not of major significance at a local level in parts of the region.

**Table 5: NRM Risk to Agricultural Production by Sub-region**

NRM ISSUE	SUBREGION	Kent-Frankland	Albany Hinterland	North Stirlings Pallinup	Esperance Sandplain	Fitzgerald Biosphere	Mallee
Subsurface acidity		High	High	High	High	High	Low
Water repellence		Moderate	High	Moderate	High	High	Low
Phosphorous export		High	High	High	Moderate	Moderate	Low
Salinity		Moderate	Moderate	Moderate	Moderate	High	Low
Wind erosion		Moderate	Moderate	Moderate	Moderate	Moderate	Low
Waterlogging		Low	Moderate	Low High	Moderate	Moderate	Low
Water erosion		High	Low	Moderate	Low	Moderate	Low
Structural decline		Low	Low	Low	Low	Low	Low
Subsurface compaction		Low	Low	Low	Low	Low	Low

(Source: Department of Agriculture and Food WA, 2005)

Subsurface acidity is a significant threat to agricultural land condition within the region because of the low buffering capacity and inherently low pH of the sandy top soils. Addition of acidic fertilisers, removal of produce and nitrogen leaching is generally acidifying and occurs extensively. There is limited information about the significance of off-site impacts of soil acidity, but these are most likely to include reduced plant growth and increase in the risk of other threats, particularly salinity, wind erosion and phosphorous export.

Water repellence is considered to be a high risk to agriculture, especially in areas with sandy topsoils such as the Esperance Sandplain, Albany Hinterland and Fitzgerald Biosphere sub-regions. Application of clay is the most common and effective treatment for water repellence. However, the cost of application rates required to satisfactorily ameliorate water repellent sands can be substantial. New technology such as 'spading' or 'variable rate spreading' are likely to provide better management opportunities in the region. The impact from water repellence can include reduced water infiltration, which can exacerbate other risks, including nutrient and chemical loss in run-off and water erosion. Increased risk of wind erosion is also an issue resulting from bare areas created through poor pasture germination and difficulty in managing weeds.

Phosphorus export has been assessed as a high risk for soils in the Albany Hinterland and Kent Frankland sub-regions, largely due to the low relief landscape. Like salinity, phosphorous export is largely a result of land practices rather than an inherent characteristic of the region's soils, and is also associated with significant off-site impacts including eutrophication of waterways and wetlands. This has been observed in Wilson Inlet, Torbay Inlet and Oyster Harbour, which have a significant level of eutrophication.

Salinity will have a high impact on agricultural production in the Fitzgerald Biosphere as it will develop in a short time frame with a new equilibrium reached before 2020 (Department of Agriculture and Food WA, 2005). A moderate impact of salinity is expected in the Albany and Esperance Sandplain, Kent Frankland and North Stirling Pallinup sub-regions due to a longer time frame until equilibrium. For the Esperance Mallee subregion, salinity should have a low impact over a longer time frame. The impacts of salinity on water resources and biodiversity is predicted to be significant, particularly for areas of high public and conservation value.

High salinity and nutrient levels impact upon the riverine systems that flow from agricultural land, into and through conservation reserves. These polluted waters are also likely to have impacts on wetland, estuarine, coastal and marine systems.

### 5.2.2 Land use and planning

The majority of agricultural land is cropped (for wheat, canola, and other grains) or under pasture. In recent times there has been a significant area (more than 162,000 ha) planted to timber plantations (Planning Plantations, 2006) and around 4,000 ha of viticulture and various forms of horticulture. Beef production occurs in the southern parts of the region and there are a number of dairy farms in parts of the Albany Hinterland and the Kent Frankland. A small but growing number of more diverse enterprises, including inland aquaculture, cut flowers and native seed production, venison farms, tourism ventures and experimental truffle production are occurring across the region. There are also an increasing number of organic and biodynamic farming enterprises, ranging from grains to beef, dairy, poultry and vegetable production.

The establishment of tree crops in the past decade, particularly in the higher rainfall areas, has marked a significant change in the region's land use. By far the largest areas have been planted to Blue Gums (*Eucalyptus globulus*). A woodchip plant at Mirambeena north of Albany, and export facilities at the Port of Albany are now significant contributors to the region's economy. The global financial crisis and resulting impact upon the paper industry has seen a decrease in the establishment of tree plantations and the community's confidence in them as a sustainable industry has been adversely affected.

A recent trend in land use within the medium rainfall zones of the region is establishment of tree plantations for carbon sequestration. This industry is likely to continue to grow over coming years. Currently these plantations are large scale monoculture plantings of species such as oil mallee and sugar gums with a long timeframe (75+ years) in the ground. While this land use has the potential to deliver many positive NRM outcomes such as reduced recharge, wind erosion control and improve the connectivity and resilience of native habitats, there is the possibility that there will also be negative impacts on the environmental and social fabric of the South Coast NRM Region. These possible negative impacts include the decline of rural towns due to families selling their land and leaving the



PHOTO: South Coast NRM.

*Surface water quality can be improved by excluding stock from waterways.*

region, the loss of productive agricultural land for food, an increase in feral animals and weeds within plantations and increased risk of fire. To avoid these negative impacts and gain the largest benefit from this land use, adequate planning controls need to be in place. In addition, it is important that complementary outcomes such as biodiversity and strengthening of ecological links are achieved.

To this end, commercial wood pellet manufacturing operation has successfully been established in Albany in 2008-09. This operation value adds to the timber industry in the Great Southern region by using residue from harvested plantations and creating small wood pellets for export for use in overseas energy generation.

A proposed Green Power Station is still progressing through the planning stage for construction in the

Albany area. This proposed system would also take the residues from plantations; wood processing and municipal and agricultural green waste products.

Plantings of *Pinus radiata* commenced in 1987, and there are now around 3,500 ha established within an 80km radius of Albany. *Pinus pinaster* planting commenced in 1997 and there are now 2,500 ha established within 120 km of Albany and 2,000 ha within 160 km of Esperance. Harvesting of some of these pine plantations commenced in 2005 and contributes to the export of soft timber saw logs through the Albany Port facility.

Establishment of sandalwood (*Santalum spicatum*) as a long term industry commenced in 1999. Research into sandalwood establishment techniques in the region has been undertaken by scientists working with South Coast NRM, Green Australia,

Centre for Excellence in NRM and Department of Agriculture and Food WA. Incentives for land managers to establish sandalwood for both commercial and biodiversity outcomes have been available under Southern Incentives (and are being further developed and applied by Greening Australia through the Gondwana Link program).

Integrated Farm Forestry makes a positive contribution to rural and regional landscapes, environments and communities including helping to control rising water table which threatens biodiversity, water supplies, agricultural land and infrastructure assets. When Farm Forestry is integrated successfully with farming businesses, it provides business diversification and employment in rural areas. Appropriately placed trees are assets that provide shelter for stock, crops and pasture.

Planning tools such as Local Planning Strategies and Town Planning Schemes, which are administered by Local Government Authorities and the Western Australian Planning Commission have the potential to be powerful mechanisms for achieving regional natural resource outcomes if they are integrated with NRM goals. Active participation and advocacy is essential to ensure that planning tools deliver long term NRM outcomes for the broader community. Planning for the peri-urban interface needs to be carefully managed to prevent loss of prime agricultural land and to reduce conflict between land uses. Equally, planning for biosecurity, climate change adaptation and NRM innovation will become increasingly important.

### 5.2.3 Information base

In 2008 a web based NRM-Local Government Planning Support Tool was launched to support the integration of the principles of NRM into local land use planning ([www.eksa.com.au/scnrm-planningtool](http://www.eksa.com.au/scnrm-planningtool)). While the website receives multiple 'hits' from different locations, the online tool needs to grow to accommodate new land use planning modules and options for various levels of community in the region.

Soils have been extensively mapped at the landscape level across the South Coast region at varying scales to assist with regional planning (i.e. scales ranging from 1.50,000 to 1.250,000). The mapping data is supported by a comprehensive map unit database comprising over 200 attributed units and some 20,000 data/profile observation points. Some soil-landscape mapping areas in the region were mapped in more detail during the *Southern Prospects*

2004-2009 (SCRIPT, 2004) investment phase. Additional sampling points and aggregated data have also been placed on community websites such as [www.soilquality.org.au](http://www.soilquality.org.au) for easy comparison of soil qualities across the region.

While the soil-landscape mapping is still at a scale unsuitable for paddock-scale planning, the mapping and associated database has assisted in providing information for analysing the risk of potential on site land degradation to soils and agricultural land assets. These on-site land-soil risks are reported on the basis of Agro-ecological Zones (AeZs) in the NRM sub region areas (Department of Agriculture and Food WA, 2005). AeZs are based on common soil, hydrological, geological, geomorphological, climate, biological and vegetation differences (Department of Agriculture and Food WA, 2005).

Comprehensive State wide soil risk data reported by local government areas is also available online through the NRM Information website and presented in Resource Management Technical Report Number 370 (van Gool et al., 2008). The risk analysis is based on potential risks and has not included analysis of the actual levels of degradation. This would require additional information on soil condition and management practices that is generally not readily available or accessible at a regional scale. The focus of the analysis is based on agricultural land only.

With improved access to digital mapping technology (e.g. radiometric digital landscape mapping) for the region, opportunities will arise to create more detailed maps of some of the existing broad scale land resource surveys in priority or strategic areas. This will assist in improving base information and our understanding of on-site and off-site land degradation issues in the region.

Rapid Catchment Appraisals (RCA) or Focus Catchment studies have been carried out for many of the region's catchments by inter-disciplinary study groups. RCA reports include catchment analysis (climate, geology, soils and landforms, hydrogeology and salinity risks) as well as information on appropriate management options for the catchments. Many of the publications released between 2002 and 2005 are likely to require revision. The Bremer Strategic Catchment aligns with one of the RCA study areas and a snapshot review of this area is currently being prepared to show the effects of NRM investment (Tim Overheu, pers. comm.). Strategic catchment planning has also provided significant information to stakeholders.

## 5.2.4 Salinity and groundwater

The State Salinity Strategy framework (now expired) recognised three over-arching management goals of recovery, containment, and adaptation and that the appropriate areas for these approaches needed to be based on an analysis of public and private assets and the threats, and an assessment of the technical and economic feasibility of management. The State Government endorsed principles developed by the former State Salinity Council for the strategic investment of public funds into managing salinity (Government of Western Australia, 2000), and these were incorporated in the development of the Salinity Investment Framework. State of the Environment Reporting (Government of Western Australian, 2007) indicates that salinisation is still a significant issue with about 1.1 million hectares in the South West land division salt affected. Over 14,000 hectares of land is lost from production each year. Suggested responses (Government of Western Australian, 2007) include:

- continued implementing the State Salinity Strategy
- continued monitoring to determine the extent and changes to levels of salinisation.

Within the region, hydrological balance investigations have been undertaken for each of the Strategic Catchments (Fitzgerald River, Frankland Gordon, Lake Warden, Oyster Harbour (Kalgan), Pallinup (Middle), Stokes (Young), Torbay, West River, Wilson) across the South Coast NRM Region. The analysis identified priority sub catchment areas and priority perennial planting areas where actions would be most likely to achieve recharge reduction and contain groundwater rise.

While the monitoring timeframe is still too short to draw any firm conclusions, review of 2009 bore data from the Bremer River Strategic Catchment suggests that the increase in perennial pasture plantings across the catchment since 2004 has assisted in lowering the ground water table in some areas. This is a successful outcome of promoting perennials as one tool for reducing recharge, containing rising water tables and addressing waterlogged soils.

## 5.2.5 Soil health

Waterlogging, water erosion, wind erosion, structural decline and subsurface compaction have all been assessed as posing a moderate to low risk at a sub-regional scale, although they may pose higher risks to agricultural production at a property or local scale.

The range of management options available has been summarised by van Gool (2008) and Nicholas (2005). Management options to address the main risks to soil health have been identified and their effectiveness evaluated by van Gool (2008) for the South West region. The management options and implications will be similar in most cases for the South Coast region. Farmers are already adopting many of the identified options.

Gazey and Davies (2009) summarised the management of acidity in agriculture, which is largely dependent on soil testing, appropriate fertiliser use, and the application of lime or dolomite. While incentive schemes have increased the application of lime within the region in recent years, lime use is still less than that considered optimal for agricultural production (Gazey & Davies, 2009). Andrews and Gazey (2008) undertook a regional investigation comparing soil acidity condition for the Northern and Southern Agricultural regions of WA. The investigation suggests that due to the cost and limited availability of lime, acidification could only be reduced by between 5 – 30%. This is mostly due to nitrate leaching in high rainfall areas, which exacerbates acidity levels. However, there are steps that can be taken to reduce acidification rates including selection of non-acidifying nitrogen fertilisers and reduction of leaching through split nitrogen applications. These activities are not likely to remove the need for lime application to soils that require remediation.

There are social and environmental issues associated with the supply of appropriate quality lime for agriculture, as well as issues of competition with the mining and construction industries. The Department of Industry and Resources is working towards a State Lime Supply Strategy (Department of Industry and Resources, 2006). Issues of supply and demand within the region need to be addressed and included in planning for the region (Government of Western Australia, 2003) to ensure that conservation values of supply areas are not compromised.

The mapping of acid sulphate soils in the region has improved (e.g. Green Skills, 2008; Galloway & Clarendon, 2009) but there remains many gaps in knowledge and priority areas. These need detailed assessment to confirm the presence or degree of acid sulphate soils. From regional reconnaissance, the incidence of acid sulphate soils is low and generally restricted to the lower coastal plains and estuarine areas in the region (Department of Environment and Conservation, 2009a).

Where acid sulphate soils do exist, disturbance and exposure to air has a high risk of release of acid and pollutants (such as heavy metals). Outcomes from a State-wide project have resulted in a number of useful publications discussing the protocols for appropriate management of acid sulphate soils for agricultural practices in the region.

Soil fertility and soil organic carbon content decline have not been assessed for the region in the previous investment phase because of the inadequate information base. However, baseline and benchmarking surveys for soil organic carbon content for representative South Coast soils has been underway since 2007 by the Australian Farming Future Climate Change (Better Soil Management) Research Program. This has assisted with the detailed investigation of three large study areas in the South Coast NRM Region (Esperance-Condungup; Woogenellup-South Stirling, and Kojonup). The investigation, a collaborative activity between the Australian Government Department of Agriculture, Fisheries and Forestry, UWA and DAFWA aims to measure 'actual' soil carbon content and model 'potential' soil carbon for key soils by land use in the three South Coast study areas. This information will allow for development of management options to store carbon and assist in mitigating the potential impacts of climate change.

### 5.2.6 Best practice management

Two of the most beneficial practices that can be employed to improve the sustainable management of land are whole of farm planning (including careful matching of land uses and practices to land capability) and the more widespread use of perennial species (Tim Overheu, pers. comm.). Most of the region is ideally suited to perennial species due to the high probability of summer rainfall. The use of perennial species (including trees and pastures) to restore or maintain hydrological balance has been identified as a preferred option for managing salinity, but can also assist in reducing or avoiding nutrient export, subsurface compaction, water repellence, waterlogging, and wind and water erosion.

There is also likely to be increasing pressure for primary production industries to demonstrate that their production methods are sustainable and that they are using best management practices as part of accredited production systems. Environmental Management Systems (EMS) and land condition monitoring is being promoted in the region by the Best Farms project team. A number of EMS

workshops have been delivered in region (in the Wilson Inlet catchment area and through Kojonup) with the target audience being mostly semi-rural land holders.

About 48 properties are operating as organic farming businesses, with 20 of these being certified under recognised organic standards (Tim Overheu, pers. comm.). The range of produce includes beef, mixed vegetables, wine, olives and some grains.

Agricultural statistics from the Australian Bureau of Statistics provide information on the level of use of soil ameliorants and can be used to infer regional soil conditions and trends (however, these are insufficient to establish definitive benchmarks on land condition in high risk areas). A State wide survey (Painted Dog Research, 2010) measuring changes in farming practices between 2009 and 2010 (and prior years to 2007) generally shows that landholders are increasing their soil sampling activities and monitoring of soil conditions (e.g. soil compaction, soil acidity and water repellence). The survey indicated that:

- 45% of South Coast rural landholders regularly monitor their water table levels (compared to 24% in 2009)
- 60% of South Coast NRM Region landholders increased the implementation of non-irrigated perennial pastures (compared to 46% in 2008/2009) as a tool to recover or contain ground water level rise, while also seeking to adapt to the region's increasing climate variability by both increasing ground cover and 'green-pick' pasture leading into dry seasons. These actions are helping to reduce the risk of wind erosion and to better use excess soil moisture to reduce seasonal water logging.
- in the pastoral area there was an increase to 58% of landholders excluding their stock from areas impacted by land degradation in 2009/2010 (compared to 43% in 2009).

Approximately 50% of landholders test their topsoil annually (Tim Overheu, pers. comm.). However, there is no regional database of the results, so there is no clear evidence for the trends in soil fertility and other factors. Anecdotal evidence is still the only source of soil testing results, provided through follow-up workshops where some landholders are willing to share their analytical results.

### 5.2.7 Climate change and seasonal variability

CSIRO (2008) projections for primary production in the South West of Western Australia are summarised in Table 6 and include:

- some agricultural crops may benefit from higher CO<sub>2</sub> concentrations however protein content of grains is likely to decline by between 4-14% (assuming no management adaptations)
- frost-sensitive crops, such as wheat, may respond well to some warming however more hot days and less rainfall may reduce yields
- adverse effects for agriculture include reduced stone fruit yields in warmer winters, livestock stress and an increased prevalence of plant diseases, weeds and pests.

Unfortunately there are likely to be knock-on effects on NRM assets caused by the uncertainty and reduced production in agricultural areas. Adaptation strategies can reduce the impacts of climate change. The Australian Bureau of Agricultural and Resource Economics (ABARE) estimated that adaptation measures can reduce the economic impacts of climate change on agricultural production by approximately half (Gunasekera et al., 2007). A range of adaptation options for agriculture and forestry are shown in Table 7.

CSIRO (2008) provided an overview of the impacts, options and priorities of adaptations to climate change in Australian primary industries, with adaptations issues classified according to industry and region. Issues such as the need for climate data and monitoring, and the acceptance of uncertainty, are common across industries.

*Perennial plants (both woody and herbaceous) integrated into farming landscapes are effective land management tools.*



PHOTO: Karl Hansom

**Table 6: Impacts of Climatic Change on Primary Production for the Mediterranean Agro-climatic Zone**

INDUSTRY	REGIONAL CLIMATE CHANGE IMPACTS AND ISSUES
Cropping	Potentially large reductions in rainfall will reduce yields markedly leading to flow on effects to regional communities and businesses. Cropping will become more challenging at the current dry margins but may expand into areas currently generally too wet for regular cropping. There may be a reduction in the risk of dryland salinity. A range of adaptations, particularly aimed at improving crop water management may be required.
Viticulture	Seasonal shifts to wine grape vines (e.g. flowering) may result in ripening in a warmer part of the season. Quality will be affected. Grapevine variety suitability will change and planting of longer season varieties to fit the warmer climate will reduce any negative impact. Water may become a limiting factor for grape production in these regions.
Horticulture	Timing of crop cycles for annual horticulture crops may be hastened requiring crop scheduling and marketing responses. Reduction in chilling over winter may affect suitability for growing of some perennial fruit crops. Increased frequency of extreme temperature events resulting in undesirable physiological responses must be managed. Water availability and security of supply is essential, especially for perennial horticulture.
Forestry	Bioclimatic analysis should be used to identify particularly vulnerable <i>E. globulus</i> , <i>Pinus radiata</i> , <i>P. pinaster</i> and oil mallee plantings so these can be monitored to provide early warning of any problems. Many eucalypts in native forests in the South West have narrow climatic ranges and may be particularly vulnerable to climate change.
Intensive Livestock	Irrigated dairy likely to be impacted by reduced water allocation, and increased temperatures. Landscape rehydration through wetland creation is a priority. Heat stress issues for livestock. Increased energy demands for cooling production sheds; increased demand for new energy efficient designs or retrofitting of existing sheds.
Water resources	Median runoff projections are for moderate decreases for the South West. Increased demand and reduced supply is a substantial issue. Catchment risk score is moderate to very high.
Invasive species	Invasive species that are currently not widespread may become more common under conditions created by climate change. ‘ Sleeper ’ species need to be monitored to ensure that they can be managed to prevent ‘ break out ’. Under climate change condition, native species or ecosystems that are under stressful conditions may be replaced by invasive species.

**Table 7: Climate Change Adaptation Options in Agriculture and Forestry**

CROPPING AND HORTICULTURE
<ul style="list-style-type: none"><li>• Alter the variety or species planted to those with more appropriate thermal, time and vernalisation requirements and/or with increased resistance to heat, frosts or drought</li><li>• Alter application times and amount of fertiliser or irrigated water to maintain growth and quality</li><li>• Alter timing and location of cropping activities</li><li>• Enhance water efficiency by using zero tillage, retaining crop residues and changing planting patterns</li><li>• In lower rainfall areas, enhance water management by implementing or expanding water harvesting technologies and acting to conserve soil moisture; in higher rainfall area, improve water management to prevent waterlogging, erosion and nutrient leaching</li><li>• Enhance pest, disease and weed management practices through integrated pest and pathogen management and using more pest and disease resistant varieties</li><li>• Reduce potential for soil erosion by retaining stubble, reducing fallow times etc.</li></ul>
LIVESTOCK
<ul style="list-style-type: none"><li>• Adapt annual production cycle to better match feed production</li><li>• Alter pasture rotations and modify grazing times</li><li>• Alter forage and animal species or breeds</li><li>• Provide supplementary feeding</li><li>• Provide alternative housing infrastructure – for example winter housing or increased shading</li><li>• Change or improve feed concentrates.</li></ul>
PLANTED FORESTS
<ul style="list-style-type: none"><li>• Change management intensity, harvesting patterns and rotation periods as appropriate</li><li>• Select a variety of species</li><li>• Manage landscape to reduce fire risk</li><li>• Undertake prescribed burning of native vegetation to reduce vulnerability of native and planted vegetation to fire damage.</li></ul>

Table 7: Climate Change Adaptation Options in Agriculture and Forestry (cont.)

SECTOR WIDE
<ul style="list-style-type: none"> <li>▪ Introduce practices which ensure conservation and wise use of water resources</li> <li>▪ Use seasonal forecasting to reduce production risk</li> <li>▪ Diversify farm income by integrating other farming activities or increasing off-farm income</li> <li>▪ Move to alternative income sources outside of agriculture</li> <li>▪ Minimise high input costs in high risk area or time periods</li> <li>▪ Have emergency response plans in place for fire, flood, hail and heavy rain etc.</li> <li>▪ Offset increased costs of managing climate change by reducing other costs</li> <li>▪ Use financial risk management tools or options to manage risk – for example futures contracts, water trading, carbon offsets, income stabilisation, and insurance</li> <li>▪ Spread risk through multiple holdings in different climatic regions</li> <li>▪ Increase resilience of land systems through land care and stewardship initiatives.</li> </ul>

(Source: Gunasekera et al., 2007)

### 5.3 Achievements

The following provides a short summary of achievements for the Land theme (a more complete description of achievements has been compiled in a status report [South Coast NRM, 2011]):

- the Healthy Catchments Initiative established seven strategic catchments (Kalgan River, Bremer River, Middle Pallinup, Young River, Lake Warden, Oyster Harbour and the Upper Hay River), each with a community-based management committee and 25-year catchment plan to address salinity, soil loss (sedimentation), nutrient loss and other threats to natural resource values. The catchment plans integrate with other regional NRM themes. Continued funding has seen the further development of three other strategic catchment plans for the West River, Fitzgerald and Lake Warden catchments.
- the strategic catchment projects have resulted in:
  - the Catchment Demonstration Initiative (2003-2009) in the Fitzgerald River catchment and the extension of the groundwater bore monitoring network, assisted in leading the revision of salinity and hydrological target outcomes for all of the priority catchments
  - support for significant farmer investment (despite dry seasons) in land use and practice change. This support enabled the implementation of 20,046 ha of perennial pastures, 2,185 ha of agro-forestry, 1,126 km of fencing, 12,456 ha of investment in soil health, 120 stock crossings and 112km of engineering earthworks.
  - the development of 22,075 ha of perennial pastures, 102 km of drainage earthworks, installation of 97 stock crossings, 13,217 ha of soil amelioration, 60 km of fencing to protect remnant vegetation and extensive drilling of water monitoring bores, through direct funding. Of these on ground works, Southern Incentives was responsible for 3,202 ha of perennial pastures and 3,917 ha of soil amelioration.
  - linkage with the Catchment Demonstration Initiative project and the Evergraze project provides research and technical papers that validates the practice change approach
  - CatchPlan, a GIS database that enables mapping and analysis of farm and catchment plans, has been adopted by four strategic catchments
  - adoption of the monitoring, evaluation, review and improvement processes (MERI) to ensure investment is effective for targeted outcomes. Research and Development by State Government agencies, industry and farmer groups have developed 'best practice' NRM actions for managing land resources
- the *One Million Hectares of Productive Use of Land with Salinity (1MPULS>)* project combined

- research and extension work associated with the five year *Sustainable Grazing of Salt Land Program* and the *Cooperative Research Centre for Future Farm Industries*. A significant legacy of information, skills, knowledge and experience has now been developed in the community (Saltland Pastures Association Inc. 2002, 2003). Several key local groups in the regions such as the Gillamii Centre, based in Cranbrook are now progressing with initiatives such as the successful *Farm Ready* funded project. The Gillamii Centre have established themselves as leaders in the saltland management field and have the capacity to lead future initiatives similar to the role they recently played in hosting the highly successful *Ever Green – Ever Graze* saltland management workshop and the joint production with DAFWA of the *Saltland Management Glove Box Guide* for the South Coast.
- a scoping study was completed for the Frankland-Gordon catchment. More than 300 farm plans were developed through workshop processes in priority sub-catchments which are now being implemented by farmers. Technical support is provided through 'start-up projects' in profitable perennials, land systems mapping, soil health, NRM risk containment, integrated engineering and catchment land use planning.
  - hydrological and salinity assessments have been conducted for priority sub-catchments and identified assets. Information gathered has been used to develop a support tool to analyse and evaluate issues in specific areas.
  - land system, soil, salinity mapping and land suitability assessment has established regional benchmarks for soil qualities such as salinity, water repellence and subsurface acidity
  - establishment of a demonstration deep drain in the West River catchment included extensive participation of landholders. An engineering Environmental Impact Assessment for a feasibility study for dewatering Lake Wheatfield in the Lake Warden Catchment has been completed.
  - installation of a demonstration evaporation pond and pumping equipment in the West River catchment resulting in lowering of the local groundwater table and containment of further loss of land to salinity
  - a surface water management planning report for the Neridup Catchment (Lake Warden) has been completed.
  - an NRM Innovation project provided support in soil health and perennial based agricultural systems funded through Southern Incentive 3 for areas other than the Strategic Catchments. This included links with local research programs (e.g. EverGraze and Sustainable Grazing on Saline Land) and other national programs. Extension within the region was from 10 'satellite sites' for farming systems research and soil health (including soil carbon management) demonstration sites.
  - the Saltland Genie ([www.saltlandgenie.org.au](http://www.saltlandgenie.org.au)) has become the one-stop shop for information and advice on saltland management. With its origins as a national product of the Sustainable Grazing of Salt Land Project it has been maintained and improved by the collaborating partners of the Future Farm Industries Community Resource Centre. The web site offers growers and interested parties information, contact details for technical support as well as local case studies.
  - research and industry organisation partnership arrangements have been established to develop farming systems based on perennial plants, or alternatives where these are not suitable. This initiative has supported the development of the seven strategic catchment plans and farm plans.
  - the South Coast Farm Sustainability Indicators and Adoption Strategy identified several drivers for adoption of perennials, such as degradation management and the desire to improve efficiency and productivity as well as several barriers to adoption, particularly financial risk, lack of time and equipment, up-front cost and seasonal constraints
  - Identifying Key Limiting Factors for Sustainable Production project identified biological, chemical and physical constraints to crop production through trials conducted across nine locations in farm paddocks. The findings of these trials were made available to collaborating farmers for incorporation into farm management plans. This project also facilitated engagement through the provision of fact sheets, field walks and other extension activities.
  - the Land Potential Project investigated three catchment areas. Upper Gordon (Gillamii); Middle Pallinup (North Stirlings Pallinup) and the western Fitzgerald Biosphere area (Fitzgerald Biosphere Group). Two series of workshops were conducted with landowners to determine the potential for innovative rural enterprises and new perennial pasture species as alternatives to traditional farming and cropping activities.



PHOTO: Cindee Page.

*Working with the community to revegetate road verges.*

- Lake Warden AgMaps were produced and provided detailed land capability information to landowners in the Esperance region
- completion of the Enrich project involving field trials for fodder species suitable for salt affected land
- a number of Southern Incentive schemes were delivered through the 2004-2009 Regional Investment phases, including the South Coast Productivity Grants and the Southern Incentive (Strategic Actions) NHT project. The Southern Incentive scheme has contributed to the uptake of perennial pastures and planting of woody perennials over the last five years. Further uptake of perennial species will require significant industry investment and land manager participation in the development of profitable farming systems, including research and development of suitable species for South Coast conditions.
- the Department of Agriculture and Food (WA) are producing a comprehensive draft Resource Management Technical report (Justin Hardy, pers. comm.) on saltland management with the objective of protecting the productivity of the natural resource base. This work outlines the extent of saltland areas and has the potential to guide actions to increase farm productivity by improving grazing land management.
- other projects include:
  - an assessment of oil mallee root biomass to develop an accurate understanding of the carbon sequestration potential of oil mallee species
  - improved monitoring networks demonstrated the benefits to natural resources from investment in land management.

#### 5.4 Current community capacity

While there is an increasingly comprehensive level of information available to land managers for management options, there is still a need to improve both the accessibility of that information and to target those land managers who do not yet have the information they need. The Department of Agriculture and Food (WA) has been the primary source of specialist technical information and support to land managers across the South Coast NRM Region. The organisation has undergone a recent transition and its focus is likely to move more towards fostering farming community prosperity through guidance for good resource management. As

an organisation engaged in economic development, they will continue to offer the best available information on the management of agricultural resources and risks. They will also continue to provide specialist support through partnerships with primary producers and industry bodies and act on opportunities to enhance agricultural growth.

The Department of Agriculture and Food (WA) is strongly aligned to the interests and outcomes of the Grower Groups across the region and will continue to have a strong role in the provision of specialist technical information on sustainable farming to on-ground community, staff or volunteers who serve as conduits of information to the South Coast rural community. They also provide information and support to the peri-urban community through the Small Landholder Information Service (SLIS) and works with Local Government Authorities on strategic land use planning matters.

The provision of information and general technical advice to the Community is also shared by regionally based NRM officers, who provide significant on-ground support to land managers across large areas, often with the responsibility for also developing and implementing other catchment-based programs for biodiversity, water management or coastal protection. However, the regional NRM Officers have often been employed on short-term and insecure contract conditions. This has hindered the retention of highly skilled and experienced people in these roles. Technical, scientific and managerial support to the NRM Officers is variable across the region. Some Local Government Authorities provide significant administrative or financial support for the NRM officer positions.

Total farm planning, including soil management planning, can potentially assist in addressing the suite of farm sustainability issues but has not as yet been taken up on a large scale, particularly by the private sector advisors (e.g. agricultural consultants). South Coast NRM and its partners are well placed to be key promoters of integrated farm and land use planning.

The Fitzgerald Biosphere Marketing Association helped to identify marketing opportunities to increase recognition of the Biosphere concept and its sustainable development ethos. This was linked to the Fitzgerald Biosphere development and trial of an Environmental Management System. The Great Southern Marketing Association and the Great Southern Wine Producers Association are working

to increase the profile of the region's producers and their market share. Initiatives such as the Albany Farmers Market are increasing the exposure of consumers to the region's producers, including organic and biodynamic enterprises, and 'value-adding' to these enterprises.

A number of training and skills-development programs have been conducted, including five 'Master Tree Grower' programs for farmers, and two 'Introduction to Farm Forestry' courses for NRM professionals.

## 5.5 Gaps

The following gaps have been identified:

- current ability to adapt to seasonal variability and climate change
- development of the State and National Monitoring Indicators framework
- tailoring of catchment scale water management for the region, including:
  - assessment of critical risk areas with 'whole of landscape risk analysis'
  - identification of water management intervention required and projected benefits and impacts
  - scenario-based option analysis
  - investment benefits and risks
  - community engagement and participation
  - framework for delivery of baseline risk information and assessment of feasibility, benefits and impacts of water management plans
  - assessment of water quality issues (e.g. nutrients, salinity and environmental acidity)
  - off-site risk and impact assessment
- continued assessment of market based instruments to determine their feasibility for adoption in the region
- engagement of hinterland Local Government Authorities to strengthen partnership arrangements with the Department of Planning
- recognition and management of environmental acidity (acid sulphate soils) with regard to NRM
- review of land assets, threats and appropriate management responses.

## 5.6 Program logic summary – Land

### ASPIRATIONS (25+ YEARS)

**Improved and protected land resources through sustainable land use, matched to land capability.**

1. Improved landscape resilience through:

- water balance - appropriate management options for containment, adaptation or restoration of hydrological balance in priority catchments
- nutrient and chemical balance - minimal nutrient and chemical export from primary production
- ecological balance - reduced threats from invasive species and diseases
- energy use and carbon sequestration balanced for NRM outcomes in the region.

2. Improved and protected land resources through:

- land manager participation in developing sustainable and profitable production systems to meet NRM goals
- information base for managing soils and land, and monitoring effectiveness of management practices
- best management practices maintaining soil health and reducing offsite impacts
- primary production systems and practices matched to land capability
- increased range of commercial land use options with beneficial environmental values
- value-adding opportunities decreasing reliance on single commodity
- increased capacity to predict and manage change.

### GOALS (10+ Years)

**Goal L1. Soil and land resources** Soil health (soil chemical, physical and biological qualities) is protected and improved over the South Coast landscape, in line with identified benchmarks (reviewed by 2013) by 2020.

**Goal L2. Invasive species** Strategic control and/or containment of invasive species, sufficient to ensure that they have minimal impact on sustainable land use by 2020.

**Goal L3. Water balance** Managed hydrological change in line with identified benchmarks (reviewed by 2013) for agricultural land in priority catchments (areas of high value biodiversity, water values, infrastructure and agricultural assets) by 2020.

**Goal L4. Nutrient levels** Improved nutrient balance in priority catchments in line with identified benchmarks (reviewed by 2013) by 2020.

**Goal L5. Climate change adaptation** Protection of priority land assets at risk from effects of climate change and associated threats through the implementation of adaptive management responses by 2015.

## OUTCOMES (1 – 5 Years)

### MEASURES AND MONITORING

**Outcome L1. Identify priorities** Review and establish South Coast community's focus for priority land assets for next five years by 2012 (to be informed by review of existing data, community knowledge and prior investment).

**Outcome L2. Review and improve soil quality and land condition measures** Review benchmarks with land managers by 2013 and implement priority soil quality improvement strategies by 2015.

**Outcome L3. Increase understanding** Increased understanding of land assets management by maintaining, supporting and where appropriate expanding, adaptive management, land asset research and monitoring programs in priority areas by 2013 (ongoing).

**Outcome L4. Assess achievements/outcomes** Monitor project outcomes to allow for meaningful assessment of resource condition for all projects.

### ON GROUND ACTIONS

**Outcome L5. Effective on-ground works** Contain/reduce land degradation risks for priority land assets by implementing effective management programs by 2015.

**Outcome L6. Control invasive species** Identify, prioritise and control/reduce invasive species that impact land resources with quantifiable targets (set by 2013) for sub-regions by 2015.

### CAPACITY BUILDING

**Outcome L7. Education and training** Increase the NRM knowledge and skills of land managers and the associated services sector by 2015 (and ongoing).

**Outcome L8. Improve awareness and recognition** Review and increase awareness of the value of land asset management, across the region in light of State, National and International frameworks by 2013 (ongoing).

### PLANNING AND POLICY FRAMEWORKS

**Outcome L9. Review best management practices** Review NRM best management practices and support implementation for priority land assets by 2015.

**Outcome L10. Integrate land use planning with NRM** Facilitate the integration of NRM principles (e.g. matching land capability to land use) into land planning processes by 2015.

**Outcome L11. Climate change adaptation** Develop and implement adaptive responses to climate change in priority areas, in partnership with industry and land managers by 2015.

**Outcome L12. Support sustainable industries** Review, prioritise and facilitate future sustainable food, fibre and energy production industries by 2015.

## 5.7 Measures and indicators

Use of the following indicators and measures (Table 8) as a guide will assist in setting targets for projects and programs and allow for standard

approaches to measurement. Indicators should be selected according to the principles of cost, simplicity, consistency, practicality and capacity to deliver information across the region.

**Table 8: Measures and indicators – Land**

ASSET	INDICATOR HEADING	RECOMMENDED INDICATORS
Soil	<ul style="list-style-type: none"> <li>Area of land threatened by shallow or rising water tables</li> </ul>	<ul style="list-style-type: none"> <li>Depth to groundwater</li> <li>Groundwater salinity</li> <li>Base flow salinity</li> <li>Location, size and intensity of salt affected areas.</li> </ul>
	<ul style="list-style-type: none"> <li>Soil condition</li> </ul>	<ul style="list-style-type: none"> <li>Soil acidification</li> <li>Soil erosion - water</li> <li>Soil erosion – wind</li> <li>Soil carbon content.</li> </ul>

*(Based on Department of Environment, Water, Heritage and the Arts, 2007)*

## 5.8 Trade-offs

The use of land for primary production has impacts on soils, biodiversity and water resources. Primary production also has significant social and economic benefits for the region. Balancing the benefits and costs is not easy, but the proposed targets are intended to improve the recognition of high value production areas, the matching of land uses to land capability and the management options for improved productivity with reduced environmental costs.

Establishing clear benchmarks and sustainability indicators that are part of assessing the outcomes of either accredited production systems (such as environmental management systems) or recognised industry best management practices will assist to determine the region's sustainable productive capacity. Investments by industries, land managers and governments in developing these frameworks will lead to improved economic capacity for continued private investment in NRM. Land managers will need to consider the economic lag between the implementation of environmental management systems, best management practices or any other action that proposes a change to the farm system, and increased productivity and profitability.

The assumption is that improved productivity and greater profitability will lead to increased investment in NRM for beneficial environmental outcomes. The need for land managers to be willing to invest in NRM outcomes that may not have a direct financial benefit to them also needs to be considered and addressed. Many people are becoming increasingly aware that NRM is actually 'insurance' to prevent accelerated decline in resource condition and to maintain productivity that would otherwise be in decline.

For some areas, productivity increases may be insufficient to meet environmental costs. In such circumstances, additional measures such as structural adjustment may be necessary. At the very least, a comprehensive review of financial incentives and disincentives to manage natural resources sustainably needs to be undertaken at national and State levels and the results implemented within regions. Subsidies for activities that may exacerbate natural resource degradation could for example be replaced by payments for the provision of ecosystem services (similar to carbon credits, and extended to salinity, water quality and biodiversity credits).



PHOTO: South Coast NRM.

*Children can learn how to restore the land.*

