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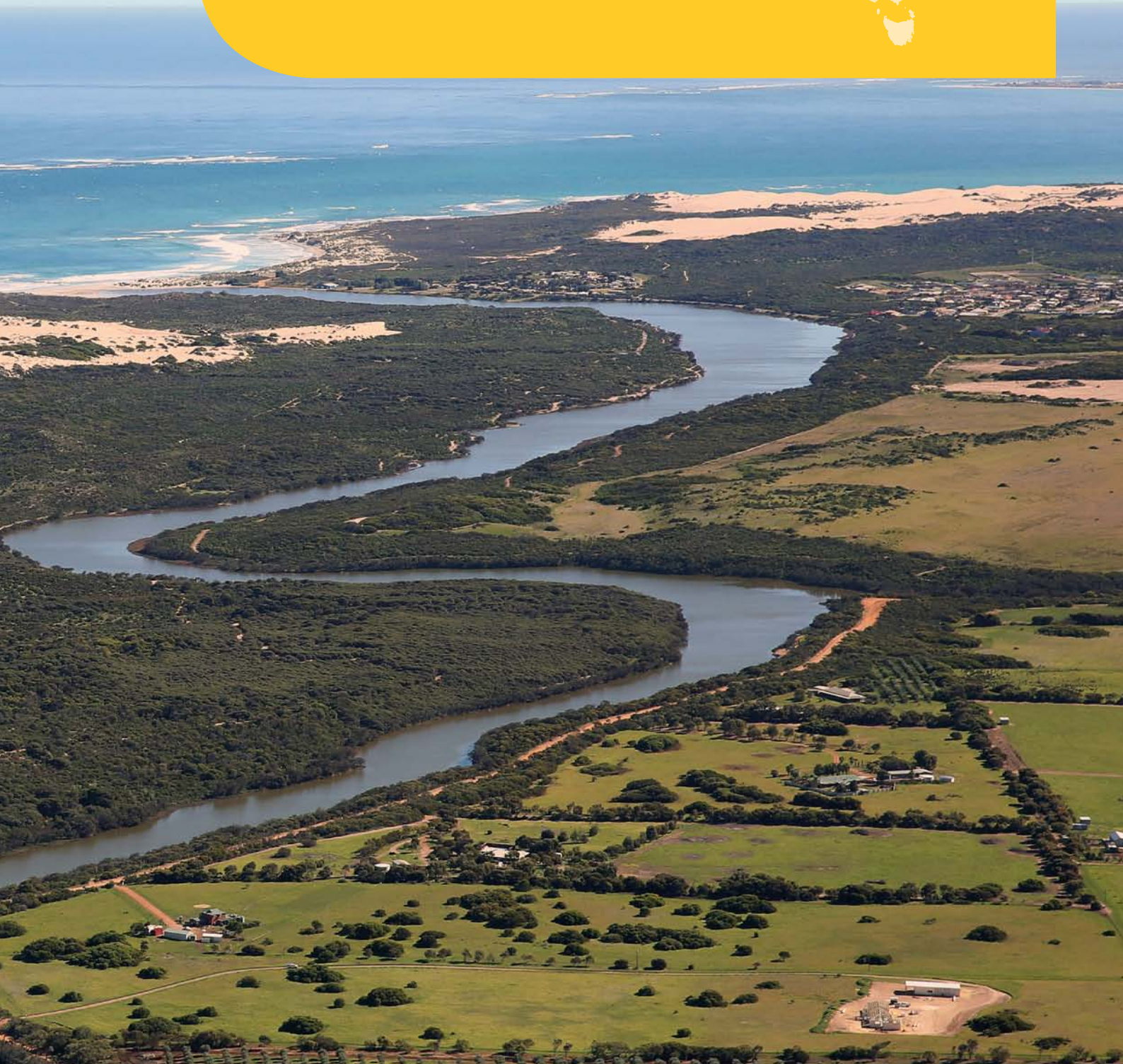
NARVIS

Vision for the Northern Agricultural Region of Western Australia



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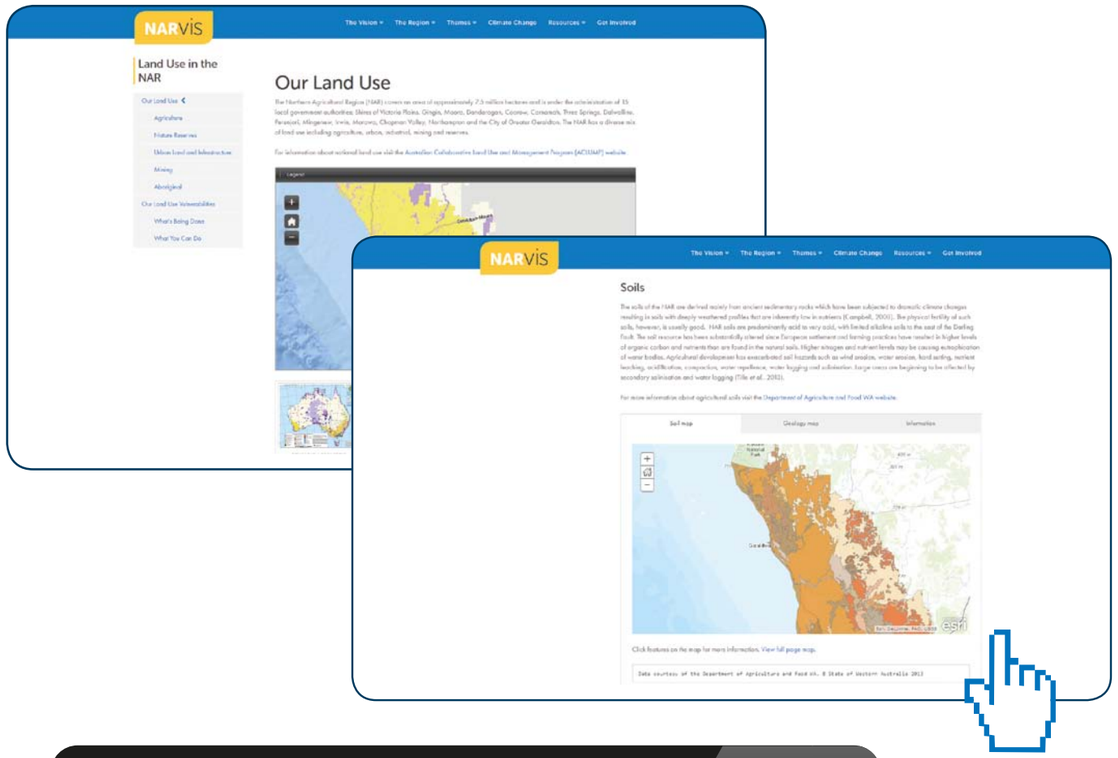
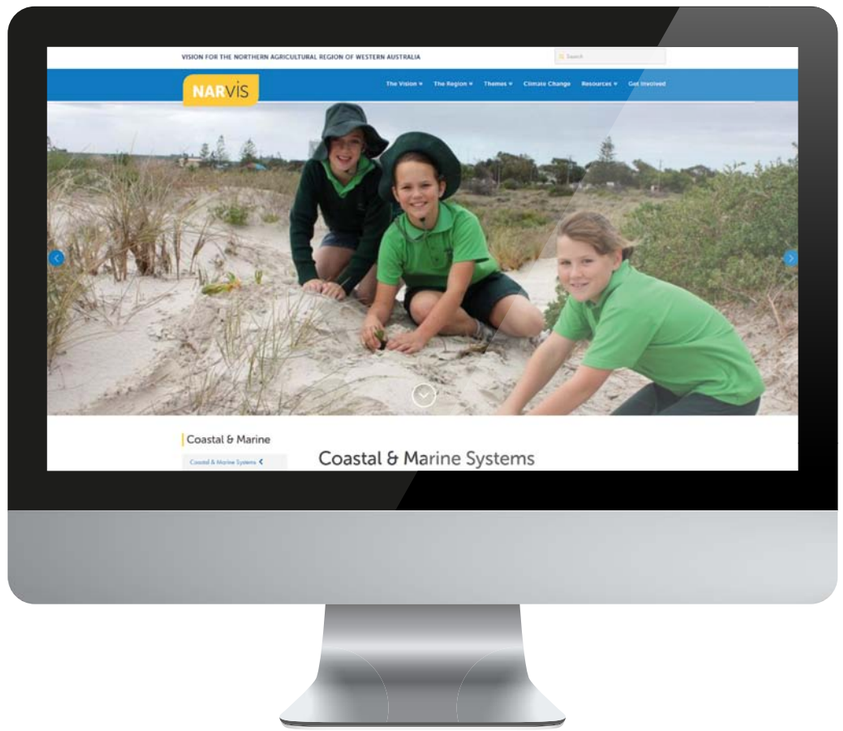




What is **NARvis**?

NARvis is the Natural Resource Management Strategy for the Northern Agricultural Region (NAR) of Western Australia. Rather than a traditional printed document, NARvis (short for NAR Vision) is being presented as a website with interactive maps and content.

narvis.com.au

Please share the website link with your friends and colleagues.

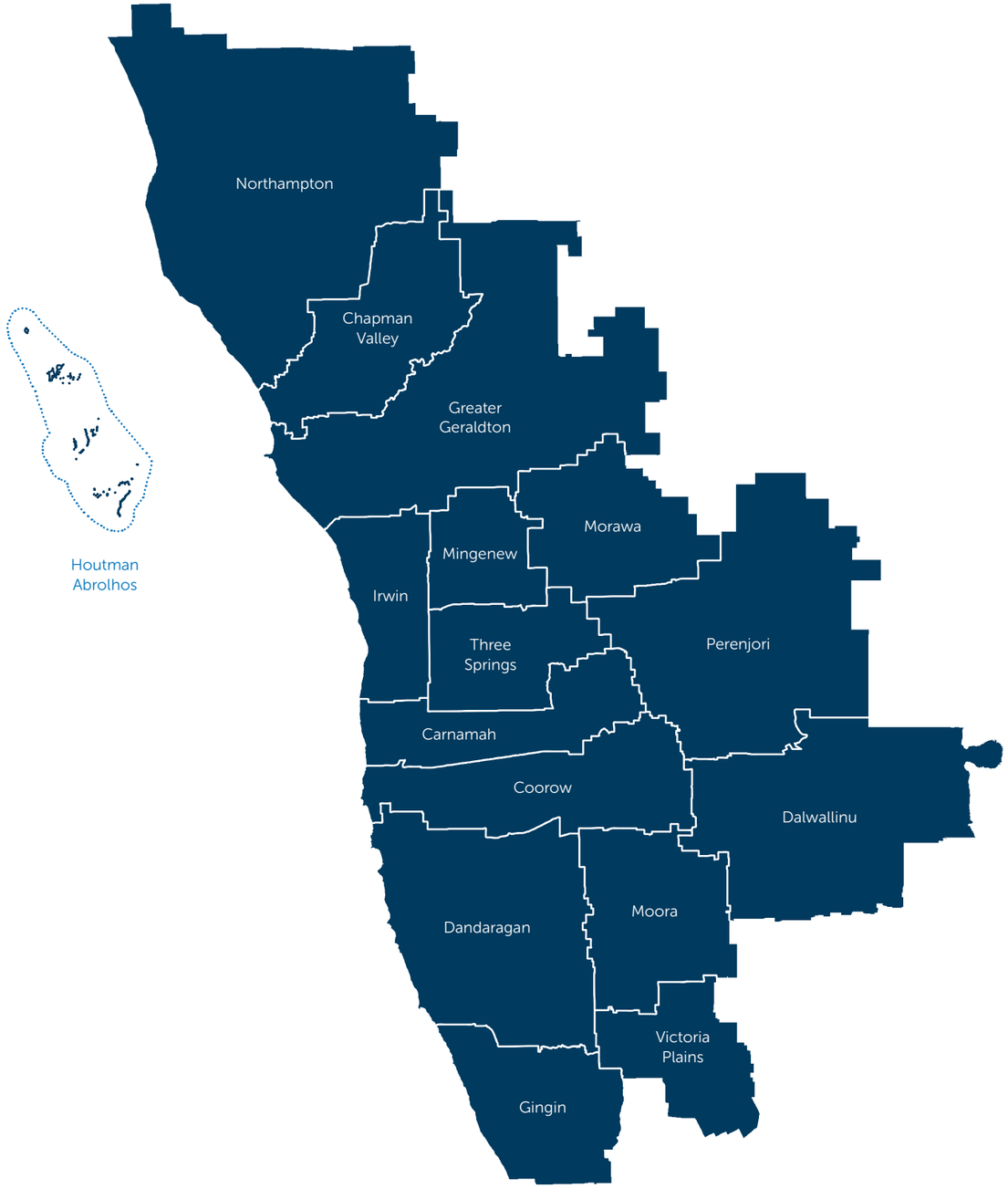
The NARvis website is packed with information and research on the NAR and strategies to manage the region's natural resources.
The site includes:

- Climate modelling projections.
- Interactive maps with geospatial datasets highlighting things like conservation corridors or mining tenements.
- Local Government Area (LGA) profiles.
- Research reports and case studies.
- Photo galleries of each LGA.
- Directory of Natural Resource Management (NRM) community groups in the region.
- Ability to comment or ask questions about any aspect of the strategy.
- Ways to make a difference and improve our natural resources as an individual, land manager, community group or government agency.
- Information on carbon farming and government carbon policies.
- Grants directory including grant writing tips and tools.

COVER PHOTO

Graeme Gibbons
Greenough River Mouth

NARvis



About **NAR**vis

NARvis is a regional plan created with input and support of State Government agencies, local councils, community groups and land managers. It has been designed as a tool for these stakeholders to identify and prioritise NRM investment in the NAR and promote collaboration across all levels. It is an update of the 2005 Regional NRM Strategy.

NARvis is, and will continue to be, a work in progress that will evolve to meet community and stakeholder needs.

NARvis objectives

In line with national, state and regional priorities, NARvis is a tool to support stakeholders throughout the NAR to:

- Conserve and enhance our natural resources through sound NRM planning.
- Identify priority landscapes for carbon plantings and strategies to build landscape integrity and guide adaptation and mitigation actions to address climate change impacts on natural ecosystems.
- Develop sound, logical and practical management actions that will improve the condition of key natural resources and will lead to enhanced on-ground outcomes.
- Promote a broader understanding of the importance of investing in NRM in this region and to develop a framework for such investment.
- Integrate and coordinate NRM activity both across the region and with state and Australian Government partners.

Who developed NARvis?

Development of NARvis has been coordinated by the Northern Agricultural Catchments Council (NACC) with funding from the Australian Government and in-kind and technical assistance from the State Government.

NACC has drawn on both expert advice and community input in the creation of NARvis. Community members will continue to be a key element of the process as it continues to develop. NARvis would not be possible without the energy, knowledge and commitment of local people who have invested in it.

How targets and regional aspiration were set

The targets and regional aspirations identified in NARvis have been drawn from the extensive research and effort that went into developing the previous 2005 Strategy. These targets were refined with input from state agency and subject matter experts, tested through a series of community workshops, and are presented in this document.

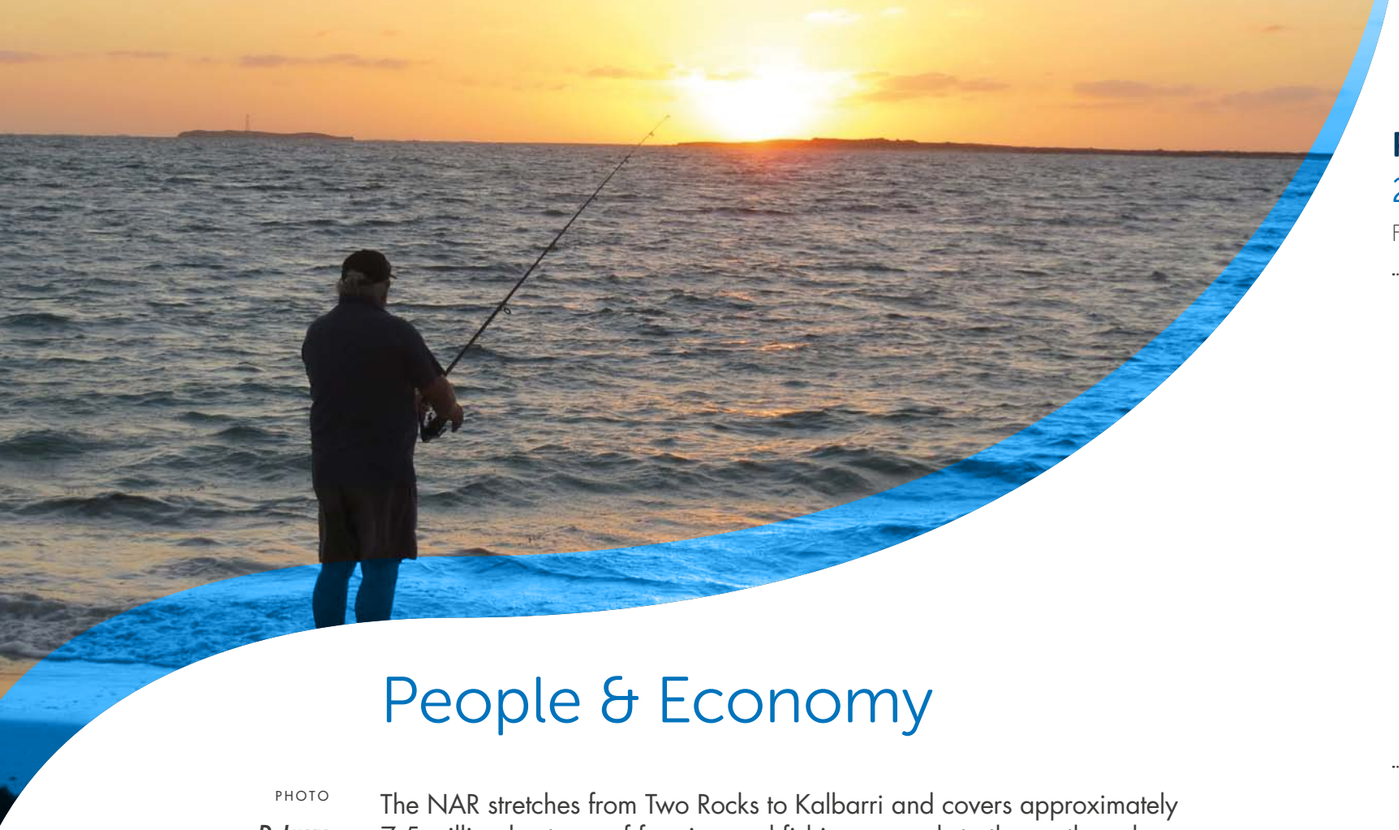
Regional Aspirations are long term goals, a vision of how the community would like the Region to be.

The Targets are medium term goals (about 5 years) which we as a regional community hope to achieve.

One of the main differences from the previous strategy is that the Regional 'targets' are separated into Regional Aspirations and Targets and are no longer grouped by theme (water, land, biodiversity etc). It was felt that landscape scale benefits were more likely to be achieved using this framework.

Have your say

You can provide input at future community consultation workshops or give feedback directly by making a comment at the bottom of any page of the NARvis website.



People & Economy

PHOTO

D. Lucas
Lone fisherman
Jurien Bay

The NAR stretches from Two Rocks to Kalbarri and covers approximately 7.5 million hectares of farming and fishing grounds to the north and north east of Perth. It is home to two national biodiversity hotspots, over 200 conservation reserves and a unique diversity of flora and fauna.

Did you know?

Over 70 per cent of all tonnage and 100 per cent of iron ore exported through Geraldton Port goes to China.

The Yamaji and the Noongar people are the Traditional Owners of the NAR.

City of Greater Geraldton has the largest population in the NAR.

People

The NAR is the traditional land of two Aboriginal groups. Yamaji (also spelled Yamatji) people are the Traditional Owners of land and coastal waters extending north from the coast at Green Head, to Onslow and the Ashburton River. Noongar people are the Traditional Owners of land south of Coorow and Lake Moore. In the NAR there are at least six distinct Yamaji language groups and at least two Noongar language groups.

The NAR supports a population of around 64,000 people, with approximately 60 per cent of the population residing in the City of Greater Geraldton (Figure 1). Many LGAs that are dependent on agriculture are declining in population, while coastal areas are experiencing growth. Australian Bureau of Statistics data indicates that coastal LGAs experience on average a growth rate of 1.1 per cent per year, compared to inland LGAs which see an annual average growth rate of just 0.3 per cent.

According to Western Australian Planning Commission forecasts, the population of the NAR will reach 82,000 people by 2026.

Economy

Agriculture and mining are the dominant industries in the NAR. Agriculture in the region contributed approximately $4 billion to the Western Australian Economy between 2011 and 2012. Other significant economies in the NAR include tourism, fishing and aquaculture.

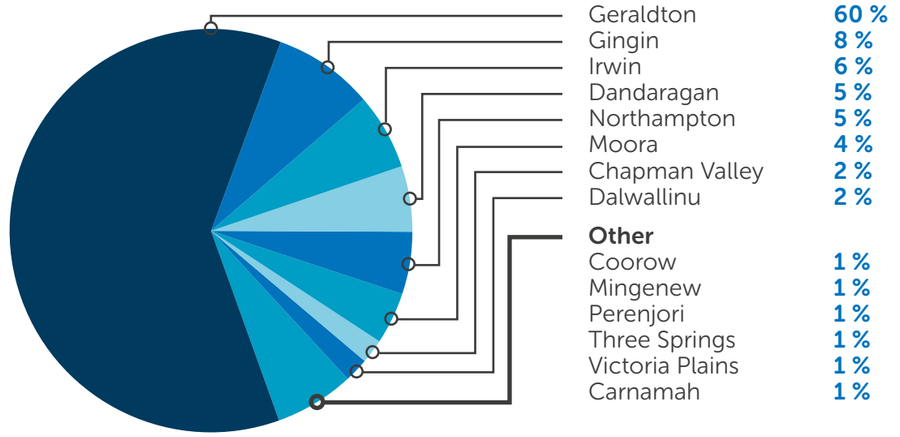
Employment

Approximately 30,000 NAR residents (almost half) are employed in the work force. The main industries of employment are agriculture, forestry/fishing and mining, along with services (which includes construction) and retail related industries. A breakdown of employment by industry is shown in Figure 2.

Population Distribution

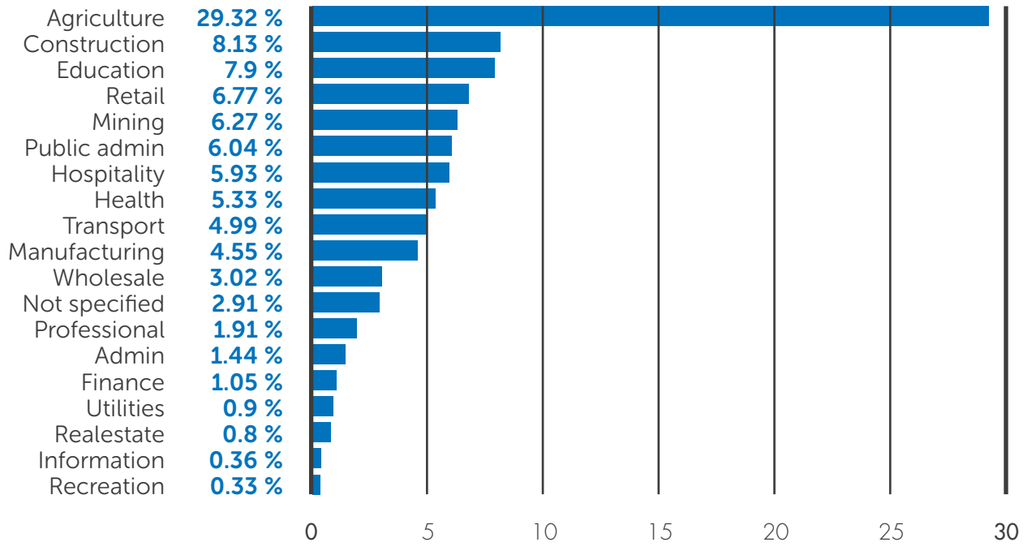
2013

Figure 1



Employment by Industry

Figure 2



Land Use

PHOTO

N. Gay
Farm friendly cattle infrastructure

Did you know?

Broadacre agriculture is the main land use in the NAR.

The area between Green Head and Jurien Bay has the largest number of Aboriginal midden deposits in the south-west of Western Australia.

Lake Thetis in Nambung National Park contains thrombolites which are rock-like structures built by mirco-organims.

Agriculture

The NAR covers an area of over 7.5 million hectares with 70 per cent of the land used for mixed farming activities. Around 93 per cent is used for cropping, and the remaining 7 per cent is used for pastoral leases.

Infrastructure and industry

Major arterial roads such as the Brand and Great Northern Highways help connect rural towns to Perth, while the Region's railway system connects mine sites and broadacre farming to the Port of Geraldton. This is the only port in the NAR to handle both imports (mainly phosphorous, urea and petroleum products) and exports (including iron ore, grains, lupins, mineral sands, talc, garnet, livestock, copper and zinc).

Conservation reserves

Some of the region's native vegetation is protected in conservation reserves such as state forests, national parks and nature reserves. In fact, the NAR contains several unique conservation reserves.

Kalbarri National Park is one of the most visited national parks in WA. More than 800 species of wildflowers bloom from late winter through early summer, with numerous species found only in the coastal cliff tops and gorge country in the Park.

Nambung National Park is home to the amazing Pinnacles Desert and is also known for its beautiful beaches, coastal dune systems and low heathland rich in flowering plants. At the Park's northern end is Lake Thetis where you can see fascinating thrombolites.

Cultural heritage

There is evidence of Noongar and Yamaji people occupying various parts of the coast for extensive periods of time. Stone artefacts have been found in caves in the Jurien Bay region, and the area between Green Head and Jurien Bay has the largest number of midden deposits in the south-west of WA.

Managing Our Land Resources

Dryland salinity

- The Department of Agriculture and Food WA (DAFWA) and the Department of Water (DoW) promote a number of strategies to manage dryland salinity, including planting of saline tolerant species.
- Technical support for salinity management is also being provided through the DoW's Engineering Evaluation Initiative.

Agricultural productivity and land degredation

- DAFWA has recently released the *Report card for sustainable natural resource use in agriculture*. The report demonstrates that productivity is driven by three primary factors: climate, land characteristics and land management.

Biosecurity

- DAFWA manages the *Biosecurity and Agricultural Management Act 2007*. DAFWA requires biosecurity services to be delivered through a regional network of volunteer groups focusing on the areas of animals, plants, invasive species, borders and farms.

Development and infrastructure

- Rural planning should be consistent with *State Planning Policy 2.5: Land Use Planning in Rural Areas* and the *Rural Planning Guidelines*.
- Water management for developments should be consistent with *State Planning Policy 2.9: Water Resources and meet the requirements of Better Urban Water Management*.
- Development should also be consistent with the *Acid Sulfate Soils Planning Guidelines* and *Guidelines for Visual Landscape Planning in Western Australia*.

Mining and basic raw materials

- Exploration and mining licences for minerals and petroleum resources are administered by the Department of Mines and Petroleum under the *Mining Act 1978*.
- Mining operations in sensitive environments require approvals under Part IV of *the Environmental Protection Act 1986* to manage impacts on biodiversity values and landscapes. This includes having mine closure plans which address rehabilitation of mine sites. The assessment of mining proposals does not, however, consider the cumulative impact of mining proposals at a landscape scale.

Contamination

- The *Contaminated Sites Act 2003* requires that sites known or suspected to be contaminated with substances at concentrations which risk harm to human health, the environment or any environmental value, must be reported to the Department of Environment Regulation (DER).
- DER maintains a database of known and suspected contaminated sites in Western Australia and guidelines for assessment and management of sites.

Get Involved

VISIT narvis.com.au/land-use

Browse maps and detailed information on managing our land use pressures. Find out how you can get involved.

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PHOTO

NACC
Soil Testing

Geology & Soils

The NAR contains a diverse range of topography and soils. Coastal areas are comprised of sandy beaches, gently undulating dunes and rocky promontories. Inland semi-arid areas are characterised by stony ridges, abrupt escarpments with broad valleys separated by stony sediment plains with shallow soils.

Did you know?

Dinosaur fossils have been found around Geraldton and Dandaragan.

The Pinnacles is one of twenty geological heritage sites in the NAR. Find out where the others are on NARvis.

Geology

The NAR is dominated by two major geological regions; the Yilgarn Craton and the Perth Basin separated by the Darling Fault, which runs up the middle of the region. These geological provinces are overlaid with a complex array of bedrock formations.

In the northern portion of the region, Jurassic sediments of the Northampton complex form mesas - the flat topped hills with steep break-away slopes that characterise the Moresby Ranges.

The east of the region is dominated by Archaean granite and gneiss of the Yilgarn Craton. To the south west of the region the geology is more varied with geological features like the Tamala Limestone pinnacles in Nambung National Park and accretionary structures such as the stromatolites and microbial mats formed in an interdunal depression in the Holocene Quindalup Dune System on the margin of Lake Thetis.

Soils

A total of 21 soil types have been characterised in the NAR. The soils are derived mainly from ancient sedimentary rocks which have been subjected to dramatic climate changes over millennia. The resulting soils have deeply weathered profiles that are inherently low in nutrients and organic matter (frequently less than 1 per cent).The physical fertility of such soils however is usually good.

Soils are vulnerable to wind and water erosion, build-up of salts in the soil (salinisation), and soil contamination.

About 47 per cent of soils have a high to extreme risk of being affected by wind erosion, with 10 per cent of these soils classified as having a very high to extreme risk.

Managing Our Geology & Soils

Agriculture and soil fertility

Soil is particularly important to agricultural production, which accounts for 70 per cent of land use in the region. A range of human and environmental pressures affect agricultural soil fertility.

Most soils of the NAR are inherently low in all nutrients, with phosphorus, nitrogen and trace elements such as copper and zinc being historically of most significance. However, continual removal of potassium and sulphur in agricultural produce, and the use of fertilisers low in these nutrients, has resulted in wider problems. Losses from leaching or surface water run-off and soils that have a low capacity to retain anions can cause substantial losses of nutrients, especially nitrate.

In the NAR, 32 per cent of all soils are susceptible to developing soil structure decline due to excessive cultivation, stock movement, loss of organic matter and burning to reduce stubble.

It has been estimated that 36 per cent of soils in the region are susceptible to soil compaction due to machinery and livestock movement.

What are the main vulnerabilities associated with our soils?

- Dryland salinisation
- Fertility decline
- Wind erosion
- Water erosion
- Structure decline
- Soil acidity
- Soil compaction
- Non-wetting soils
- Water logging

Get Involved

VISIT narvis.com.au/geology-soils

Browse maps and detailed information on geology formations, soil types, and on what's being done to manage our soils. Find out how you can get involved.

NARvis

Biodiversity

PHOTO

Ray Morton
Native Garden

Biodiversity is essential to sustaining the living networks and systems that provide us all with health, food, wealth, fuel and the vital services our lives depend on. The NAR is recognised for outstanding biodiversity and rare wildlife communities.

Did you know?

The Cloudy Stone Gecko (Diplodactylus nebulosus) is a new species of gecko lizard endemic to the Geraldton region. It has a restricted range, occurring from near Geraldton in the north to Mt Lesueur ~200 km to the south.

It differs from other species in that it has a pattern on its back resembling a cloud or nebula, instead of a straight line like its Wheatbelt relatives.

Biodiversity hotspots

The NAR is part the Southwest Australia biogeographic region – an internationally recognised biodiversity hotspot stretching from Shark Bay in the north to Israelite Bay in the south.

In addition, two nationally declared biodiversity hotspots include areas of the NAR:

- Mt Lesueur – Eneabba
- Geraldton to Shark Bay Sand Plains

Threatened native flora and fauna

Two intriguing conservation-significant animals found in the NAR are the rare Malleefowl and the Carnaby's Cockatoo.

- Malleefowl (*Leipoa ocellata*) are ground dwelling birds somewhat larger than a domestic hen and build their nest out of pebbles. Malleefowl mounds may be used over many generations and can attain an impressive size of 22 metres in circumference and one metre in height.
- Named in honour of West Australian naturalist Ivan Carnaby (1908 – 1974), the Carnaby's Cockatoo is one of only two species of white-tailed black-cockatoo found anywhere in the world. They are only found in the south-west of Western Australia and are listed on state, national and international threatened species lists.

Why are these species under threat?

There are numerous threats impacting on these species including climate change, grazing, predation by feral animals, fires and exposure to agrochemicals (i.e. aerial spraying). However loss of habitat due to land clearing is probably the main threatening process. In the NAR approximately 56 per cent of native vegetation has been cleared since European settlement. Most of the native vegetation remaining occurs within pastoral land to the east and in national parks and conservation reserves.

Managing Our Biodiversity

There are a number of activities being undertaken at state and local level to protect our biodiversity now and into the future. These are summarised below.

Vegetation removal or degradation

- *Western Australia's Environmental Protection Act 1986* (EP Act) has provisions to protect native vegetation such as environmental impact assessments on planning proposals and regulation of native vegetation clearing.
- Conservation reserves on crown land also help to maintain and improve biodiversity and prevent further degradation of vegetation.

Recreational use

- The Department of Parks and Wildlife (DPaW) manages biodiversity, fire, and key invasive pest animals, plants (weeds) and diseases on unallocated crown land and in the conservation estate, including areas designated for eco-tourism and passive recreation.

Altered hydrology

- River restoration projects help alleviate the extent of erosion and sedimentation eg. stabilising banks with native trees and shrubs, fencing to exclude stock and realignment of large woody debris to improve flow.
- Management of feral animals, for example pigs and goats, also reduces damage.

Increased recreational fishing

- The WA Department of Fisheries (DoF) actively manages commercial and recreational fishing. Recreational fishing is managed through size and catch limits based on risk categories for various species.
- DoF also monitors the intensity of recreational fishing through the requirement for a 'Recreational Fishing from Boat Licence' for boat fishing.

Pests, feral animals and weeds

- DAFWA maintains a list of organisms that have been classified under the *Biosecurity and Agriculture Management Act 2007* as either Declared pests; Permitted; Prohibited or Permitted requiring a permit. The West Australian Organisms List (WAOL) is available from the DAFWA website, however this list does not yet identify declared pests in a particular area.

Altered fire regimes

- While the Department of Fire and Emergency Services (DFES) is responsible for coordinating emergency services during a bushfire that threatens life and property, DPaW is responsible for the management of conservation areas in order to prevent bushfires.

Disease

- DPaW has guidelines for the management of diseases affecting ecosystems, such as dieback.
- Management of dieback should be consistent with the Department of Environment and Conservation (DEC) *Best Practice Guidelines for the Management of Phytophthora Cinnamomi* and other relevant information.

Lack of detailed information

- A number of localised flora and vegetation surveys have been undertaken, but none have been undertaken at a wider regional level to provide more detail regarding vegetation types in order to determine priorities for protection.

Get Involved

VISIT narvis.com.au/biodiversity

Browse maps and detailed information on biodiversity hotspots and what's being done to protect our biodiversity. Find out how you can get involved.

NARvis

Coastal & Marine Systems

PHOTO

Mic Payne
Sandy Cape

The coastal and marine areas of the NAR are highly valued for their ecological, recreational, cultural and economic values and services.

The NAR has a coastline of over 550 km, which includes the 'Turquoise Coast' from Guilderton to Dongara and the 'Batavia Coast' from Dongara north to Kalbarri. There are many beaches and dune systems, along with impressive coastal cliffs in the northern portion.

Did you know?

The NAR is home to the Abrolhos Islands which is one of the largest temperate limestone reef systems in Australia.

The Islands are classified as an A-Class Reserve and the surrounding waters have special status as a Fish Habitat Protection Area.

The coral reefs associated with the Islands are one of the highest latitude reef systems in the world, resulting in a unique species composition.

The NAR is home to the Houtman Abrolhos Islands, one of the largest temperate limestone reef systems in Australia, and 38 offshore island nature reserves between Dongara and Lancelin. These provide habitat for a mix of temperate, tropical and endemic marine fauna and flora, and diverse terrestrial ecological communities.

The central coast is rich in bird species including marine and migratory species of seabirds. The heathlands are important as habitat for fairy-wrens and honeyeaters, and support other animals such as reptiles. The coastal lands are also important for the conservation of heath-dwelling mammals such as dibblers and dunnarts.

The species diversity of seagrass, macroalgae, fish, birds, invertebrates and other marine flora and fauna is very high and the combination of both temperate and tropical species is notable.

Many migratory species, particularly Cetaceans (whales and dolphins) and seabirds, utilise the marine system off the coast of the NAR. Other specially protected species that occur in the region include several species of sharks, syngnathids (seahorses and sea dragons), dugongs, and turtles.

Why are our coastal and marine systems vulnerable?

Coastal and marine systems are vulnerable to coastal developments destabilising coastal areas, vegetation loss to sand dunes, fishing pressure by commercial and recreational fishers, marine pollution and climate change.

Managing Our
Coastal & Marine Systems

There are a number of activities being undertaken at state and local level to protect our biodiversity now and into the future. These are summarised below.

Coastal Management

- *State Planning Policy 2.6: Coastal Planning Policy (2013)* has guiding principles for coastal zone development, providing a framework for integrated coastal zone management.
- Department of Planning (DoP) provides assistance through the Coastal Management Plan Assistance Program and Coastwest Program and the Department of Transport funds Climate Adaptation and Protection grants.
- Various coastal managers such as State Government agencies, local councils, NACC and community groups, either undertake directly, or provide funding for, projects to improve coastal environments.

Recreational activities and tourism

- Coastal and foreshore management plans are prepared by both the DoP and relevant local governments to address recreation and access.
- Coastwest Grants are provided annually by the Western Australian Planning Commission to support coastal projects.

Public access

- Coastal studies like the 2001 *Batavia Coast Strategy* and the 2005 *Geraldton-Greenough Coastal Strategy and Foreshore Management Plan* discuss the need for more foreshore reserves and improved management of public access.
- The *Batavia Coast Strategy* provides details on coastal attributes, access, land ownership and land-use pressures, but the information is now out-dated.

Commercial and recreational fishing

- There is good information on the environmental impact of fisheries operating in the vicinity of the Abrolhos, and considerable information exists for the western rock lobster fishery.
- A number of research programs monitor the coral communities associated with the Abrolhos Islands. These studies help to increase understanding of the vulnerability of coral habitats to climate change, and quantify the effects of lobster fishing with pots.
- Surveys of the community structure of finfish are also underway within and outside of non-fishing areas.

Decreased marine and estuarine water quality

- The Environmental Protection Authority (EPA) has released guidance on the protection of marine and coastal water quality. These include *EAG 3 – Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment* and *EAG 7 – Marine Dredging Proposals*.

Aquatic biosecurity

- DoF is leading an effort to prevent aquatic pests arriving and establishing themselves in our waters with a multi-million dollar aquatic biosecurity program using cutting edge technology, and ground-breaking management and compliance strategies.
- The Aquatic Biosecurity Charter has been established to promote the protection of WA oceans and rivers from aquatic pest species. The charter is aimed at all members of the community from industry and community interest groups to individuals.

Climate change

- Coastal hazards such as recession and inundation need to be considered as part of land use planning decision-making, consistent with *State Planning Policy 2.6*.
- The Shire of Dandaragan, Shire of Gingin and the NACC have formed the 'Gingin Dandaragan Coastal Partnership' in order to identify coastal areas at risk and undertake joint adaptation planning initiatives to address those identified risks.

Get Involved

VISIT narvis.com.au/coastal-marine

Browse maps and detailed information about what's being done to protect our coastal and marine systems. Find out how you can get involved.

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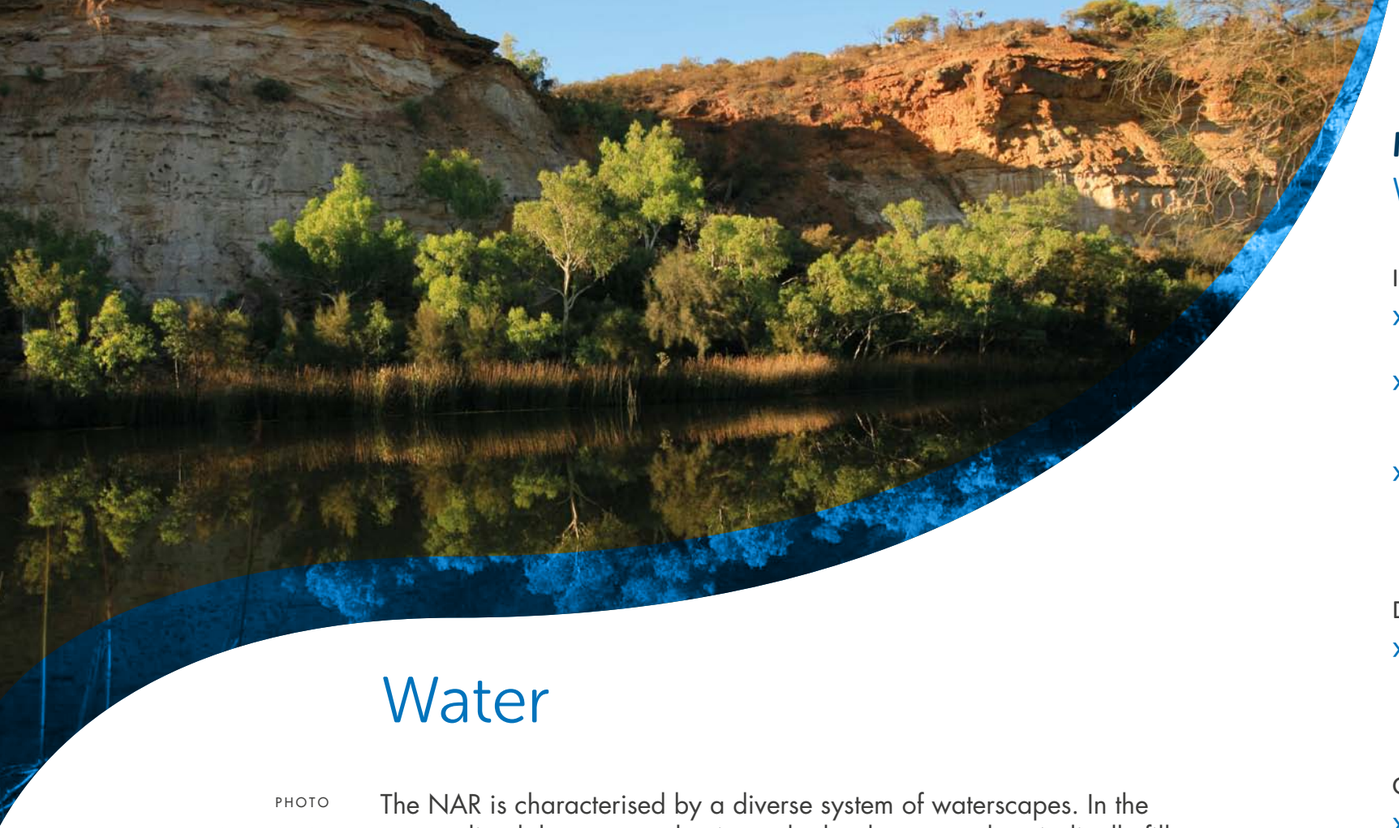

Water

PHOTO

S. Schewtschenko
Ellendale Pool reflections

The NAR is characterised by a diverse system of waterscapes. In the east, saline lake systems dominate the landscape and periodically fill following winter rains. The western portion of the NAR is characterised by groundwater fed wetlands, coastal dune wetlands, swamps, springs, karst limestone cave pools, meandering coastal plain river systems and associated pools and estuaries.

Did you know?

Thirteen major river systems and one lake system occur in the NAR.

Eight wetlands are nationally protected.

The NAR relies solely on groundwater for reticulated water supply.

River systems

River systems in the NAR are generally close to the ocean and only open temporarily following significant rainfall events. The lower reaches of these river systems are important because they form part of an estuarine ecosystem, which provides important habitat and refuge areas for many aquatic organisms and bird species.

Wetlands

Many wetlands in the NAR dry out completely during the summer, but there are some which are continuously fed by groundwater. These groundwater fed wetlands are extremely important transitory habitats for migrating birds, as well as supporting significant permanent aquatic ecosystems.

Groundwater

Groundwater is vitally important within the NAR as it is associated with significant human and ecological values, such as recreational activities, reticulated water supply, and environmental base flows to wetlands and waterways.

What are the main vulnerabilities associated with water?

Habitats in and around wetlands of the NAR are highly sensitive to water chemistry changes caused by land use practices, as well as changing hydrology from both land use and climate change, leading to altered water regimes.

The demand for groundwater is predicted to more than double in the next 30 years.

Managing Our Water Resources

There are a number of activities being undertaken at state and local level to reduce the vulnerability of our water resources now and into the future. These are summarised below.

Increased demand for water resources

- The Department of Water (DoW) is in the process of developing a *Mid-West Regional Water Supply Strategy*.
- DoW is working through a program of water reform to improve the suite of tools available to manage WA's water resources into the future.
- DoW has also developed a number of allocation plans that provide information on the various groundwater areas and management strategies that are in place.

Declining water availability for the environment

- DoW continually reviews and updates the relevant allocation plans to ensure the sustainable use of water into the future.

Changes to hydrological regimes

- Programs to improve understanding regarding surface water management are resulting in changes to land management practices to return catchments to pre-development characteristics.

Salinity

- DAFWA has recently released the *Report Card on sustainable natural resource use in agriculture*.
- DAFWA also advocate for a number of strategies to manage dryland salinity including planting of saline tolerant species and high water use farming initiatives.
- Technical support for salinity management techniques is being provided through the DoW's Engineering Evaluation Initiative and DAFWA.

Erosion, sedimentation and loss of riparian vegetation

- River restoration projects are aimed at alleviating the extent of erosion and sedimentation.
- Foreshore assessments have been developed for the Chapman, Greenough and Hutt Rivers and one is being developed for the Hill River.

Contamination and eutrophication

- The DoW aims to protect the quality of drinking water sources through the gazettal of public drinking water source areas and the preparation of drinking water source protection plans.
- Land use planning currently considers the location of potentially contaminating uses in proximity to sensitive environments (eg. fertilizer application by soil type to prevent leaching).

Flooding

- DoW has undertaken floodplain mapping for the Greenough, Chapman, Irwin, Murchison, and Moore rivers.
- Consistent with *State Planning Policy 2.9: Water Resources*, new development must consider impacts on and from water resources including flooding.
- Where climate variability is leading to increased storm intensities, some work may need to be undertaken to assess townsite flood risks and undertake mitigation and/or adaptation strategies.

Get Involved

VISIT narvis.com.au/water

Browse maps and detailed information to find out what's being done to protect our water resources and how you can get involved.

NARVIS

Climate Change

The scientific evidence of warming of the Earth's climate system is unequivocal.

Did you know?

Temperatures are projected to increase, winter rainfall decline and extreme weather events are likely to intensify.

Climate change is a major environmental challenge for the NAR. The main indicator of climate change is global warming due to greenhouse gas emissions from human activities.

NAR climate records indicate there is an increasing trend in maximum temperatures and a decreasing trend in rainfall. Climate modelling from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology (BoM) anticipates the NAR can expect warmer days, less cold nights, declining rainfall and more extreme weather events, such as floods and droughts, in the future.

Overall, climate change will inevitably have long term implications on our natural resources and these require management, particularly at a regional level.

PHOTO

Sam deVries
Pindar desert wanderers

Impact of Climate Change

Within the NAR climate change is expected to impact on people, land use, soils, biodiversity, hydrology and coastal and marine systems.

Agriculture

Expected impacts of climate change on agriculture in the region include:

1. A decline in wheat production by 30 per cent by the year 2050.
2. Larger farms with reduced returns per hectare.
3. Increased frequency of heat stress in livestock.
4. Shorter growing periods for livestock.
5. Increase in the frequency of locust plagues.

Marine systems

Significant impacts to marine systems include:

- Loss of coral reefs associated with the Abrolhos Islands.
- Decrease in size at maturity of the western rock lobster.
- The migration of many species southwards, at a rate of approximately 72 km per decade.

Predicted Trends for the Northern Agricultural Region

Temperature

Expected each decade

↑ 0.05 - 0.15 °C

Expected by 2090

↑ 1.2 - 2.1 °C

Rainfall

Expected by 2030

May to October	↓ 30 %
Autumn	↓ 10 %
Spring	↓ 30 %
Summer In eastern parts	↑ 10 %

Wind Speed

Expected by 2030

Spring	↑ 5%
Winter	↑ 5-10%

Expected by 2070

Annual	↑ 5%
Summer	↑ 5%
Autumn	↑ 2-5%

Wind speed is measured 10 m above ground level

Responding to Climate Change

The Australia Government's Department for Climate Change (2008) identified two broad categories of climate change responses:

1. Mitigation (avoiding or reducing greenhouse gas emissions and increasing sequestration of greenhouse gases).
2. Adaptation (making adjustments to natural and human systems to avoid and/or minimise the impacts of climate change).

Climate change mitigation

Changes to the Australian Government and the repeal of the carbon tax has led to a significant amount of uncertainty in the Australian carbon market.

Under the current Government's new Direct Action Plan, the five per cent reduction in emissions by 2020 has bipartisan support. This will be achieved through an amended Carbon Farming Initiative (CFI) and a new Emissions Reduction Fund (ERF).

The CFI allows land managers to generate carbon credits and create new earning opportunities through a range of activities, such as planting trees, manure management, fertiliser management, reduced livestock emissions and improved rangeland and cropland management.

The Government has committed $2.55 billion for direct purchase of Australian carbon credits under the ERF through reverse auctions.

A key mitigation initiative in the NAR is CarbonQuest – a service established and run by NACC that gives farmers and businesses a low-risk entry into the carbon trading market. By endorsing and promoting carbon projects of high quality, CarbonQuest makes it easy for carbon buyers and sellers to connect.

Climate change adaptation

Two approaches to climate change adaptation are risk management, and reducing vulnerability and/or increasing resilience. The risk management approach is likely to be more helpful at the enterprise level and the Australian Government has developed specific resources to assist organisations to apply a risk management approach to climate change. The reducing vulnerability approach is considered more helpful at regional and catchment scales.

PHOTO

A. Killen
Gutha Salinity

Climate vulnerability

Vulnerability to climate change is a product of the potential impact of climate change versus our capacity to adapt (see Figure 3 below). The level of exposure is determined by a combination of probability and magnitude of climate change. Sensitivity is the responsiveness of systems to climatic influences. Together these two factors determine whether the potential impact is positive or negative.
A systems' adaptive capacity is the ability for a system to cope with climate change as a result of being better prepared through autonomous or planned adaptation.

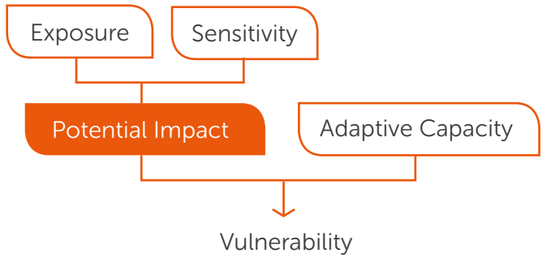

Figure 3. Factors determining vulnerability.

Managing resilience and adaptive capacity on a regional scale with result in improved ability within the NAR to anticipate, adapt and respond to a changing climate. Regional level action may involve mitigating greenhouse gas emissions (eg. through CarbonQuest) and reducing habitat fragmentation (eg. though conservation corridors).

Get Involved

VISIT narvis.com.au/climate-change

For the latest information and guides on undertaking a CFI project.

Targets

Aspirational Goals	Targets (5 year)
Production systems in the NAR are resilient, diverse and proactively managed utilising environmentally sensitive practices.	» 100 per cent of agricultural land managers undertaking sustainable land use practises by 2020. » 50 per cent of cleared Agricultural land (2 million hectares) managed using sustainable land use practises by 2020. This sustainable management includes whole farm management of the following issues: » Wind erosion » Water erosion » Surface water quality » Soil compaction » Soil organic carbon » Salinity » Non-wetting soils » Acidity » Pests, weeds and disease
Biodiversity and ecosystem integrity are maintained and improved at a landscape scale.	» 20 per cent of defined corridor areas (yet to be defined) protected and revegetated by 2020. » 2000 ha of native vegetation (not on reserves) protected by 2020. » Active management of fire regimes in areas of native vegetation. » X ha of priority species habitat (as identified through the Investment Framework for Environmental Resources (INFFER) process) actively managed. » 20 000 ha of riparian vegetation actively managed. » 500 ha of coastal and Island vegetation protected and enhanced by 2020. » Marine ecosystems and fish stocks maintained at current levels of quality and health. » Undertake four projects to support marine research by 2020.
Invasive species – (animal and plant pests, diseases) are effectively managed both at a local and regional scale.	» 75 per cent of land managers engaging in coordinated management of invasive species (animal and plant pests, diseases). » X ha of native vegetation covered by a weed management plan.

Aspirational Goals	Targets (5 year)
Communities in the NAR (urban and rural) are able to maintain economic and population viability, through effective adaptation to a changing climate.	» 30 000 ha of land utilised for suitable carbon bio-sequestration. » Coastal hazard and risk assessment undertaken for all coastal communities by 2020. » All coastal infrastructure maintained to continue fishing practices.
Aboriginal and cultural heritage is protected and valued by the wider community.	» Management of 25 sites of cultural and heritage significant by 2020. » Undertake five traditional knowledge projects by 2020.
The community has a sufficient level of knowledge, ability and willingness to contribute to effective NRM.	» Increased technical capacity of the region to sustainably manage natural resources. » Encourage and support sustainable urban design and practices including: stormwater management, urban planning, native gardens, alternative energy sources and water usage, waste management and transport. • 20 per cent of homes in urban areas have native gardens by 2020. • 10 per cent decrease in waste to landfill. • 10 per cent decrease in scheme water usage. » Increased Aboriginal participation and employment in NRM. » Local sources of marine debris identified by 2020.
Water resources are valued and support water dependent communities and ecosystems.	» Allocation of water resources does not exceed sustainable levels. » Water resource allocation plans are developed through community consultation.

NACC
Managing Natural Resources

Australian Government

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