A 100-year Biodiversity Conservation Strategy for Western Australia

DRAFT

Phase One: Blueprint to the Bicentenary in 2029

GOVERNMENT OF WESTERN AUSTRALIA

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Front cover main photo: Montebellos Marine Park and Montebellos Conservation Park off the Pilbara coast comprise about 180 islands, islets and rocks. The surrounding waters are rich in tropical flora and fauna, with a high diversity of invertebrates, coral and seagrass communities. Photo – Col Roberts/Lochman Transparencies
Insets, from top:
Children learn about mammal trapping to monitor population numbers at Perth Hills National Parks Centre. Photo – DEC
Marl or western-barred bandicoot (*Perameles bougainville*). Once widespread across arid southern Australia, the marl is now extinct on the mainland and found only on Bernier and Dorre Islands, Shark Bay. Photo – DEC
Australian sea lion (*Neophoca cinerea*) in an *Amphibolus* seagrass meadow, Jurien Bay Marine Park. Twenty-seven species of seagrasses are known to occur in WA waters, providing a level of species richness unequalled anywhere in the world. Photo – Mick Eidam
Mouse ears (*Calothamnus rupestris*) belongs to a genus of about 40 plant species endemic to WA, mainly found in the south-west. The south-west of WA is Australia's only international biodiversity hotspot, known for its high vascular flora richness and endemism as well as the high level of threats. Photo – Keith Claymore

Back cover photo: Tropical savanna with scattered boab and rainforest trees, Walcott Inlet, Kimberley. The boab (*Adamsonia gregorii*) is unique to north-western Australia and WA in particular. The north Kimberley is one of eight national terrestrial biodiversity hotspots that occur in WA. Photo – Keith Claymore

Foreword

Western Australia's biodiversity is rich and diverse; much of it is unique to the State, and is recognised as nationally and internationally significant. It is undoubtedly the State's greatest asset, underpinning many of our industries such as nature-based tourism, flora harvesting, forestry, pastoralism and fishing as well as being fundamental to our health and well-being. However, we have profoundly impacted upon this irreplaceable natural heritage, with significant depletion occurring over the past 150 years. It is incumbent upon all Western Australians to play their part in ensuring that future generations enjoy the same benefits from biodiversity that this generation enjoys. This draft 100-year Biodiversity Conservation Strategy for Western Australia recognises the need to act now to prevent further biodiversity decline and accelerate our recovery efforts.

It provides a framework to guide action for biodiversity conservation in Western Australia for the next 100 years. This timeframe recognises that we have taken more than 100 years to diminish our biodiversity and that it will take a similar period to recover from these impacts. The interim target is to achieve considerable recovery ahead of the bicentenary of the founding of the Swan River Colony in 2029. A central theme of the draft strategy is to raise public awareness of, and involvement in, biodiversity issues and reconnect people with nature. It emphasises the need to improve our scientific knowledge and better link it to decision-making for biodiversity management. It also promotes direct and urgent conservation action.

As a State with a tremendous wealth of natural resources, we owe future generations the chance to live in an environment where biodiversity is conserved and flourishes. We have a chance to make the investments necessary to not just conserve the biodiversity we have now, but to rebuild it and recover from past mistakes. Our vision is that within 100 years, biodiversity will be secure statewide. We know that efforts taken now to protect, conserve and recover biodiversity are worthwhile and will save future generations from much greater costs of restoring communities and recovering species that could otherwise be closer to extinction. While we can be proud of past and current biodiversity conservation efforts, we must do more. We have started to slow the loss of species but this strategy proposes and challenges us to reduce our threatened species lists significantly and to remove at least 20 species from these lists over the next 22 years through successful recovery action.

We can also complete the process of establishing a representative and comprehensive conservation reserve system for all Western Australians and visitors to the State to enjoy. The draft strategy puts forward bold targets to address some of the State's major threats to biodiversity, such as *Phytophthora* dieback, salinity, altered fire regimes, invasive animals, environmental weeds and climate change.

I believe the final strategy will put Western Australia at the forefront of Australian and international biodiversity conservation. We can achieve the targets if we work together. In combination with regional strategies and broad community involvement, this strategy provides a challenging, but practical blueprint. I invite you to take the opportunity to comment on, and contribute to, the development of *A 100-year Biodiversity Conservation Strategy for Western Australia: Blueprint to the Bicentenary in 2029*.

Mark McGowan MLA
Minister for the Environment

Summary

Top 10 deliverables by 2029:

1. **Completion** of the terrestrial and marine conservation reserve system to meet the requirements of comprehensiveness, adequacy and representativeness, including coverage of at least 15 per cent of WA's land area, as well as a network of sanctuary zones in marine parks and reserves that are representative of the full range of habitats, and management of the reserve system to best practice standards.
2. **Integration** of conservation with other land and resource uses across landscapes and seascapes, including through the use of market-based instruments, and voluntary conservation agreements in at least five million hectares of privately managed lands.
3. **Improvement** in the conservation status of at least 100 threatened species through recovery action, including 20 species fully recovered and removed from the State's threatened species lists:

   Animals
   - Chuditch (*Dasyurus geoffroii*)
   - Western barred bandicoot (*Perameles bougainville*)
   - Boodie (*Bettongia lesueur lesueur*)
   - Black-flanked rock-wallaby (*Petrogale lateralis*)
   - Orange-bellied frog (*Geocrinia vitellina*)
   - Cape Leeuwin freshwater snail (*Austroassiminea letha*)
   - Bilby (*Macrotis lagostis*)
   - Shark Bay mouse (*Pseudomys fieldi*)
   - Heath mouse (*Pseudomys shortridgei*)
   - Western bristlebird (*Dasyornis longirostris*)

   Plants
   - Piawaning clawflower (*Calothamnus accedens*)
   - Dwarf hammer orchid (*Drakaea micrantha*)
   - Dwarf rock wattle (*Acacia pygmaea*)
   - Christine's spider orchid (*Calendenia christineae*)
   - Beard's mallee (*Eucalyptus beardiana*)
   - Victoria desert smokebush (*Conospermum toddii*)
   - Small-petalled beyeria (*Beyeria lepidopetala*)
   - Mt Augustus foxglove (*Pityrodia augustensis*)
   - Narrogin pea (*Pultenaea pauciflora*)
   - Saltmat (*Roycea pycnophylloides*)
4. **Effective** control of invasive animals in priority areas for biodiversity conservation, including three-fold expansion of the *Western Shield* feral predator (fox and cat) control and fauna recovery program to more than 10 million hectares, and targeted action against other invasive animals including camels, goats, pigs, cane toads and starlings.
5. **Containment** of WA's top 30 environmental weeds, including rubbervine, athel pine, prickly acacia and date palm and elimination of at least 10 'sleeper' weed species, in tandem with the prevention of new weeds being established.
6. **Attack** on *Phytophthora* dieback in major infections threatening key biodiversity assets and containment of its extent, especially in Fitzgerald River and Stirling Range National Parks and in priority threatened flora populations and threatened ecological communities.
7. **Effective management** of other processes threatening the State's biodiversity, including salinity, altered fire regimes, eutrophication, native vegetation clearing and pollution.
8. **Substantial improvement** in knowledge of the State's biodiversity, including completion of a statewide program of systematic terrestrial and marine biological surveys, and completion of taxonomic description of a further 500 species of the State's flowering plants (or about one-third of the plant species estimated to still remain undescribed).
9. **Incorporation** of consideration of the impacts of climate change on biodiversity in all planning and actions involving land uses and natural resource management.
10. **Whole-of-community** involvement in biodiversity conservation, through awareness and active engagement, including Indigenous people, youth, land managers, private enterprise, community groups, local government, and people from urban, regional and rural areas.

A 100-year Biodiversity Conservation Strategy for Western Australia (Draft) has been prepared in response not only to the problem of continuing decline in indigenous biodiversity, but also the opportunity we still have to protect and restore biodiversity in the State. The health and well-being of all Western Australians and future generations, and the State's economy, is dependent on our ability to reverse this decline and maintain biodiversity values.

The most important general causes of biodiversity loss in WA are:

- habitat loss and modification associated with land and natural resource uses and practices;
- biophysical consequences of introduced species (plants, animals and pathogens); and
- effects of human-induced climate change.

The overall goal of the strategy is to recover and conserve WA's biodiversity within 100 years. This will require focusing on those species and ecosystems that are known to be under significant pressure from a range of factors and on the brink of extinction, while at the same time preventing decline of biodiversity in ecosystems and landscapes that are ecologically intact and in relatively good condition. The goal up to the year 2029 is to significantly slow then halt decline of indigenous biodiversity by addressing key threatening processes, improving public empathy and support for WA's natural heritage and ensuring biodiversity values are conserved through protection and management of land and waters. This will be achieved by strengthening key initiatives where biodiversity conservation is the primary goal, and making biodiversity conservation an integral part of the business of Government, industry and the private sector.

This strategy provides an overarching set of goals and targets applying at the whole-of-State level. Current and future regional strategies will be important in refocussing at the closer regional scale.

This strategy will also require initiatives that reach across generations and communities, and that improve knowledge and technical capacity to predict changes and determine trends in biodiversity. This will aid decision-makers at all levels and bring about effective on-ground changes that will improve the conservation status of indigenous taxa and ecological communities and condition of ecosystems.

OVERVIEW OF KEY STRATEGIC DIRECTIONS

Eight key strategic directions provide an overarching framework for 138 lower order primary actions to meet the strategy's goal and vision:

Key Strategic Direction 1:

Build biodiversity knowledge and improve information management

(We need to know what biodiversity we have and what it requires to survive, to ensure its conservation.)

Objectives:

To maximise scientific research and improve knowledge of biodiversity and ecological processes.

To improve scientific knowledge of the composition and patterns of biodiversity and trends in biodiversity.

To better integrate research with management requirements, predict the consequences of key threatening processes and better account for the values of biodiversity.

To allow for comparative biological studies of living organisms and better organise biotic collections.

To improve biodiversity data collections and transfer of knowledge by ensuring the best available data and information are available to decision-makers and managers.

2029 key desired outcomes:

- Critical gaps in scientific knowledge of biodiversity and related ecological processes addressed.
- Better dissemination of scientific information and uptake of knowledge by decision-makers at all levels.
- Improved policy relating to biodiversity and biodiversity conservation management.
- Improved tools for biodiversity planning and management at a range of scales.

Key Strategic Direction 2:

Promote awareness and understanding of biodiversity and related conservation issues

(We need everyone in the community to be aware of biodiversity conservation requirements to help ensure the success of our conservation programs.)

Objective:

To increase Western Australians' appreciation of biodiversity and understanding of the requirements for biodiversity conservation.

2029 key desired outcomes:

- Increased public knowledge and appreciation of the values and benefits of biodiversity.
- Increased proportion of State public funding for key biodiversity conservation programs and initiatives.
- A community that embraces biodiversity.

Key Strategic Direction 3:

Engage and encourage people in biodiversity conservation management

(The more people involved in biodiversity conservation programs, the easier it will be to meet our goals.)

Objective:

To get more people involved in biodiversity conservation and to encourage maintenance and recovery of biodiversity values.

2029 key desired outcomes:

- People take greater responsibility for biodiversity conservation and stewardship of biodiversity is improved.
- 500,000 people are involved in voluntary biodiversity conservation activities in WA.
- Five million hectares of privately managed land under voluntary nature conservation agreements and delivering key biodiversity conservation outcomes.
- Improved Western Australians' health and well-being as a direct consequence of experiencing the benefits and opportunities from biodiversity conservation.

Key Strategic Direction 4:

Improve biodiversity conservation requirements in natural resource use sectors

(We need to ensure that all industry sectors take due account of the importance of biodiversity conservation.)

Objective:

To ensure special recognition is given to biodiversity conservation in ecologically sustainable development of natural resources.

2029 key desired outcomes:

- Resource and land use practices make sufficient provisions for the protection and management of biodiversity, and minimise impacts on biodiversity by adhering to appropriate codes of practice and guidelines.

Key Strategic Direction 5:

Enhance effective institutional mechanisms and improve integration and coordination of biodiversity conservation

(The importance of biodiversity conservation needs to be recognised across all sectors of government, as well as major community-based groups including natural resource management groups and all of these sectors need to work together to achieve biodiversity conservation.)

Objectives:

To improve institutional mechanisms for biodiversity conservation and reduce social and institutional impediments.

To better integrate and coordinate biodiversity conservation matters in policy, legislation and initiatives, and increase relevance to Government.

To maximise biodiversity conservation in the development of natural resources.

2029 key desired outcomes:

- Biodiversity conservation is regarded as fundamental in decision-making, planning, management and policy development.
- Biodiversity conservation is better coordinated and targeted to achieve on-ground outcomes, including through a Biodiversity Conservation Act, regional natural resource management strategies, local government biodiversity plans, State biodiversity strategy for climate change, and regional and local planning schemes.
- The status of species and ecological communities on local government and State agency lands and in State waters is improved as well as the condition of landscapes and ecosystems.

Key Strategic Direction 6:

Establish and manage the formal conservation reserve system

(The formal conservation reserve system is the backbone of all biodiversity conservation initiatives. We need to ensure appropriate areas are permanently conserved so that the combined value of the reserves and additional efforts on other lands is maintained.)

Objectives:

To consolidate and complete a formal terrestrial and marine conservation reserve system that meets the criteria of representativeness, adequacy and comprehensiveness, and contributes towards ecosystem resilience and continental scale connectivity.

To improve conservation reserve system design, including testing biodiversity surrogates and providing analytical tools.

To ensure the effective management of the conservation reserve system to maintain biodiversity values.

2029 key desired outcomes:

- A system of terrestrial conservation reserves where the full range of ecosystems are represented and afforded the highest level of statutory protection in perpetuity, and managed to meet International Union for the Conservation of Nature and Natural Resources (IUCN) Protected Area Management Categories I, II or IV and covering at least 15 per cent of the State's land area.
- A system of marine conservation reserves in all Interim Marine and Coastal Regionalisation for Australia (IMCRA) bioregions in State waters, within which the full range of representative habitat is afforded the highest level of statutory protection and managed as sanctuary zones to meet IUCN Management Categories I or II and complemented by other management zones that meet IUCN Management Categories IV or VI.
- A terrestrial and marine conservation reserve system that forms the basis for continental scale ecological linkages and contributes towards ecosystem resilience, and which is complemented by a network of Indigenous and private protected areas where in perpetuity statutory protection and biodiversity conservation is the primary goal.
- Biodiversity condition targets under a State monitoring and evaluation program are achieved for the terrestrial and marine conservation reserve system.

Key Strategic Direction 7:

Recover threatened species and ecological communities and manage other significant species/ecological communities and ecosystems

(We need to prevent species becoming extinct to meet the basic requirements of biodiversity conservation.)

Objectives:

To recover threatened species and ecological communities, and resolve the conservation status of priority taxa and ecological communities.

To maintain the conservation status of significant species, such as migratory birds, and improve the condition of special ecosystems, including Ramsar and nationally significant wetlands, and tuart and wandoo woodlands.

2029 key desired outcomes

- Improvement in the conservation status of at least 100 threatened species through recovery action, including 20 species fully recovered and removed from the State's threatened species lists.
- Status of 50 per cent of priority taxa and ecological communities conservation is resolved.
- Twenty ecological communities improved in conservation status because of conservation action.
- No species or ecological community becomes extinct where conservation action is being undertaken.
- All Ramsar wetlands are protected and improved in condition.
- Tuart and wandoo woodlands are better protected and improve in condition.

Key Strategic Direction 8:

Conserve landscapes/seascapes for biodiversity (integrating on- and off-reserve conservation and managing system-wide threats)

(While small, isolated conservation initiatives can be valuable, the most secure, effective and efficient means to provide for biodiversity conservation is through landscape and seascape scale programs. These provide for the contribution of the wide variety of ecological processes which support biodiversity.)

Objectives:

To conserve biodiversity values and better focus management at a landscape/seascape scale (i.e. hundreds to thousands of hectares).

To lessen or address the effects of system-wide biophysical threats and pressures on biodiversity.

To bring about a fire regime that will maintain and recover biodiversity.

2029 key desired outcomes:

- Better targeting of biodiversity conservation effort at a scale that manages and recovers landscapes/seascapes and ecosystems of high biodiversity value and maintain ecological processes and the natural resources they depend on.
- Continental scale ecological linkages in place for the south-west to assist in reduction of the effects of human-induced climate change and biodiversity decline.
- Key invasive animals affecting biodiversity in the rangelands to be reduced in extent by 10-30 per cent. This includes feral and unmanaged goat, feral camel, feral cat, feral pig and the European fox. Biodiversity should show an improvement in condition and status.
- A 90 per cent reduction in European starling populations and a reduction in the impacts on biodiversity values.
- The top 30 environmental weeds are contained.
- Ten 'sleeper' weeds are eradicated.
- Biodiversity decline is halted in 25 natural diversity recovery catchments in the agricultural zone of the south-west of the State.
- Containment in the extent of *Phytophthora* dieback in the south-west of the State.
- Priority marine pests are controlled.
- Appropriate fire management regimes in place for the north Kimberley, Karijini-Fortescue, Goldfields, arid-zone hummock grasslands, south-west forests and kwongan heathlands.

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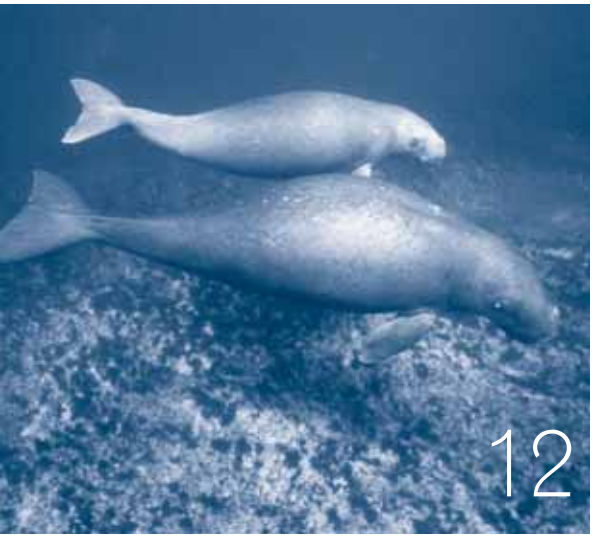

Top: The marl (western barred bandicoot *Perameles bougainville*). Photo – DEC

Centre: Dugongs. Photo – Doug Perrine/DEC

Bottom: Loggerhead turtle hatchlings. Photo – Babs and Bert Wells/DEC

Karri (*Eucalyptus diversicolor*) forest in Warren National Park. Karri are the tallest trees in the State, and among the tallest of all eucalypt species. These majestic plants grow up to 90 m tall and occur in the wettest parts of the south-west.
Photo – Chris Garnett/DEC

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1. Introduction – Biodiversity matters

Western Australia (WA) has some of the richest and most unusual biodiversity on Earth, much of which occurs nowhere else and is recognised as being significant at both national and global scales. However, it has been profoundly affected by human activities during the past 150 years. This is of concern because it is this biodiversity that will underpin our well-being and survival, as well as providing the basis of the State's primary production and nature-based industries.

Current trends and projections indicate an inexorable decline in terrestrial biodiversity over the next few decades, with an accelerated rate of loss in the immediate to near future, especially for the south-west of the State. This will lead to deterioration in ecosystem services and will have an insidious impact on the health and well-being of all Western Australians, reducing opportunities and benefits from biodiversity for future generations, and affecting the State's ability to cope with climate change.

An unprecedented effort will be required to slow the rate of biodiversity decline initially, then reverse the trend. Because the full ecological impacts of threats are usually delayed or go undetected and institutions cannot respond quickly enough in many instances, it may take decades to bring about this turnaround. However, a consolidated effort and an increase in action now will reap major returns and maintain opportunities for future generations.

WA has a real opportunity to protect and restore its biodiversity, compared to other Australian jurisdictions or nations where impacts have been significantly greater or where there are fewer resources available for conservation. However, this advantage will diminish as species become extinct and ecological communities are destroyed. Expansion of biodiversity conservation initiatives, sustained investment, better targeting of effort, greater cooperation among all stakeholders and willingness to effectively deal with both direct and indirect causes of biodiversity loss in a comprehensive manner will be needed during the next 100 years. A whole-of-community approach will be needed to address this issue.

Butterfly feeding on silky grevillea (*Grevillea pteridifolia*). The flowers contain abundant nectar and are an important food source for birds and animals. Photo – Keith Claymore

This strategy focuses on *Phase One: Blueprint to the Bicentenary in 2029* — the framework for addressing the complex challenge facing WA in reversing the decline in biodiversity, while at the same time maintaining biodiversity in intact landscapes and seascapes. It will strengthen and build on initiatives where biodiversity conservation is the primary goal, promote the integration of biodiversity conservation into mainstream business across government, industry and community sectors, and accumulate scientific knowledge needed to underpin management and decision-making.

1.1 What is biodiversity?

Biodiversity (or biological diversity) embodies the totality of life; that is the variability within and among genes, species and ecosystems. It covers marine, terrestrial, subterranean and aquatic life and implies a highly complex system of interacting living entities that occur over a range of temporal and geographic (from local to global) scales.

The values of biodiversity go beyond species richness and recognition of individual components, such as charismatic animals or plants. It is important to take a broad approach and recognise the multiple dimensions of biodiversity and the complexity that results from the various interactions within and between genes, species and ecosystems at different geographical scales and over time.

Opposite: Balga or grass tree (*Xanthorrhoea preissii*) in jarrah (*Eucalyptus marginata*) dominated woodland with parrot bush (*Dryandra sessilis*). Balga are ancient plants; their lineage can be traced to the time of the super-continent, Gondwana. Individual plants can survive for centuries. Photo – Keith Claymore

1.2 What does biodiversity do?

Biodiversity provides the life support systems that enable all organisms on Earth to survive, including humans. It underpins economic and social sustainability by providing resources such as clean air, water and fertile soils. It helps regulate climate and temperature and mitigates the effects of pests, disease, pollution and floods. It provides a stream of products such as timber, fuel, clothes, food, and medicines. Other benefits include recreation, aesthetic, scientific, education and spiritual values and a sense of place. In addition to the direct and indirect utilitarian values that benefit humans, biodiversity is important in its own right and we have a moral and ethical responsibility to ensure that all indigenous species and the full range of ecosystems have a right to exist. Biodiversity is also likely to have values that are unknown to us today but will present options for future Western Australians, and these opportunities must be protected through the use of precautionary approaches to minimise impacts from today's activities.

Taken in its entirety, that is the combined diversity of genes, species and ecosystems, biodiversity fosters a resilience that provides the ability for ecosystems and species to cope with change and fluctuations in disturbances, either natural or human induced. It also allows for evolutionary processes to occur, including speciation brought about from genetic variation and ecological adaptation. Hence, the notion of biodiversity is greater than the sum of its parts, and the range of services and benefits that flow from it are greatly enhanced by this intactness.

Loss of biodiversity diminishes the ability of ecosystems and species to cope with environmental and climatic variations, reducing stability and resilience. This potentially compounds any socioeconomic and biophysical impacts or flow-on effects from loss of ecosystem services. Similarly, the introduction of alien organisms to ecosystems can disrupt natural processes and result in loss, while maintaining healthy ecosystems will enhance resistance to invasion.

Human health and well-being are inextricably linked to biodiversity, and its ability to provide a stream of multiple services and products. Simply put, diminishing biodiversity will ultimately result in a general decline in the quality of life and well-being for current and future generations, resulting in impacts on economic markets and social cohesion.

1.3 Where is biodiversity found?

Biodiversity is everywhere: life can be found in water, soil, air and in habitats that make up all environments. However, of particular importance are natural ecosystems and habitats that contain higher levels of indigenous biodiversity than in modified areas where native habitat has been removed, modified, degraded, or replaced with exotic species. All land and seascapes in WA have some level of biodiversity value. However, relative importance varies according to biodiversity make-up (composition, structure and richness), condition (degree of intactness, and extent and future projected impact of threats), and ecological rarity and endemism.

WA comprises a third of the Australian continent, or about 250 million hectares, and is one of the most biodiverse jurisdictions on Earth, given its size and range of climatic variations. WA also has 13,500 kilometres of coastline, marine waters covering around 12.6 million hectares, and around 3500 islands, some of which retain fauna that once occurred on mainland Australia such as the marl (western barred bandicoot *Perameles bougainville*), the mernine (banded hare-wallaby *Lagostrophus fasciatus fasciatus*) and the boodie (burrowing bettong *Bettongia lesueur lesueur*). Parts of the far north of the State comprise some of the last remaining ecosystems on mainland Australia that are ecologically intact and contain the full assemblage of fauna and flora found prior to European settlement.

Because of climatic and geological variations, there is a wide range of terrestrial ecosystems found in WA extending from the tropics in the north to warm temperate southern latitudes and the arid interior. This range includes rainforest patches and mangrove forests in the north of the State, extensive open eucalypt-dominated savannah woodlands, spinifex grasslands, and Acacia shrublands in the semi-arid

Box 1: Fauna conservation significance of offshore islands

WA has around 3500 offshore islands, with most containing high biodiversity values, including rare or restricted vegetation types and fauna. Some larger islands, such as Barrow, Bernier and Dorre, have assemblages of mammals that are now threatened or extinct on the mainland. Exotic species such as foxes, feral cats and domesticated animals remain absent from these islands and exotic rats have either been eradicated or have always been absent.

Once widespread across arid southern Australia, the marl (western barred bandicoot *Perameles bougainville*) is now extinct on the mainland and can only be found in the wild on WA's Bernier and Dorre Islands, about 60 kilometres west of Carnarvon. It is listed as endangered with less than 3000 individuals remaining in the wild. Bernier and Dorre Islands also hold the last wild populations of the mernine (banded hare-wallaby *Lagostrophus fasciatus fasciatus*), the mala (*Lagorchestes hirsutus bernieri*) and the boodie (burrowing bettong *Bettongia lesueur lesueur*).

In some instances, due to size and difficulty of access, islands can offer suitable habitat for the translocation of threatened taxa[1] to enhance mainland biodiversity recovery initiatives. Within an integrated recovery plan approach, this may increase populations of threatened species facing extinction on the mainland and provide them with an expanded range.

In recent years, there have been introductions of mala to Trimouille Island in the Montebello Islands, dibblers (*Parantechinus apicalis*) to Escape Island off Jurien Bay, Shark Bay mouse (*Pseudomys fieldi*) to Doole Island in the Exmouth Gulf and North West Island in the Montebello Islands, and the noisy scrub-bird (*Atrichornis clamosus*) and Gilbert's potoroo (*Potorous gilbertii*) to Bald Island off the south coast near Albany.

The marl has a high reproductive rate, which makes it an excellent candidate for reintroduction to the mainland. The gestation period of the marl is 12.5 days, one of the shortest gestation periods recorded for mammals. Photo – DEC

[1] The term "taxa" is used throughout this document to include species and sub-specific groups such as subspecies and varieties. This is particularly important as it allows for the recognition of genetic lineages within species, and lists of threatened species often include subspecies.

and arid interior, heathlands and low Eucalyptus-Banksia woodlands along the western and southern coastline giving way to tall eucalypt forest and woodlands in the warm temperate and Mediterranean type climate of the south-west interior and montane heathlands on the south coast.

Wetlands in WA support a rich natural heritage of plant and animal life. Wetland systems include tidal mangroves, sand and mudflats, coastal lakes, subterranean aquatic systems, swamps and marshes. There are 120 nationally important wetlands and wetland systems in WA, and 12 wetlands listed under the Convention on Wetlands, also known as Ramsar sites, covering approximately 500,000 hectares. Among their many biodiversity values, these areas are important habitat and breeding grounds for migratory birds. Further, within WA there are about 208 major waterways, with a combined length of more than 25,000 kilometres, and 171 estuaries (Water and Rivers Commission, 2000). Forty-eight have been identified as 'wild rivers' due to their 'pristine', 'near pristine' and 'relatively natural' state (Department of Water, 2006).

At the species level, there are about 39,000 formally described taxa for WA, but it is estimated there are over 285,000, excluding bacteria, viruses and protozoa (see Appendix 1). The south-west of the State is one of 34 global biodiversity hotspots, recognised for its endemic vascular plant richness that is under severe threat, and is the only region in Australia accorded this status. It is estimated that of Australia's plant species, 32 per cent are found in the south-west of the State, of which approximately 79 per cent are endemic. In addition, WA contains eight of the 15 national terrestrial biodiversity hotspots (see Appendix 2).

WA also has an exceptionally rich marine biodiversity, as a result of the large latitudinal range (tropical to temperate) and because of the unusual oceanographic conditions occurring along the coast of WA. A unique feature of the coastal waters of WA is the Leeuwin Current, which flows down the western coastline and crosses the southern coastline into the Great Australian Bight. The Leeuwin Current has a major influence on the biogeography of the State's marine flora and fauna, bringing warm waters down the coast, and is responsible for the occurrence of tropical species at latitudes where they are not typically found, such as the corals reefs off the Abrolhos Islands and corals and tropical fish found in the waters around Rottnest Island off Perth.

The cool, temperate coastal waters off the south and west coast are micro-tidal (<2m tidal range), exposed to high wave energy and are generally nutrient-poor. As a result of the clear water conditions, seagrass and macro-algae meadows, and coral reefs characterise the coastal waters of this part of WA. By contrast the warm, tropical inshore waters along the north-west and northern coasts are macro-tidal (2 to >10m tidal range), exposed to low wave energy (except during cyclones) and contain higher suspended sediment loads. The turbid inshore tropical waters are characterised by mangroves and mudflats with extensive coral reefs occurring in the clearer, offshore waters.

This marine biogeographical setting has produced a wide variety of ecosystems with many unique features including: tropical reefs off the Kimberley coastline and at the Rowley Shoals about 200 kilometres west of Broome; extensive tropical and arid-zone mangrove communities along the Kimberley and Pilbara coastline; a 300-kilometre fringing coral reef (Ningaloo Reef); an inverse-estuarine, hypersaline ecosystem maintained by 4000 square kilometres of seagrass meadows at Shark Bay; an extensive coral reef complex at the Abrolhos Islands - the largest coastal temperate limestone reef system in Australia; nutrient-poor coastal embayments and lagoons, protected by reefs and islands, that give rise to highly diverse and endemic seagrass flora (central and south coasts); and the nutrient-poor high-energy coast with granite reefs and highly diverse and endemic algal communities and faunal assemblages in the south-west and south coasts.

The unique environmental conditions off the west coast of Australia result in the coastal marine biodiversity of WA being ranked second highest out of 18 of the world's marine biodiversity hotspots (based on species richness and endemism) and fourth lowest in terms of threatening processes (see Appendix 2 for location of marine hotspot).

Box 2: Genetic and species variability within triggerplants

With more than 260 recognised taxa, the triggerplant genus *Stylidium* is among the richest flowering plant genera in Australia. Triggerplants are annual or perennial herbs that derive their name from the ingenious way they attract and use insects to exchange pollen. When an insect visits a flower, a catapult-like trigger flips rapidly through the air and strikes the insect on its body. This trigger action either dusts the insect with pollen, or picks up pollen that the insect is already carrying.

Stylidium is most diverse in south-west WA, a region internationally recognised for its floral diversity. Whilst they occur in most south-west ecosystems, there is a noticeable concentration of species in high rainfall habitats. It is not uncommon to find several species sharing the same habitat.

Triggerplants display a large diversity in growth form, leaf structure and arrangement and flower structure. The genus comprises both annual and perennial herbs that grow between three centimetres and three metres high. They are well adapted to the south-west climate, escaping the harsh summer as soil-stored seed, or dying back to an insulated stem stock or growth node, which lies dormant until the onset of autumn or winter rains. *Stylidium* flowers exhibit a remarkably diverse morphology. They are often adorned with appendages and/or striking markings that function both to entice insects toward the throat of the flower and to correctly orientate them for pollen transfer. The shape and size of the petals, appendages and markings is highly variable, and can be unique to a given species.

Knowledge of *Stylidium* is currently insufficient for scientific and conservation needs. While some species of *Stylidium* are common and reasonably widespread, many are rare and/or geographically restricted as a result of highly specific habitat requirements or, in many cases, habitat loss. Fifty-seven taxa are currently recognised as threatened and priority taxa in south-west WA. Extensive field survey is required to determine the conservation status of many of these taxa.

There are also many unnamed species of *Stylidium*, several poorly defined taxa, and no identification aid to the presently known taxa. This incomplete taxonomic knowledge is a major impediment to effective conservation of this genus. Undescribed species are of special concern since until they are discovered and their conservation status determined, they are not actively targeted in conservation programs. While recent research has prompted the recognition and description of many new WA *Stylidium* species, further research is required to attain a better understanding of this unique Australian plant group.

The flower of the white butterfly triggerplant (*Stylidium hispidum*). Different species of triggerplants have various shapes and lengths of the column, which can strike from under, over or from the side. Photo – Keith Claymore

1.4 What is the state of biodiversity in WA?

Quantitative scientific evidence that indicates changes to biodiversity at an ecosystem level is generally lacking. Nevertheless, it is well known that the south-west of the State has experienced extensive destruction of ecosystems from broadscale land clearing for agriculture (especially in the 1920s to 1980s), expansion of urban areas, and development of infrastructure and use of natural resources. This has led to loss and fragmentation of habitats, with a range of biological effects, which include the slow dismantling of ecological communities and species habitat – resulting in eventual species extinctions and loss of biodiversity richness (Saunders *et al.* 1991; Gonzalez 2000; Hobbs and Yates 2003). The pastoral rangelands, which occupy about 35 per cent of the State's land area, have also been modified by pastoralism to varying degrees. As a result of these impacts, decline in ecosystem (and species) diversity and function has occurred at a range of geographic scales, and some parts of WA have been irreversibly damaged.

There has been widespread reduction in the extent and abundance of indigenous species across much of the State. In some instances, species and ecological communities have become extinct. The number of extinctions is likely to be worse than recorded because of the lack of baseline information and gaps in scientific knowledge. It is also likely that extinctions may not become apparent for several generations because of the time lag effect from initial impacts of threatening processes, and some species may currently be below their minimum viable population size to survive over the long-term.

While the overall condition of WA's marine biodiversity is generally considered sound, compared to terrestrial and freshwater biodiversity, there have been localised impacts in some parts of the State's coastal waters due to industrial pollution, land-based agricultural run-off and intensive commercial and recreational fishing that have impacted on some targeted species such as pink snapper (*Pagrus auratus*) in Shark Bay and the brood stock of dusky sharks (*Carcharhinus obscurus*) along the south coast (State of the Fisheries Report, 2004).

Table 1 provides a summary of the conservation status of taxa and ecological communities, and impacts on ecosystems.

Table 1: Summary of status of taxa and ecological communities, and impacts on ecosystems in Western Australia

Attribute	Number	Selected references	Comments
SPECIES			
Presumed extinct	11 mammals 4 land snails 2 birds 1 bee 14 plants	Wildlife Conservation (Specially Protected Fauna) Notice 2006(2) Wildlife Conservation (Rare Flora) Notice 2006(2)	Notices are reviewed and updated annually
Threatened	582 taxa Plants: 378 (376 flowering plants; 1 fern and 1 moss) Animals: 204 (42 mammals, 45 birds, 23 reptiles, 3 frogs, 8 fish, 83 invertebrates)	Wildlife Conservation (Specially Protected Fauna) Notice 2006(2) Wildlife Conservation (Rare Flora) Notice 2006(2)	Includes IUCN equivalent categories Critically Endangered, Endangered and Vulnerable

Attribute	Number	Selected References	Comments
ECOLOGICAL COMMUNITIES			
Presumed destroyed	3	Threatened Ecological Communities list (January 2004)	
Threatened	66	Threatened Ecological Communities list (January 2004)	Includes IUCN equivalent categories Critically Endangered, Endangered and Vulnerable
SW[2] ECOSYSTEMS			
Area of SW of State cleared	72% (10% of State land area)	Department of Environment and Conservation 2006	Land cleared under environmental protection (clearing of native vegetation) regulations for 2004/05 was 9894 ha
Remaining area of remnant vegetation in Wheatbelt	7%	Beecham 2004	
Area of Swan Coastal Plain cleared of native vegetation	80%	Beard 1995	
Proportion of wetlands modified or destroyed on Swan Coastal Plain	80%	Balla 1994	
Area in SW affected by salinity	1 M ha	McFarlane et al. 2004	Annual rate of increase is 14,000 ha
Projected area of salinity in SW	5.4 M ha	McFarlane et al, 2004	
Area affected by *Phytophthora cinnamomi*	20% jarrah forest 60% Stirling Range banksia woodlands 70% banksia woodlands in Shannon and D'Entrecasteaux National Parks	WWF 2004; *Phytophthora* Dieback Management and Investment Plan for WA 2006-2013	
Native plant species susceptible to *Phytophthora cinnamomi*	2284	Shearer et al. 2005	Equates to around 40% of the total number of plants in the south-west (5710)
RANGELANDS ECOSYSTEMS			
Area of pastoral rangelands in good condition	38.8 M ha (46%)	Van Vreeswyk *et al.* 2004	
Area of pastoral rangelands in fair condition	25.3 M ha (30%)	Van Vreeswyk *et al.* 2004	
Area of pastoral rangelands in poor condition	20.2 M ha (24%)	Van Vreeswyk *et al.* 2004	
Proportion of west Kimberley in poor condition	30%	Van Vreeswyk *et al.* 2004	
Proportion of Murchison in poor condition	42%	Van Vreeswyk *et al.* 2004	
MARINE ECOSYSTEMS			
Area of State waters open to trawling activity		No data available	

[2] In this context, south-west relates to those ecosystems that comprise and are located within the South West Botanical Province.

1.5 What are the causes of biodiversity loss in WA?

Land and natural resource use practices have left a legacy of problems that have set in train a number of degrading processes which continue to impact on biodiversity. These include:

- salinisation and waterlogging of ecosystems in the south-west of the State as a consequence of broadscale native vegetation removal for agriculture;
- *Phytophthora* dieback in the south western parts of the State;
- over-grazing of native vegetation by domestic animals, loss of soils and altered hydrology in the pastoral rangelands;
- excessive harvesting of groundwater for industry and domestic purposes, especially in the south-west;
- pollution of waterways, for example from nutrient loading from fertiliser overuse in agricultural and urban areas;
- over-exploitation of native plants and animals;
- altered fire regimes;
- habitat fragmentation effects in the wheatbelt and Swan Coastal Plain as a consequence of agriculture and human settlement; and
- impacts from the introduction of invasive animals and environmental weeds[3].

At this same time, pressures from new development and land uses, with consequential incremental loss of habitat and ecosystem fragmentation, altered groundwater hydrology, and modification of rivers and wetlands, pose an increasing threat to biodiversity.

The dominant pressures affecting the WA marine environment include:

- habitat loss due to direct physical damage caused by port and industry development;
- excessive loads of nutrients and pollutants from industry, domestic and agricultural sources;
- land-based activity associated with ports, mining, aquaculture and farming;
- direct physical damage caused by unsustainable recreational and commercial boating activities including anchor and trawling damage; and
- the harvesting of marine species for commercial or recreational purposes and the introduction of exotic species, especially from ballast water and hull-fouling.

A primary cause of biodiversity loss is a general lack of public awareness and appreciation of biodiversity and its values. This disconnect with nature often results in a lack of empathy with our natural heritage, and biodiversity not being recognised as underpinning ecologically sustainable development, resulting in short-term socioeconomic benefits outweighing long-term environmental considerations. The growing demands of an expanding human population (often associated with changes in demography) and growing global markets are placing additional pressures on our natural wealth with long-lasting consequences.

Coupled with persistent biophysical threats and socioeconomic causes is human-induced climate change, which is projected to exacerbate biodiversity loss through increase risk of species extinctions and ecosystem decline, especially among those already at risk and limited in their climatic range.

Table 2 lists the major factors contributing to the loss of biodiversity in WA, along with associated ecological consequences. Supplementary information relating to status and trends in biodiversity, and major biodiversity conservation issues facing WA can be found in a number of publications, including: the draft *State of Environment Report 2006; Bioregional Summary of the 2002 Biodiversity Audit for WA; A Biodiversity Audit of WA's 53 Biogeographical Subregions in 2002, and Towards a biodiversity conservation strategy for WA (2004)*.

[3] There are around 1350 environmental weed species recorded for WA, of which 34 species have been recognised as being of particular concern due to their extent and invasiveness.

Table 2: Causes of biodiversity loss in WA

Factor	Ecological consequences	Selected references
TERRESTRIAL		
Broadscale clearing of native vegetation	Removal of flora and vegetation, loss of habitat, degradation or loss of whole ecosystems, extinctions or reductions in the diversity of species, soil erosion, ecosystem fragmentation, species relaxation (refer to Glossary), displacement of native fauna, native vegetation structural changes, decline in the ability of species to colonise, propensity towards genetic 'bottlenecks', altered hydrology, alteration of microclimate, altered nutrient cycling and loss of ecosystem resilience.	Hobbs and Saunders 1993; Saunders *et al.* 1991.
Introduced predators (including European red fox and feral cat)	The predation of native animals leading to decline or extinction, and the carrying and spreading of harmful diseases.	Abbott 2001; Kinnear *et al.* 1988, 2002.
Introduced herbivores and omnivores (including house mouse, European rabbit, feral goat, feral pig, feral donkey, feral horse and feral camel)	These compete with native animals for food and habitat, destroy or degrade habitats, carry and spread harmful diseases, compact soils and accelerate soil erosion.	Dyne and Walton 1987; Short *et al.* 1997; Woolnough *et al.* unpublished; Burbidge and McKenzie, 1989.
Introduced animal diseases	There is no opportunity for native species to evolve immune responses or adaptations, there is death of fauna, communities are destroyed and biodiversity is reduced.	Abbott MS.
Introduced plant diseases (including *Phytophthora* spp)	There is no opportunity for native species to evolve immune responses or adaptations, there is death of flora, communities are destroyed and regrowth of many species is prevented, biodiversity is reduced and primary productivity and habitat for fauna is reduced.	Shearer *et al.* 2005; Withers *et al.* 1994.
Introduced exotic plants (environmental weeds)	There is competition with native plants for resources, habitats are modified, fire regimes change and they do not provide adequate habitats for native fauna.	Groves *et al.* 2003; Keighery and Longman, 2004.
Land contamination	Reduced growth and reproduction in plants and animals, acute or chronic health effects and the land may become uninhabitable.	National Environmental Protection (Assessment of Site Contamination) Measure 1999.
Human-induced climate change	Changes to temperature, rainfall and extreme events occur altering the nature and scale of existing biodiversity pressures. Changes to landscapes and ecosystem services, species extinctions, the inability of biota to disperse across a 'hostile' landscape matrix of different land uses, the displacement of species and the increased growth of some native vegetation occurs.	Abbott 1999; Hughes 2003; Indian Ocean Climate Initiative 2002.

Table 2: Causes of biodiversity loss in WA continued...

Factor	Ecological consequences	Selected references
TERRESTRIAL continued…		
Altered fire regime	This causes homogenisation of ecosystems, loss of species diversity and native vegetation structural and floristic decline.	Burbidge 2003; Robinson & Bougher 2003; Van Heurck & Abbott 2003; Yates *et al.* 2003; Burrows & Wardell-Johnson 2003.
Urban development and infrastructure	Removal of flora and vegetation, loss of habitat, degradation or loss of whole ecosystems, extinctions or reductions in the diversity of species and soil erosion. This leads to ecosystem fragmentation including species relaxation, the displacement of native fauna, native vegetation structural changes, a decline in the ability of species to colonise, propensity towards genetic 'bottlenecks', altered hydrology, an alteration of microclimate, altered nutrient cycling and loss of ecosystem resilience.	Abbott 1997; How & Dell 2000; Hobbs and Saunders 1993; Saunders *et al.* 1991.
Exploration and mining	Removal of native vegetation and the loss of specialised habitat for plant and animal species (including subterranean fauna) occurs, as can pollution, the introduction of disease, altered hydrology and effects proportional to mine size.	Davies *et al.* 1996; Leigh and Briggs 1992; Woodside and Neill 1995.
Pastoralism (includes infrastructure development, cattle and sheep grazing and provision of artificial water sources)	A thinning of native vegetation and habitat, and a loss of habitat through grazing occurs. There is also a homogenisation of ecosystems (loss of diversity and structure and a loss of ecosystem resilience), species relaxation, reduced infiltration rates and altered hydrology.	Burnside 1979; Holmes 1983; Harrington *et al.* 1984; Pringle 1998; Select Committee into Land Conservation 1991.
Tourism	An interruption to ecological and reproductive processes can occur as well as a contribution to issues such as species loss, habitat destruction, water availability, pollution and waste.	Worboys, Lockwood and De Lacy, 2005.

Factor	Ecological consequences	Selected references
MARINE		
Dredging and dumping (reclamation)	This introduces soil and mud into the water column, increases the turbidity and sedimentation, smothers coral and other sea floor communities, causes the physical loss of habitat, and changes the distribution and condition of native habitats and biota in and around the affected area.	Brodie Hall and Barr 2004; Fabricus 2005; Fabricus and McCorry 2006; Vazquez-Dominguez 2003.
Fishing (includes trawling)	This causes the loss or modification of habitat. The removal of predator or prey animals, an unbalancing of the community and the triggering of trophic cascades, reef damage and a reduction in the overall biomass of the ecosystem.	Frank, Petrie et al. 2005; Jackson, Kirby *et al.* 2001; Jackson 2001; Mumby, Dahgren *et al.*
Coastal development	This causes the removal or modification of native vegetation and ecosystems (including beaches and near-shore reefs), habitat loss, native vegetation structural decline, a reduction in species diversity, increased sedimentation and soil erosion and modification or loss of wetlands.	Nordstrom, Lampe *et al.* 2000; Powell and Martens 2005.2006.
Poaching	Loss of biota occurs along with a decline in species diversity, reef damage and a reduction in the overall biomass of the ecosystem.	Berkes, Hughes *et al.* 2006; Pauly, Christensen *et al.* 2002; Pauly, Watson *et al.* 2005.
Mariculture (farming of marine plants and animals in brackish and marine areas)	A modification or destruction of habitat such as mangroves occurs with a changing of the ecology of an area. Nutrient enrichment from outputs also occurs.	Caruso, Genovese *et al.* 2003; Xu and Qian 2004.
Contamination	There is an accumulation in biological tissues that can lead to the acute or chronic poisoning of marine organisms. Pathogens also occur.	Collett, Taylor *et al.* 1981; Reitsema *et al.* 2003; Reitsema and Spickett 1999; Waycott, Longstaff *et al.* 2005.
Introduced marine pests	Predation on native species, increased competition for space and food, altered nutrient cycles, and a loss of diversity in local species occurs.	Elliott 2003; Grosholz 2005; Hayes and Sliwa 2003.
Human-induced climate change	Coral bleaching and the displacement of species occurs.	Graham, Wilson *et al.* 2006; Harley, Hughes et al. 2006; Perry, Low *et al.* 2005.
Oil and gas industry (oil/chemical contamination and release of pollutants/ on-shore and off-shore impacts)	Altered species composition and sediments around off-shore installations (benthic fauna communities) occurs as does loss of species in and structure of marine habitats. Native vegetation is removed and loss of biodiversity occurs.	Blanchard, Feder *et al.* 2003; Brakstad and Lodeng 2005; Vieites, Nieto-Roman *et al.* 2004.

Box 3: Seagrass meadows

Seagrasses are highly specialised marine flowering plants adapted to grow in soft sediments in nearshore waters. Twenty-seven species of seagrasses are known to occur in WA waters providing a level of species richness unequalled anywhere in the world. Seagrasses cover an estimated 20,000 square kilometres of inshore seabed, and are an important component of the coastal ecosystems in WA waters (Kirkman and Walker, 1989).

Seagrasses are ecologically important, producing organic matter and acting as a substrate for many epiphytic[4] plants. Productivity of the epiphytic population is important because they provide a food source for many grazers. Seagrasses are also economically important, supporting the State's Western Rock Lobster fishery and prawn industry[5] with the larvae sheltering in the inshore meadows prior to moving offshore.

Impacts from a range of activities such as coastal engineering projects, landfilling, dredging and sand mining can destroy seagrass communities. Thermal pollution, sedimentation, nutrient enrichment, sewage discharge, oil and chemicals have also been shown to impact on seagrass communities.

The extensive, relatively calm, shallow expanse of Shark Bay (13,000 square kilometres) contains 12 species of seagrasses, which cover an estimated 4000 square kilometres of seabed, including the 1030 square kilometres Wooramel Seagrass Bank that is the largest structure of its type in the world. Dugongs (*Dugong dugon*) feed on at least five of the 12 seagrass species found here. Shark Bay's dugong population is estimated at 13,000 animals, which is the largest population in Australia and one of the largest in the world. It represents an estimated one-eighth of the world's population of this species. The management of this dugong population has been identified as critical on a global scale. The dugong population is identified as a major value of the Shark Bay World Heritage Property.

Their slow breeding rate and long life span mean that dugongs are particularly susceptible to factors that threaten their survival. Major threats include loss of seagrass habitat, entanglements in fishing nets, disturbance from inappropriate tourism, over-hunting and vessel impacts. Photo – Doug Perrine/DEC

[4] An epiphyte is a plant that uses another plant for physical support but does not take nourishment from it.

[5] Estimated annual value for the year 2003-2004 of the Western Rock Lobster Fishery is $257 million, estimated annual value for the year 2003-2004 for the prawn industry is $49 million (State of the Fisheries Report 2004-2005, Department of Fisheries).

BOX 4: Environmental weed or improved pasture?

Environmental weeds are one of the most serious threats to biodiversity in WA. These are plants that establish themselves in, or are deliberately introduced into, natural ecosystems and then proceed to modify ecological processes, usually adversely, resulting in the decline of the communities they invade as they outcompete native plants. The *Environmental Weed Strategy for WA 1999* identifies 1350 species of environmental weeds in WA. Of these, 34 have been designated as 'high priority' for control or eradication.

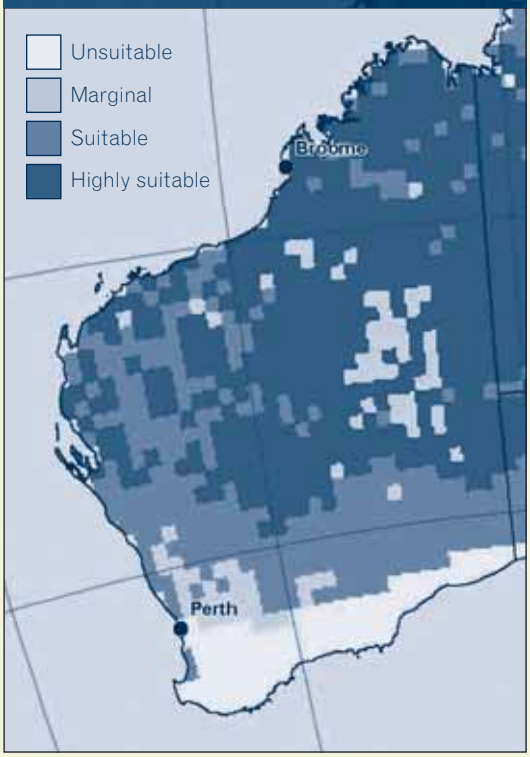
One of the most widespread and highly invasive environmental weed in WA is buffel grass (*Cenchrus ciliaris*). Buffel grass is native to Africa, Arabia, the Canary Islands, Madagascar, Indonesia, northern India and Pakistan.

Seeds of buffel grass were first bought into Australia's north-west in the saddles of cameleers in the mid to late 1800s. Since then, the plant has been cultivated for the pastoral industry and actively used as an "improved pasture" for domesticated animals, particularly cattle. It is resistant to heavy grazing and is considered the most drought tolerant of all the introduced grass species. Numerous strains have been widely planted in pastoral regions and it has become widely established as a weed in many ecosystems, particularly in coastal areas, valleys and along creeklines from Shark Bay to the Pilbara and Kimberley, and is now extending into the arid deserts along watercourses and transport corridors. Buffel grass continues to spread, in the north and south of the State, both naturally, by wind and water dispersal, and through deliberate establishment.

While buffel grass is considered by many pastoralists as offering a source of feed to stock, often in times of drought, buffel grass reduces biodiversity through direct competition with native plants (including a reduction in native grass species) and by altering fire regimes, resulting in a change in native vegetation structure and composition. It dries quickly and produces higher biomass than native plants it replaces, and hence creates more intense fires which can affect native vegetation by altering its structure and floristics. Buffel grass can quickly colonise areas burnt and outcompete native plants in early establishment. There is evidence to suggest that buffel grass is also allelopathic[6], where leachates from the leaves and roots have been shown to affect the development and growth of neighbouring plants.

Cultivars of buffel grass are now widely established in Queensland, South Australia, the Northern Territory and WA. Predictive modelling has indicated that buffel grass could establish across 58 per cent of mainland Australia.

Predicted distribution of buffel grass in WA based on climate and soils modelling.



Source: Adapted from Lawson, B.E., Bryant, M.J., and Franks, A.J. (2004). Assessing the potential distribution of buffel grass (Cenchrus ciliaris L.) in Australia using a climate-soil model. Plant Protection Quarterly Vol. 19

[6] Allelopathy refers to the chemical inhibition of one species by another. The 'inhibitory' chemical is released into the environment where it affects the development and growth of neighbouring plants.

The whale shark (*Rhincodon typus*) is the world's largest fish. Each year whale sharks are drawn to Ningaloo Reef to feed following the mass coral spawn which occurs in March and April. Photo – Tourism WA

1.6 What has been achieved so far?

The beginning of biodiversity conservation in WA is rooted in the setting aside of land by the State for the protection of flora and fauna in the late 1800s and early 1900s when:

- the first reserve declared was in September 1899 for the purpose of the 'Protection of Boronia' near Albany; and
- the first national park, Greenmount National Park (which has now become John Forest National Park) was established in 1900 on the outskirts of Perth.

The first marine park established in WA was the Marmion Marine Park, declared on 13 May 1987.

Establishment of a formal conservation reserve system, where there is long-term statutory protection and public accountability of management, remains the cornerstone for biodiversity conservation in WA. It is also a vital strategy for providing secure areas for many conservation recovery initiatives, which are often planned for decades, and areas for sustainable public use. WA's terrestrial conservation reserve system now has around 1500 reserves and comprises around 22.8 million hectares[7], or about 8.9 per cent of the State. Furthermore, a total of about 1.4 million hectares of land in the rangelands was recently identified for exclusion from pastoral leases, when these expire in 2015, and incorporation into the conservation reserve system. The marine conservation reserve system has 12 reserves and covers about 1.54 million hectares or 12.2 per cent of State waters.

WA's commitment to the conservation of biodiversity is also reflected in the range of statutes and legislative frameworks that protect and regulate the use of biota, and establish quarantine and threat abatement practices to minimise the introduction and impact of invasive pests, diseases and weeds (refer to Appendix 3 for a list of key statutes). The proposed Biodiversity

[7] This figure includes 5,244,774 ha of former pastoral leasehold land that has been acquired for conservation reserves, as at June 2006, but which have yet to be reserved, and approximately 195,000 ha of land tenure changes to conservation reserves that are yet to be implemented under the *Forest Management Plan 2004-2013*.

Conservation Act will help strengthen these arrangements by providing a framework for the protection of the State's biodiversity, including codifying the protection of threatened ecological communities and providing recognition of major threatening processes impacting on biodiversity. It is also proposed that this Act will provide formal accreditation of planning instruments for a range of stakeholders to recover and manage biodiversity.

Similarly, there have been a number of significant biodiversity conservation-related policies developed, such as the *Wetlands Conservation Policy for Western Australia* (1997), *New Horizons in Marine Management* (1994), and planning policies under the *Town Planning and Development Act 1928*, which help coordinate effort, integrate biodiversity conservation with land and seascape management, and foster sustainability. Complementing these key policies are a number of State strategies and plans that provide the direction and framework to ameliorate a number of threatening processes and manage ecosystems and species. These include the *State Salinity Strategy* (2000), *WA State Sustainability Strategy* (2003), *Environmental Weeds Strategy for WA* (1999), *Forest Management Plan* (2004-2013), *WA Greenhouse Strategy* (2004), and *Draft WA Waterways Strategy* (2001). There are also a number of management plans for the sustainable use of a range of terrestrial flora and fauna, such as western grey and red kangaroos, and marine fauna such as the western rock lobster and abalone.

There are a number of regional and local natural resource management (NRM) strategies and plans that augment the above policy directions and planning instruments, many of which have initiatives in place to bring about long-term benefits for biodiversity (refer to Appendix 3 for primary and supporting strategies and plans aimed at biodiversity conservation in WA). There have been significant steps over the past four years in integrating biodiversity conservation into broader natural resource management through the development and implementation of regional NRM strategies, investment plans and associated programs by WA's six regional NRM groups, in partnership with governments, industry, non-government organisations and land managers.

WA has also recognised its role in implementing national commitments through its obligations under the National Strategy for the Conservation of Australia's Biological Diversity (and the companion National Objectives and Targets for Biodiversity Conservation), and a range of Australia's international commitments under a number of agreements, including the Convention on Biological Diversity (1992), Convention on Wetlands (1971), Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975), Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) and the International Convention for the Regulation of Whaling (1946).

Woolly mat-rush (*Lomandra leucophala subsp. robusta*) near Wiluna. Photo – Neil Gibson

During the past decade, the breadth of biodiversity conservation initiatives has expanded considerably to include a number of direct off-reserve conservation mechanisms, in recognition of important biodiversity values that occur outside the formal conservation reserve system and the need to manage ecological processes at an ecosystem or whole-of-landscape scale. There is now a range of conservation instruments administered by non-government organisations, community-based groups, local government authorities and State Government agencies aimed at encouraging biodiversity conservation on private lands. These include provision of technical advice and information, and financial incentives. For example there are around 60 different incentive programs for landholders that occur at a range of scales from local to State level (for further details see *Biodiversity Incentive Programs in Western Australia*, Government of WA 2004).

One of the most successful State level programs is *Land for Wildlife* that provides technical advice to enable planning and management for biodiversity on about 1500 properties, covering an area of more than one million hectares, of which landholders have nominated approximately 240,000 hectares as being managed for wildlife. There are also now a plethora of training and education programs aimed at schools, community-based groups and the general public, that seek to engage regional and local communities in promoting biodiversity conservation.

Biodiversity conservation is fundamental to achieving ecologically sustainable development and industry has become more aware of its role in protecting biodiversity. There has been considerable effort to integrate biodiversity conservation goals with production outcomes. This is illustrated in a general movement towards establishing environmental management systems for a number of natural resource sectors, and the development of conservation practices and investment in a number of biodiversity conservation initiatives. These include initiatives to 'offset' negative impacts on biodiversity to allow access to non-renewable resources. The resources sector has also pioneered many of the technological advances in the rehabilitation of degraded sites following mining.

In the fisheries sector, there has been the development of Integrated Fisheries Management (IFM) to achieve sustainable management of WA's fisheries. The IFM process involves setting the total harvest level of fish that can be sustainably harvested from each fishery, and then allocating explicit catch shares between the State's commercial, recreational and Indigenous fishers. The principles of sustainability are highly relevant to fisheries management. Achieving sustainability requires that not only are the effects of the fishery on the target species managed, but also the effects the fishery may have on ecosystems. To complement single fisheries management and the establishment of the marine conservation reserve system there has been a system of Fish Habitat Protection Areas (FHPAs) established.

Recovery of threatened taxa and ecological communities on the edge of extinction has become a major response in preventing biodiversity loss. There are currently 16 full recovery plans and 227 interim recovery plans. Fauna reconstruction at a landscape scale has been successful in re-establishing some indigenous species in State forest and conservation reserves in the south-west of the State, and there is progress towards fauna reconstruction in parts of the rangelands. The fauna recovery program *Western Shield*, which commenced in 1996, along with previous fauna recovery programs, has pioneered and been the focus for much of this work. To date, 12 mammal and two bird species in the Avon Valley, wheatbelt, south-west and at Shark Bay have been reintroduced to areas where they had become extinct. This program has also brought about major technological advances in achieving effective control of foxes and feral cats at a scale unparalleled worldwide. In the past eight years the Department of Environment and Conservation (DEC) has also undertaken translocations of 33 plant species, which has involved augmenting (adding plants to an existing population) six populations and starting 37 new populations in secure locations. A number of these have shown significant success with second generation recruits now established in the wild.

A honey possum (*Tarsipes rostratus*) is pictured on a scarlet banksia (*Banksia coccinea*). The honey possum is restricted to the south-west of WA, although it was once much more widespread. It survives exclusively on pollen and nectar, especially from *Banksia* spp. Photo – Babs and Bert Wells/DEC

There have been major advances in conservation science, and a number of programs have been established to determine composition of biodiversity and the conservation status of taxa. The WA Herbarium, established in 1929 and now housed within DEC, currently holds approximately 650,000 specimens. These include about 11,500 taxa of native vascular plants, around 2600 non-vascular plants, and approximately 2600 fungi for WA that have been described by science. However, of the total estimated number of known vascular plants, which is around 14,000 taxa, there are still more than 1500 to be formally classified and named.

The State has established a systematic terrestrial biological survey program, which has operated during the past 35 years, to record WA's species diversity. Currently, about 25-30 per cent of the State's land area has been systematically surveyed. Numerous other marine and terrestrial biological surveys undertaken by Government agencies, industry, universities and environmental organisations have contributed greatly to our knowledge of biodiversity at a species level, but there are still significant gaps and further work is required to better understand ecosystems and how they function.

There has also been major progress in understanding some of the biophysical threats to biodiversity. For example, the connection between land clearing and secondary salinisation of water and soil in the agricultural zone of the south-west is now well understood and recognised in broader land use and landscape planning. There have been some achievements in the reconstruction of fragmented landscapes by reconnecting and enhancing the ecological viability of remnant vegetation. This work is being complemented by research and development on native plants that will lead to commercial broadscale plantings and revegetation.

Box 5: Off-reserve conservation mechanisms: financial incentives to private landholders

Private landholders have a vital role to play in conserving WA's biodiversity. Financial incentives to positively influence the behaviour of landholders can provide an effective means to achieve biodiversity conservation on private lands, especially if focused at a whole-of-landscape scale, targeted at protecting and managing high biodiversity values, and complementary to other primary biodiversity conservation strategies such as the establishment and management of the conservation reserve system.

Woodland Watch is a collaborative project between World Wide Fund for Nature Australia and private land managers across the WA wheatbelt. The project collaborates closely with DEC, the National Trust of Australia, Greening Australia WA and the Department of Agriculture and Food. Funding support for the project has primarily been provided from the Australian Government's Natural Heritage Trust and National Action Plan for Salinity and Water Quality. Through a series of partnerships and voluntary agreements, *Woodland Watch* is helping landholders and local government authorities to protect and manage eucalypt-dominated native woodlands.

Native woodlands in the wheatbelt region have been cleared throughout most of their original extent, with approximately 7 per cent remaining and between 2 and 5 per cent per cent of native vegetation only remaining for some local government shires. *Woodland Watch* concentrates on ecosystems which are under-represented in the State's conservation reserve system, such as those dominated by red morrel (*Eucalyptus longicornis*), salmon gum (*Eucalyptus salmonophobia*), and York gum (*Eucalyptus loxophelba*). These highly fragmented landscapes also contain native habitats that can be species rich and contain naturally restricted biota and populations of threatened taxa as well as occurrences of threatened ecological communities.

Currently more than 50 wheatbelt landholders have agreements in place, or under negotiation, that aim to protect more than 2500 hectares of native woodlands, through a mix of informal voluntary and formal voluntary instruments. An integral part of *Woodland Watch* has been to undertake flora surveys on private land in collaboration with DEC. This has generated new floristic data including at least 30 occurrences of new plant species previously unknown to science.

A rare stand of wheatbelt wandoo (*Eucalyptus capillosa*) with occasional salmon gums (*Eucalyptus salmonophloia*). Photo – DEC

Recent advances in the use of powerful molecular ecological techniques have been used to develop a better understanding of the importance of gene flow (pollen and seed dispersal) among plants and the viability of remnant vegetation in fragmented landscapes typical of large areas of the south-west agricultural zone. Findings to date indicate that size and isolation are key variables with isolated populations of a few hundred plants likely to have a significantly decreased probability of persistence. These techniques have also demonstrated high levels of pollen movement across these landscapes despite any clear indication of connectivity in terms of significant remnant vegetation and suggest that paddock trees or very small patches of native vegetation may be critical for maintaining this pollen flow and the viability of larger remnants.

Since the early 1990s, there has been intensive research in WA on the use of phosphite to control disease in native ecosystems caused by the *Phytophthora* pathogen. The integration of phosphite with traditional control strategies represents one of the most significant advances in 40 years of *Phytophthora* dieback management. Methods for *ex situ* preservation, of rare or threatened flora susceptible to *P. cinnamomi* infection, have also been pioneered in WA. Of the estimated 49 per cent of threatened flora taxa that are susceptible to *P. cinnamomi* infection, 107 are now in permanent long-term germplasm storage.

1.7 Why does WA need a strategy?

While there has been much effort aimed at the recovery and maintenance of biodiversity over the past few decades, and an increasing focus on biodiversity conservation, much of this effort is fragmented, reactionary and at an insufficient scale or intensity to bring about long-term, meaningful change or address the underlying causes of decline. There remains much to be achieved by adequate implementation of existing policies and management strategies and their translation into actions and outcomes.

We need a State biodiversity conservation strategy to ensure that further investment will reap the greatest benefits for all Western Australians, and future generations. The strategy will also help provide priorities and a framework for conservation actions and decisions occurring at local and regional levels, as well as provide guidance for national and international initiatives. It will provide a sharper focus for investors from government, industry and private sectors.

A State biodiversity conservation strategy is needed to:

- **establish** a common vision and goal for biodiversity conservation;
- **identify** and clarify responsibilities for biodiversity conservation within the State, and promote the need for collective responsibility by all levels of government, non-government organisations and individuals in the conservation and sustainable management of biodiversity;
- **guide** investment decisions by individuals, community-based groups (including natural resource management groups and groups involved in private conservation activities), industry and local, State and Commonwealth Governments;
- **outline** institutional reforms necessary to better achieve biodiversity conservation and resolve overlaps to clarify responsibility and accountability;
- **complement** other government roles and initiatives in biodiversity conservation;
- **meet** WA's national obligations, and ensure that key international biodiversity-related policies and programs are addressed in WA;
- **ensure** that the wider community understands, appreciates and values the State's biodiversity and is prepared to support collective actions that are required to effectively conserve biodiversity values;
- **stimulate** the engagement of people and encourage stewardship, and strengthen existing effective mechanisms and programs aimed at effective biodiversity conservation; and
- **conserve** indigenous terrestrial, subterranean, freshwater aquatic and marine biodiversity under significant pressure.

1.8 What is the strategy trying to achieve?

The overall goal of the strategy is to recover and conserve WA's biodiversity within 100 years. This will require focusing on those species and ecosystems that are known to be under significant pressure from a range of factors and on the brink of extinction, while at the same time preventing decline of biodiversity in ecosystems and landscapes that are ecologically intact and in relatively good condition. The goal up to the year 2029 is to significantly slow then halt decline of indigenous biodiversity, with full recovery of at least 20 threatened species.

It is important to recognise that the rapid decline in WA's biodiversity over the past five decades or so will require a significant period of time to correct. There are a number of reasons why this is the case, including the:

- time lag effect of threatening processes on biodiversity, where some ecological effects are not detected or do not become evident until some time after initial impacts;
- time required to repair degraded ecosystems;
- availability of technology and lack of scientific understanding to address threats;
- ability to overcome socio-political inertia to address problems and to organise institutional responses; and
- time needed to build technical capacity and social capital to implement responses.

For the most part, the combined effect of the strategy will take many decades to show an overall reversal in the trend of decline. There will, however, be early indications of improvements to some components of biodiversity.

Figure 1 conceptualises the intended total effect of implementing the strategy during the next 100 years. It illustrates the potential net gain resulting from increasing investment now, better targeting of biodiversity conservation actions and improving application of knowledge in decision-making.

1.9 What does the strategy cover and who is it aimed at?

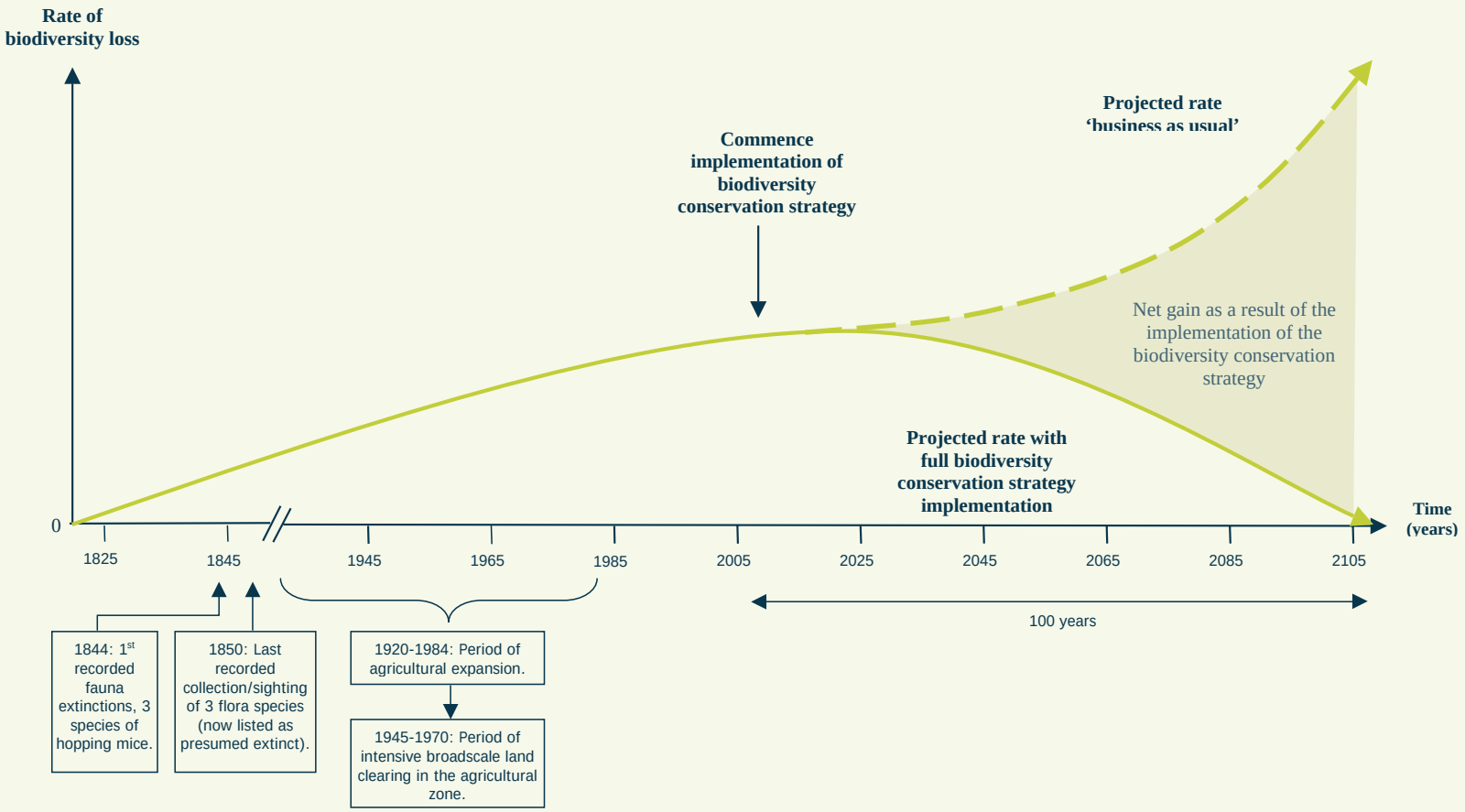
The strategy is for the biodiversity and the people of WA. Biodiversity conservation is everybody's business because everyone benefits from biodiversity. The strategy embraces all indigenous forms of biota, whether found in terrestrial, subterranean, marine, or aquatic environments and irrespective of their value to people. The strategy will cover WA's entire land area, which constitutes about a third of the Australian continent, and State waters.

Fully implemented, this strategy will address relevant issues faced by all land and natural resource users, and help clarify the roles and responsibilities of key players and stakeholders at a State level. The strategy will have particular relevance to decision-makers in Government and the public sector, and will help consolidate and target their effort along with initiatives undertaken by non-government organisations and the private sector.

The strategy will also provide a focus to assist those planning at a regional scale for biodiversity, including regional natural resource management groups, conservation groups, and others.

The strategy presents a vision of where WA should aim to be by 2029 and within 100 years, resulting from the effective delivery of key strategic directions aimed at accelerating conservation actions and better focusing effort at the appropriate scale. It provides the principles that will guide conservation of WA's biodiversity into the future and sets out a framework for action with targets and indicators for measuring success. Phase one of this strategy concentrates on major initiatives that will occur over the next 22 years to slow then halt overall decline in biodiversity that is indigenous to WA.

Figure 1: A conceptual representation of past and projected rates of biodiversity loss in WA and expected impact of implementing the State biodiversity conservation strategy.



2. Vision for WA – What will be different in 2029, and in 100 years?

By 2029

All Western Australians value and understand the importance of biodiversity, and are aware of the social, economic and environmental benefits from indigenous biodiversity.

All Western Australians recognise that biodiversity underpins our social and economic well-being, and recognise the need to act now to prevent further decline and actively support major initiatives for biodiversity conservation.

All Western Australians accept their part in conserving and managing biodiversity throughout the State, and there is cooperation and collective action to protect, maintain and restore WA's biodiversity.

WA is recognised as a world leader in biodiversity science and conservation.

There is a significant reduction in the rate of biodiversity decline, with biodiversity being better conserved throughout WA, including the successful recovery of at least 20 threatened species and improvement in the conservation status of a further 80 threatened species.

Within 100 years

WA's biodiversity, including all indigenous species and ecological communities, is recovered and conserved, along with representative landscapes and ecosystems.

Future generations value, care for, and enjoy the same or increased benefits from biodiversity that Western Australians currently enjoy.

Green tree ant (*Oecophylla smaragdina*). The green tree ant is commonly found in coastal tropical parts of the State and is active during the day and night feeding on both plants and animals. Photo – Keith Claymore

Opposite: Damp herbfield on loamy soil. Herbfields are often rich in short-lived annuals. Photo – DEC

3. Principles to guide implementation

The following 10 principles provide the basis for the strategy's objectives and actions.

❖ Maximise investment for long-term public benefits

Biodiversity conservation is an investment that yields substantial individual, local, regional, State, national and international benefits. Investment at a State level should be targeted to achieve the greatest benefits for the people of WA, and to bring about the greatest level of public good that will reach across generations.

❖ Shared responsibility to ensure effectiveness

All Western Australians depend on biodiversity and have a responsibility to contribute to its conservation and to use biological resources in a sustainable manner. Because biodiversity transcends institutional, administrative and political boundaries, cooperation and support are vital for effective conservation and integration of actions across organisations and jurisdictions. Biodiversity conservation in WA is also affected by national and international obligations.

❖ All indigenous biodiversity values need to be conserved

Indigenous forms of life warrant respect from humanity, irrespective of utilitarian value or whether they have an immediate benefit to humans.

❖ Biodiversity is best conserved *in situ*

Conservation of species where they occur (and not just in a botanic garden, zoo or laboratory) is a prerequisite for maintaining ecological and evolutionary processes. Consequently, a central pillar of biodiversity conservation is the establishment of a conservation reserve system that provides security of tenure and purpose in perpetuity, and management of other natural systems.

❖ Ensure that actions are outcome-focused

Action to conserve biodiversity must be approached with a clear focus on outcomes and be based on an adaptive management approach where research and evaluating effectiveness of actions are integral components to build effective management regimes.

❖ Prevention is better than cure

Prevention of ecosystem damage and species loss is more cost-effective than attempting rehabilitation or recovery. The causes of biodiversity loss must be anticipated and acted on at the source.

❖ Manage for the future, but learn from the past

Actions need to ensure that the benefits enjoyed from biodiversity by today's generation are available or enhanced for future generations. Decision making and priority setting need to be informed by past experience and scientific knowledge.

❖ Be precautionary in making decisions

Lack of full scientific certainty should not be a hindrance to enacting management to conserve biodiversity or postponing measures to prevent environmental degradation or harm. Avoid selecting irreversible options.

❖ Achieve a balance in actions

Indigenous species (or taxa) and ecological communities close to extinction require special attention, together with strategic investment that provides for conservation of intact ecosystems and landscapes.

❖ Gain understanding

Conservation is improved by ongoing improvement in knowledge and understanding of species, populations, ecological communities, ecosystems and social-ecological systems. This will require building scientific knowledge, and ensuring recognition of indigenous and local knowledge where appropriate.

Opposite: Photo – Mike Eidam

4. Areas of focus for action – A holistic approach

This section outlines eight key strategic directions with primary actions that collectively will bring about the strategy's vision and achieve its goal.

It is important to recognise that many of the strategic directions and primary actions contained in the below tables are interrelated, and complementary to each other.

4.1 Improving our knowledge and achieving better information management

Scientific knowledge underpins sound decision-making in determining priorities for biodiversity conservation, and in bringing about effective biodiversity management. Coupled with this requirement is better transfer of knowledge and information management to allow ready access of information by managers and decision-makers.

Due to its complex and dynamic nature, there remain significant gaps in knowledge of what comprises biodiversity and how ecological processes associated with biodiversity operate, and are affected by natural disturbances and impacts from human activity. There is a basic requirement for the State to have reliable knowledge of biodiversity, particularly its components (genes, taxa, ecological communities, ecosystems) and patterns, and related health. This knowledge provides the basis for conservation planning and action. Within this priority are taxonomic requirements, particularly to expand the classification of non-vascular plants, fungi, invertebrates and marine organisms.

Improved capability to predict the consequences of drivers of biodiversity loss from climate change and land use, and to better measure biodiversity and determine its trends will aid decision-making at all levels.

Volunteers injecting plants with phosphite. *Phytophthora* dieback remains a significant threat to the flora of the south-west. Phosphite injections can be effective for up to seven years in protecting plants from being attacked by the pathogen *Phytophthora cinnamomi*. Photo – Dieback Working Group

Key to primary actions:

N	=	new action
EEA	=	extension or enhancement of an existing action
E	=	existing action
H	=	highest priority for action
TBI	=	to be identified. (Lead and support organisations will be identified for reporting purposes prior to finalisation of the biodiversity conservation strategy).
L	=	Lead organisation
S	=	Support organisations
P	=	Priority

Opposite: Wheatbelt woodlands, especially those low in the landscape, are under threat from salinity and waterlogging. Photo – DEC

1 Key Strategic Direction 1:

Build biodiversity knowledge and improve information management

2029 key desired outcomes

- Critical gaps in scientific knowledge of biodiversity and related ecological processes addressed.
- Better dissemination of scientific information and uptake of knowledge by decision-makers at all levels.
- Improved policy relating to biodiversity and biodiversity conservation management.
- Improved tools for biodiversity planning and management at a range of scales.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Research planning and coordination Objective: To maximise scientific research and improve knowledge of biodiversity and ecological processes.						
WA biodiversity conservation research plan completed by 2008. Strategic research programs put in place to address critical knowledge gaps for components of WA's biota and ecosystems by 2008.	**1.** Develop and implement a rolling 10-year State biodiversity research plan that identifies and addresses critical knowledge gaps for ecological and social requirements for biodiversity conservation and sets appropriate targets.	Number of State biodiversity research projects commenced to address critical gaps. Amount of new State funding aimed at biodiversity research.	Uptake of new knowledge by decision makers and reflected in Governmental policies and strategies.	TBI	TBI	N H
WA Terrestrial Biodiversity Research Science Centre established by 2011.	**2.** Strengthen biodiversity research opportunities and partnerships through the establishment of a WA Terrestrial Biodiversity Science Centre of Excellence, and participation in relevant cooperative research centres.	Amount of State funding specifically directed towards terrestrial-related biodiversity science.	Number of scientific publications.	TBI	TBI	EEA H
WA Marine Science Institute (WAMSI) established and implementing key research priorities by 2007.	**3.** Continue cooperative arrangements for WA marine biodiversity conservation research, through initiatives such as WAMSI, to undertake marine ecological and social research, assessment and monitoring.	Amount of State funding specifically directed towards marine-related biodiversity science.	Number of scientific publications.	TBI	TBI	EEA H
Coordinated research into the genetic and ecological functioning of intact ecosystems and the consequences of ecosystem threats commenced by 2008.	**4.** Continue and expand research on disturbance and threatening processes (e.g. invasive animals, environmental weeds, pathogens, altered fire regimes), support training and recruitment of disturbance and ecosystem ecologists, and develop technologies for control of threatening processes and landscape restoration.	Number of scientific publications.	Uptake of new knowledge by decision makers and reflected in Governmental policies and strategies.	TB	TBI	EEA H

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Inventory and monitoring Objective: To improve scientific knowledge of the composition and patterns of biodiversity and trends in biodiversity.						
WA terrestrial biological survey plan completed by 2008. WA marine biological survey plan completed by 2008. Entire State (land and waters) surveyed by 2029.	**5.** Develop and implement 10-year State terrestrial and marine biological survey plans to systematically improve understanding of biodiversity components and patterns, including determining taxa and ecological communities conservation status.	Geographic area of land/sea covered by completed comprehensive biological inventories.	Proportion of State terrestrial and marine area covered by systematic biological surveys. Proportion of 2006 priority taxa where conservation status is determined as direct result of systematic surveys.	TBI	TBI	N H
Multi-taxon biological surveys completed for the Pilbara Bioregion, Kimberley near-shore islands, Southern Jarrah Forest and Warren sub-bioregions, and findings and data made available to stakeholders by 2012. Multi-taxon biological survey completed for Kimberley waters by 2012. Multi-taxon biological survey completed for the Kimberley Region by 2015. Multi-taxon biological surveys completed for Beagle and Abrolhos Islands and surrounding waters by 2012. Multi-taxon biological surveys completed for proposed extensions to the Shoalwater Islands and Shark Bay Marine Park by 2010.	**6.** Accelerate systematic biological inventory at a bioregional scale of the Pilbara Bioregion; Kimberley near-shore islands and Kimberley Region and waters; south-west forests; Beagle and Abrolhos Islands; and proposed extensions to the Shoalwater Islands and Shark Bay marine parks.	Geographic area of biological inventories completed for priority areas.	Proportion of State terrestrial and marine area covered by systematic biological surveys. Proportion of 2006 priority taxa where conservation status is determined as direct result of systematic surveys.	TBI	TBI	EEA H
Ethnobiological program established, and implemented for priority areas by 2009.	**7.** Develop and implement an ethnobiological program to facilitate the use and application of Indigenous knowledge in conservation programs.	Number of published papers.	Uptake of new knowledge in biodiversity conservation initiatives.	TBI	TBI	N
WA terrestrial biodiversity monitoring program framework and protocols developed by 2008. WA marine biodiversity monitoring program framework and protocols developed by 2008. Monitoring program established in priority areas in the rangelands, Swan Coastal Plain, wheatbelt and south-west forests by 2010. Monitoring program established in priority areas in State waters, including marine conservation reserves, by 2010.	**8.** Establish a statewide marine, terrestrial and aquatic monitoring capability to determine and report on the state of and trends in biodiversity, and to identify the causes of change (this should include development of an effective monitoring and reporting framework, identification of bio indicators and development of standard approaches and protocols for monitoring biodiversity).	Area covered by program(s).	Trends in biological indicators under State monitoring system.	TBI	TBI	EEA H
Second edition of the WA Terrestrial Biodiversity Audit completed by 2010. First edition of the WA Marine Biodiversity Audit completed by 2008.	**9.** Continue the development and ongoing maintenance of the WA Terrestrial Biodiversity Audit for biodiversity planning and monitoring purposes, and undertake a marine biodiversity audit to determine status, condition, trends, and management requirements.	Number of people accessing information.	Uptake of new knowledge by decision makers and reflected in Governmental policies and strategies.	TBI	TBI	EEA N

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Management tools and modelling Objective: To better integrate research with management requirements, predict the consequences of key threatening processes and better account for the values of biodiversity.						
Active adaptive management tool for practitioners of biodiversity conservation completed by 2008.	**10.** Undertake research to refine tools for and improve applicability of active adaptive management in biodiversity conservation.	Number of published active adaptive management projects.	Trends in biological indicators.	TBI	TBI	N
	11. Investigate and develop methods for estimating the environmental, social and economic values of biodiversity and ecosystem services.		Uptake of new knowledge in biodiversity conservation initiatives and decision making.	TBI	TBI	EEA H
A modelling program for human-induced climate change and effects on biodiversity developed by 2008. As a result of modelling, key continental scale ecological linkages and areas for consolidation into the conservation reserve system identified by 2010.	**12.** Undertake scientific modelling for climate change scenarios to determine responses by biodiversity and likely effects of adaptation strategies, with an emphasis on testing comprehensiveness and adequacy of continental scale ecological linkages and the conservation reserve system.			TBI	TBI	EEA H
Taxonomy Objective: To allow for comparative biological studies of living organisms and better organise biotic collections.						
Total coverage of threatened taxa (2007 level) in Millennium Seedbank by 2029.	**13.** Maintain and expand collections of biota in the WA Museum and WA Herbarium, including participation in national and international projects such as the Millennium SeedBank, and the facilitation of the databasing of marine and terrestrial flora and fauna collections.	Number of taxa recorded in WA Herbarium. Number of taxa recorded in WA Museum. Number of new taxa described.	Proportion of undescribed taxa to known taxa by biotic group.	TBI	TBI	EEA H
Forty per cent of undescribed vascular plant species, (2007 level) taxonomically described by 2029. One hundred per cent of known vertebrate species taxonomically described by 2029. Seventy per cent of known invertebrate species (2007 level) scientifically described by 2029.	**14.** Continue and expand taxonomic research, including a focus on invertebrates, non-vascular plants, marine organisms and fungi, and enhance genetic diversity research, and support the training and recruitment of taxonomists, geneticists and conservation biologists.	Number of new taxa described.	Proportion of undescribed taxa to known taxa by biotic group.	TBI	TBI	EEA H

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Information management and communication Objective: To improve biodiversity data collections and transfer of knowledge by ensuring the best available data and information are available to decision-makers and managers.						
Relevant biodiversity databases consolidated and rationalised, and agreements for maintenance requirements in place, and access available by 2009.	**15.** Develop systems that consolidate and promote the sharing of biodiversity information and modelling through the use of databases and geographic information systems, including the development of meta databases.	Number of people accessing information (GIS or databases).	Degree of uptake in management decision making.	TBI	TBI	N H
Ecosystem/native vegetation classification mapping for WA completed by 2015.	**16.** Develop and undertake mapping within a bioregional framework to delineate and classify ecosystems/native vegetation types to 1:100,000 scale for the entire State.	Area of State delineated or mapped.	Degree of uptake in management decision making.	TBI	TBI	N H
State biodiversity research communication plan completed and being implemented by 2008.	**17.** Ensure knowledge transfer to make sure research findings are more accessible and useable by key decision makers.	Number of people accessing information (GIS or databases).	Proportion of people accessing information who apply it in decision making.	TBI	TBI	N

Scientists monitoring coral. Improving biodiversity knowledge and undertaking monitoring to determine changes in biodiversity is critical for decision makers and managers. Photo – DEC

4.2 Raising public awareness and understanding of biodiversity and getting people involved in biodiversity conservation

Biodiversity generally remains an aloof term that is not well understood by the public, many decision makers and landholders. Increasing public awareness and understanding of biodiversity and its values is critical to bring about social empathy and build long-term support and a public constituency for programs that span the full breadth of biodiversity conservation. It is equally important that the full impacts of development and exploitation of natural resources and effects from threatening processes on biodiversity are also well understood and recognised.

Encouraging people to become involved in biodiversity conservation and enjoying its benefits is a major means to achieving this understanding and appreciation, as well as being a major strategy to build social stewardship and a sound ethical basis for future decisions relating to the conservation and use of biodiversity.

Formal education and adult training forms a major component of both of these key strategic directions.

2 Key Strategic Direction 2:

Promote awareness and understanding of biodiversity and related conservation issues

2029 key desired outcomes

- Increased public knowledge and appreciation of the values and benefits of biodiversity.
- Increased proportion of State public funding for key biodiversity conservation programs and initiatives.
- A community that embraces biodiversity.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Objective: To increase Western Australians' appreciation of biodiversity and understanding of the requirements for biodiversity conservation.						
State Biodiversity Communication Plan developed by 2008. Public and key stakeholders' awareness raising campaign for biodiversity conservation active by 2008. Conservation initiatives with eco-education and awareness focus increased by 2029.	**18.** Develop and implement a biodiversity communication and education plan aimed at the general public, industry and key user groups, politicians, government agencies, and indigenous and community-based groups in order to promote a public constituency for biodiversity conservation, and gain support for related conservation initiatives. The plan will include: • the types of information and guidance needed; • mechanisms to foster public conservation ethic and constituency; and • the development of a public awareness program.	Number and type of biodiversity information publications released by Government agencies. Number of media articles aimed at biodiversity issues.	Level of understanding of Western Australians on biodiversity issues.	TBI	TBI	N H

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Review of biodiversity conservation related syllabus in WA tertiary institutions completed by 2009.	**19.** Develop and enhance courses and material for all faculties and schools at tertiary institutions to promote and increase awareness and understanding of biodiversity and its conservation requirements.	Number of university students enrolled in biodiversity conservation related courses.	Level of understanding of Western Australians on biodiversity issues.	TBI	TBI	N H
Benchmark survey program of public awareness, understanding and support of biodiversity completed by 2008.	**20.** Conduct survey of public and key stakeholders to determine level of awareness and understanding of biodiversity and related issues, and to act as a benchmark to gauge success of education and awareness programs.	Number of people surveyed.	Level of understanding of Western Australians on biodiversity issues.	TBI	TBI	N H
Review of Environmental Education Advisory Committee audit of eco-education programs in WA completed by 2008. Benchmark survey of school students' understanding of the value of biodiversity established by 2009. Benchmark survey of students' direct action for biodiversity conservation by 2009. Policy established that requires biodiversity education in all schools as part of their management and education for sustainability by 2009. Eco-education link with Sustainable Schools Initiative established by 2008. Survey of school students' understanding of the value of biodiversity compared with 2010 survey by 2016. Survey of students' direct action for biodiversity conservation compared with 2010 survey by 2016. All students leaving secondary formal education have participated in biodiversity conservation activities, and recognise the value of biodiversity and life choices that conserve biodiversity by 2029.	**21.** Develop and implement the biodiversity component of Education for Sustainability for all levels of pre-primary, primary and secondary schools, to support teaching, learning about and involvement in biodiversity, ecological processes and biodiversity conservation.	Number of secondary schools involved in Education for Sustainability. Number of secondary school students understanding the value of biodiversity. Number of secondary school students involved in biodiversity conservation activities. Number of schools involved in biodiversity conservation actions in local and other environments.	Level of understanding of Western Australians on biodiversity issues.	TBI	TBI	EEA H
	22. Support the professional development of educators to facilitate appropriate biodiversity related education and interpretation programs.	Amount of funding aimed at increasing professional biodiversity-related educators.	Level of understanding of Western Australians on biodiversity issues.	TBI	TBI	EEA
Twenty per cent of schools are members of *Land for Wildlife* scheme by 2029. Twenty per cent of schools covered by *Urban Nature* in the Perth metropolitan area by 2029.	**23.** Develop and implement an expanded schools component of *Land for Wildlife* scheme and *Urban Nature*.	Number of WA schools involved in *Land for Wildlife* and *Urban Nature*.	Proportion of WA schools involved in *Land for Wildlife* and *Urban Nature*.	TBI	TBI	EEA

3 Key Strategic Direction 3:

Engage and encourage people in biodiversity conservation management

2029 key desired outcomes

- People take greater responsibility for biodiversity conservation and stewardship of biodiversity is improved.
- 500,000 people involved in voluntary biodiversity conservation activities in WA.
- Five million hectares of privately managed land under voluntary nature conservation agreements and delivering key biodiversity conservation outcomes.
- Improved Western Australians' health and well-being as a direct consequence of experiencing the benefits and opportunities from biodiversity conservation.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Objective: To get more people involved in biodiversity conservation and to encourage maintenance and recovery of biodiversity values.						
Empowerment of community-based organisations to undertake biodiversity conservation initiatives.	**24.** Provision of targeted information and technical support to community-based groups, including training, accessing information, use of databases, GIS and their applications.	Number of people in community-based groups accessing biodiversity information.	Trends in biodiversity indicators for privately managed or leasehold lands.	TBI	TBI	EEAH
25,000 hectares of voluntary nature conservation covenants in perpetuity by 2011. Two million hectares of privately owned or managed land being managed under voluntary nature conservation agreements by 2017. Five million hectares of privately owned or managed land being managed under voluntary nature conservation agreements by 2029.	**25.** Continue to support the development and application of new incentives and market-based instruments to facilitate adoption of biodiversity conservation on private and leasehold lands, including direct financial incentives, tender based schemes, nature conservation covenants, rate rebates and tax relief.	Area of land under formal stewardship agreement and accredited nature conservation covenant system.	Trends in biodiversity indicators for privately managed or leasehold lands under nature conservation covenants or agreements.	TBI	TBI	EEAH
400,000 hectares managed for biodiversity under the *Land for Wildlife*[8] scheme by 2012. 600,000 hectares managed for biodiversity under *Land for Wildlife* scheme by 2017. One million hectares managed for biodiversity under the *Land for Wildlife* scheme by 2029 *Urban Nature* program expanded beyond Perth to other urban and semi-urban areas by 2010.	**26.** Continue to support and expand biodiversity management advisory programs such as *Land for Wildlife* and *Urban Nature*.	Number of properties involved in Land for Wildlife. Area of *Land for Wildlife* properties managed for biodiversity purposes.	Trends in biodiversity indicators for properties in the *Land for Wildlife* scheme.	TBI	TBI	EEAH

[8] At 30 June 2006, there were 1548 properties listed under *Land for Wildlife*, with 244,398 ha being managed for nature conservation. See Glossary for description of *Land for Wildlife* and *Urban Nature* programs.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Voluntary Biodiversity Stewardship Network established by 2008.	**27.** Establish a statewide voluntary Biodiversity Stewardship Network for those organisations actively engaged in biodiversity conservation, including 'friends of', 'adopt a local reserve' or, landcare/coastcare groups, and groups involved in threatened taxa recovery and marine conservation programs, to share information and knowledge, and further stimulate local engagement.	Number of organisations involved in the Biodiversity Stewardship Network. Number of volunteer hours/days contributed in the Biodiversity Stewardship Network.	Trends in biodiversity indicators for private or leasehold managed lands.	TBI	TBI	N H
	28. Build and encourage public participation into the programs of Government agencies, such as the conservation reserve area planning, research and biodiversity recovery programs.	Number of people involved in biodiversity conservation initiatives.	Trends in biodiversity indicators for public managed lands.	TBI	TBI	E
Strategic alliances formed for *Healthy Parks, Healthy People* program by 2008.	**29.** Implement DEC's *Healthy Parks, Healthy People* program aimed at engaging people in nature-based activities.	Number of people involved in the Healthy Parks, Healthy People program.	Public and environmental health indicators (State of Environment Reporting).	TBI	TBI	E
Effective models for cooperative management established for priority areas by 2011.	**30.** Pursue opportunities for co-operative/joint management agreements between public land managers and Indigenous, and non-Indigenous, local communities where appropriate.	Area of Indigenous lands under cooperative/joint management agreements.	Trends in biodiversity indicators for Indigenous managed lands.	TBI	TBI	EEA
	31. Encourage support for Indigenous landholders to manage for biodiversity through provision of biodiversity science and conservation expertise.	Number of indigenous organisations accessing support.	Trends in biodiversity indicators for indigenous managed lands.	TBI	TBI	N
	32. Develop and implement programs that link local communities, youth, schools and tertiary institutions to biodiversity conservation actions in local environments, such as a program of identified areas of native vegetation that can be used for teaching and learning experiences for schools (i.e. Living Libraries), Bush Rangers and conservation volunteers and organisations.	Number of people involved in programs.	Trends in biodiversity indicators for related target projects.	TBI	TBI	N EEA H
	33. Embed biodiversity conservation activities into school and tertiary institutions and general public participation/community involvement events (for example Arbor Day, World Environment Day, Clean Up Australia).	Number of people involved in relevant activities.	Trends in biodiversity indicators for related target projects.	TBI	TBI	EEA
Rewards scheme developed and operating by 2010.	**34.** Develop and incentive scheme that recognise and reward the actions of those schools, tertiary institutions, industries, agencies and community-based groups who are actively working to conserve biodiversity.	Number of institutions involved in biodiversity conservation activities.	Trends in biodiversity indicators for related target projects.	TBI	TBI	N

Box 6: Ningaloo Community Turtle Monitoring Program

Turtles, like whales, present a challenge to effective conservation because they spend much of their time in the high seas, beyond the jurisdiction of any one nation. Populations may be well conserved in parts of their home range (as in WA waters) but elsewhere individuals may be hunted excessively or killed as fisheries bycatch.

Australia is one of the few nations that retains relatively large turtle populations. Six species of marine turtles have been recorded in WA: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), flatback (*Natator depressus*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*).

Loggerhead, green, flatback, hawksbill and leatherback turtles are threatened species declared to be specially protected under the *Wildlife Conservation Act 1950*. They are also listed under the *Environment Protection and Biodiversity Conservation Act 1999* as threatened. The hawksbill and leatherback are listed as Critically Endangered on the 2006 IUCN Red List of Threatened Species while the loggerhead, green and olive ridley are listed as Endangered.

The Ningaloo coast and nearby islands provide important nesting habitat for the loggerhead, green, and hawksbill turtles. In an attempt to coordinate the conservation and management of marine turtles along this coastline, a collaborative monitoring program was established in 2002 — the former Department of Conservation and Land Management, Murdoch University, World Wide Fund for Nature Australia and a local conservation group, the Cape Conservation Group, established the Ningaloo Community Turtle Monitoring Program (NCTMP). At present more than 80 volunteers are involved each year, with a high level of interest not only from the local community of Exmouth, but within WA and outside Australia.

The NCTMP monitoring program provides information on marine turtle nesting, data on successful nesting emergences, disturbance and spatial and temporal distribution of the three main species nesting in the Ningaloo area. This program will enable population changes and trends to be detected and alert conservation managers to any potential threats to marine turtle populations in this region.

When leaving the nest, usually at night, hatchlings head for the ocean. Hatchlings can be easily disoriented and attracted to bright lights from artificial sources. Photo – Babs and Bert Wells/DEC

4.3 Integrating biodiversity conservation into natural resource use and enhancing institutional mechanisms

Biodiversity underpins sustainability and industries that use, or are dependent on, renewable natural resources. All Western Australians rely on resource-based industries that provide goods and services to maintain our standard of living, and many visitors to the State benefit from enjoying WA's biodiversity. There is increasing opportunity to better promote and incorporate biodiversity conservation within natural resource use sectors[9] and bring relevant goals and targets into mainstream business. Better recognition of biodiversity conservation requirements is needed along with improved decision-making frameworks. Measures to promote sustainability need to be strengthened and expanded across all industry sectors to ensure that they specifically address and take into account biodiversity conservation needs.

While there has been much effort to provide for biodiversity conservation under various State and national statutes, and there has been significant effort towards addressing biodiversity-related problems across Government agencies and authorities, much of it is fragmented. This is partly due to an absence of an overarching State level biodiversity conservation strategy (that provides priorities), and inadequate biodiversity-related State legislation to provide an adequate regulatory and compliance framework and complementary policies to ensure integration. Government-driven processes and reforms provide the fundamental basis to ensure better targeting and coordination of existing and new biodiversity conservation initiatives.

Another key mechanism is regional natural resource management strategies and investment plans, which provide an important avenue for investment that must be targeted to bring about biodiversity conservation outcomes at a regional scale.

4 Key Strategic Direction 4:

Improve biodiversity conservation requirements in natural resource use sectors

2029 key desired outcomes

- Resource and land use practices make sufficient provisions for the protection and management of biodiversity, and minimise impacts on biodiversity by adhering to appropriate codes of practice and guidelines.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Cross-industry institutional mechanisms **Objective: To ensure special recognition is given to biodiversity conservation in ecologically sustainable development of natural resources.**						
Review of industry strategies and plans completed by 2010.	**35.** Review, strengthen and implement existing industry related ecologically sustainable development policies and plans to optimise considerations for biodiversity conservation.	Number of statewide industry plans or strategies reviewed.	Proportion of reviewed plans/strategies reviewed, where there has been further biodiversity conservation considerations.	TBI	TBI	EEA H

[9] In this context natural resource use sectors includes: oil, gas, mining and exploration sector; fisheries; aquaculture; forestry; pastoralism; flora and kangaroo harvesting industries; and nature-based tourism.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Indicators and reporting protocols for sustainable use of biodiversity developed for each industry sector by 2010.	**36.** Develop or refine reporting indicators for sustainable use of biodiversity for each industry sector, and develop monitoring and reporting protocols.	Number of industry sectors with appropriate indicators.		TBI	TBI	N H
Develop and implement guidelines for industry contributions to reserve and off-reserve conservation by 2008.	**37.** Government agencies work with peak industry bodies to put in place management systems that assist in conserving biodiversity, and promote awareness of biodiversity-related issues and involvement of key stakeholders in conservation.			TBI	TBI	E
	38. In addition to the non-regulatory approaches, extend the beneficiary-pays, user-pays and polluter-pays principles for the use of biodiversity.			TBI	TBI	N
Agriculture and pastoralism						
Framework and guidelines to incorporate biodiversity conservation into property management plans for agriculture and pastoral leases in place by 2010. Accreditation criteria established for pastoral property plans by 2010. Fifty[10] pastoral leases with accredited property management plans that adequately incorporate biodiversity conservation by 2012. All pastoral leases have accredited property management plans that sufficiently incorporate biodiversity conservation by 2029.	**39.** Develop and implement ecologically sustainable development pastoral land management practices in accordance with the *Land Administration Act 1997*, including the development and implementation of accredited property management plans for pastoral leases that sufficiently provide for biodiversity conservation and codes of practice to minimise impacts on biodiversity.	Number and area covered by accredited pastoral property management plans.	Trends in biodiversity indicators for the pastoral rangelands.	TBI	TBI	N H
Framework and guidelines to incorporate biodiversity conservation into property management plans for agriculture and pastoral leases in place by 2010. Twenty per cent of broadacre farms with appropriate property management plans by 2029.	**40.** Develop and implement property management planning for intensive agricultural and broadacre agricultural areas where biodiversity conservation provisions are integrated with production practices.	Number and area covered by accredited property management plans.	Trends in biodiversity indicators for the south-west.	TBI	TBI	N H
Gap analysis of incentives programs completed by 2009.	**41.** Strengthen delivery of government services connected with management of agricultural and pastoral systems for farmers, pastoral leaseholders and Indigenous land managers by developing and applying targeted financial, advisory and other incentives for biodiversity conservation and rehabilitation programs to ensure investment above and beyond landholders' duty of care, and set in place processes to assess their success.	Area of properties accessing incentive programs.	Trends in biodiversity indicators for the pastoral rangelands. Trends in biodiversity indicators for the south-west.	TBI	TBI	EEA H

[10] There are around 500 pastoral leases in WA.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Analysis of suitable markets undertaken to determine key products or industries to trial by 2008.	**42.** Work with industry (such as meat and vegetables) to develop protocols and standards to establish 'green markets', where products are accredited and meet sustainability criteria that ensure best land management and biodiversity conservation practices.	Number of products accredited under program.		TBI	TBI	N
Review of perverse incentives completed and reform agenda agreed by 2009. Reform agenda in progress to address perverse incentives by 2011. All industry reforms in place, and reform agenda completed by 2029.	**43.** Remove perverse incentives for agricultural and pastoralism activities that impact on biodiversity.	Number of perverse incentives removed. Trends in biodiversity indicators for affected areas.		TBI	TBI	N H
Forestry						
Achieve targets in the Forest Management Plan 2004 - 2013.	**44.** Implement ecologically sustainable forest management for native hardwood forests through the Forest Management Plan 2004-2013.	As per the Forest Management Plan.	As per the Forest Management Plan.	TBI	TBI	E
Fisheries and aquaculture						
	45. Ensure all recreational and commercial fisheries meet ecologically sustainable development requirements under relevant State and Commonwealth legislation, including the completion of accreditation of all WA fisheries and continuation and extension of the impact assessment process to low value fisheries and aquaculture.	Number of recreational and commercial fisheries accredited.	Trends in biological indicators for relevant fisheries.	TBI	TBI	E
	46. Continue to implement and develop codes of conduct to minimise impacts of fisheries on biodiversity, such as the Western rock lobster managed fishery code of practice for reducing whale entanglements and South Coast purse seine code of practice, and encourage the use of by-catch reduction devices.	Number of fisheries applying codes.	Trends in biological indicators for relevant fisheries.	TBI	TBI	EEA
	47. Implement best practice guidelines related to the National System for the Prevention of Marine Pest Incursions for commercial and recreational users.	Number of new marine pest introduced in WA waters.	Trends in biodiversity indicators for affected areas.	TBI	TBI	E H
	48. Undertake enforcement to prevent illegal fishing and use of natural resources in State waters.	Number of illegal fishers prosecuted.	Trends in biodiversity indicators in affected fisheries.	TBI	TBI	EEA H
Plan developed by 2009.	**49.** Develop and implement a State aquaculture plan and guidelines to minimise impacts on biodiversity.		State of fisheries indicators.	TBI	TBI	N H

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
	50. Accelerate the adoption of integrated fisheries management, based on ecological parameters, to determine sustainable harvest levels (total allowable catches) for fisheries for each resource sector.	Number of integrated fisheries management plans accredited.	State of fisheries indicators.	TBI	TBI	EEA
	51. Continue and strengthen the protection of taxa under the Fish Resources Management Act 1994 through strategies such as limiting the level of fishing activities or methods and establishing habitat protection areas.			TBI	TBI	EEA
Sustainable wildlife use						
Two additional potential wildlife species trialled for sustainable use by 2012.	**52.** Trial new flora and fauna suitable for sustainable use industries, where conservation benefits will be derived, and continue the sustainable use of accredited wildlife-based industries.		Wildlife indicators.	TBI	TBI	N
	53. Undertake research on key wildlife species, potentially or currently the subject of wildlife interaction, such as whale sharks.			TBI	TBI	EEA
Plan developed by 2009.	**54.** Develop and implement a sustainable sandalwood plan that provides for biodiversity conservation.	Indicators under proposed plan.		TB	TBI	
	55. Develop and implement appropriate protocols and practices to ensure that industries operating on Crown land and waters (for example apiculture, wildflower and seed harvesting and aquaculture) are consistent with principles of ecologically sustainable development.	Number of industries consistent with principles of ecologically sustainable development.	Indicators under relevant plans.	TBI	TBI	EEA
Nature-based tourism						
	56. Work with the tourism industry to ensure that commercial and recreational activities employ best practice sustainable activities when operating and interacting with the environment and biodiversity.	Level of compliance.		TBI	TBI	EEA
	57. Target information and education for the tourism industry to ensure conveyancing of biodiversity conservation message to visitors and users.			TBI	TBI	EEA
Mining, oil and gas sectors						
Implementation of best practice guidelines. Finalisation of biological survey guidelines and protocols by 2008. Implement industry biological survey to complement State systematic biological survey program and fill gaps by 2008.	**58.** Promote best practice alternative site and options analysis, biological survey and rehabilitation practices.	Number of companies adopting best practice guidelines.	Recovery indicators for disturbance areas.	TBI	TBI	EEA
Initial rolling five year industry corporate sponsorship prospectus developed by 2008.	**59.** Encourage corporate sponsorship of high priority biodiversity conservation initiatives.	Amount of funding.	Trends in biodiversity indicators related to target initiatives.	TBI	TBI	N

5 Key Strategic Direction 5:

Enhance effective institutional mechanisms and improve integration and coordination of biodiversity conservation

2029 key desired outcomes

- Biodiversity conservation is regarded as fundamental in decision making, planning, management and policy development.
- Biodiversity conservation is better coordinated and targeted to achieve on-ground outcomes, including through a Biodiversity Conservation Act, regional natural resource management strategies, local government biodiversity plans, State biodiversity strategy for climate change, and regional and local planning schemes.
- The status of species and ecological communities on local government and State agency lands and in State waters is improved as well as the condition of landscapes and ecosystems.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Institutional reform Objective: To improve institutional mechanisms for biodiversity conservation and reduce social and institutional impediments.						
Biodiversity Conservation Act proclaimed by 2008.	**60.** Replace the Wildlife Conservation Act 1950 with a Biodiversity Conservation Act for WA and implement the Act to provide a modern legislative framework for the conservation and sustainable utilisation of biodiversity.			TBI	TBI	E H
Review of institutional impediments completed by 2008, and reform agenda to remove perverse incentives finalised and being progressed by 2010.	**61.** Review of legislation and policies, to identify and remove policies (or programs) that may have an unintended adverse effect on the conservation of biodiversity (perverse incentives), and develop appropriate strategies for overcoming these.			TBI	TBI	N H
Benchmark for landholders' environmental duty of care determined for public investment by 2008.	**62.** Clarify property rights and duty of care in relation to biodiversity, with a view to provide a benchmark for public investment above and beyond environmental duty of care and to meet statutory responsibilities.			TBI	TBI	N H
Biosecurity protocols and guidelines developed by 2009.	**63.** Develop and implement appropriate biosecurity protocols and guidelines to prevent the introduction and spread of new species and pathogens to terrestrial, aquatic and marine ecosystems.	Number of new introduced species in the State.	Introduced species controlled to acceptable ecological limits as a result of amelioration activities.	TBI	TBI	N
State bioprospecting plan completed and relevant legislation in place for biodiscovery by 2009.	**64.** Develop an integrated policy and legislative framework for managing bioprospecting in WA, including arrangements for sharing benefits from the use of genetic resources, which are consistent with international commitments.	Compliance of policy framework and sharing of benefits arrangements.	Medical advances as a direct consequence of bioprospecting.	TBI	TBI	N

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Education and awareness program aimed at nurseries and garden outlets developed by 2009.	**65.** Apply measures to prevent and reduce the deliberate or unintentional introduction of garden plant species, such as through labelling of nursery stock, removal from sale and using statutory mechanisms to prevent ongoing trade in invasive plants for use in gardens, ponds and aquaria.	Number of introduced plants into the wild from horticultural sources.	Plant species controlled to acceptable ecological limits as a result of amelioration activities.	TBI	TBI	N H
Review of invasive species control policy and programs by 2009.	**66.** Improve regulatory mechanisms to ensure that there will be no gaps in State quarantine, protection, control and eradication programs across environmental, agricultural and other weed and pest threats.	Number of new invasive species prevented from entering WA.		TBI	TBI	N
Control of target environmental weeds.	**67.** Implement measures to prevent the development, use and application of 'improved pastures' that are known, or are likely to become, environmental weeds.	Area of target invasive plant controlled.	Plant species controlled to acceptable ecological limits as a result of amelioration activities.	TBI	TBI	N H
Appropriate legislation and regulation for genetically modified organisms in place by 2012.	**68.** Develop legislation and arrangements for regulating the import, development, use and release of genetically modified organisms through the work of the Commonwealth-State Consultative Group on Genetic Manipulation.			TBI	TBI	EEA
Quarantine measures established by 2009.	**69.** Implement the National System for the Prevention and Management of Marine Pest Incursions, and related Inter-governmental Agreement, and continue to implement and refine quarantine measures with relevant jurisdictions.		Number of new marine pest introduced in WA waters.	TBI	TBI	EEA H
Bioregional planning and natural resource management coordination **Objective: To better integrate and coordinate biodiversity conservation matters in policy, legislation and initiatives, and increase relevance to Government.**						
Appropriate framework for the development and accreditation of bioregional plans developed by 2008. Five[11] IBRA bioregional plans completed by 2010. Fifteen IBRA bioregional plans completed by 2017. Total coverage of the State completed by 2029.	**70.** Develop and implement terrestrial bioregional plans to integrate and prioritise biodiversity conservation and research.	Number and area covered by accredited bioregional plans.	Biodiversity conservation initiatives better targeted and biodiversity values effectively managed.	TBI	TBI	N H
State marine planning framework finalised by 2008. South coast regional marine plan completed by 2008. Kimberley regional marine plan completed by 2010.	**71.** Finalise the State marine planning framework, and develop and implement regional marine plans, with a priority for the south coast and Kimberley State waters.	Area and proportion of State waters covered by plans.	Biodiversity conservation initiatives better targeted and biodiversity values effectively managed.			EEA H

[11] There are 26 IBRA bioregions in WA, and 54 related sub-regions.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Planning guidelines for State agencies that manage or impact on biodiversity developed by 2008. All relevant State agency corporate plans provide for biodiversity conservation by 2012, and associated biodiversity conservation plans developed by 2029.	**72.** Develop and implement plans for biodiversity management and public reporting for State and local government agencies, which seek to minimise the impacts of their activities on biodiversity, and detail efforts to protect or restore components of biodiversity under their control in their rolling corporate plans.	Number of State agency corporate plans providing for biodiversity conservation.		TBI	TBI	N H
State natural resource management policy developed by 2012.	**73.** Ensure sufficient biodiversity conservation and research, and related priority actions and targets, in the development and implementation of the proposed State's NRM policy statement and strategy, and in the review of the State's Sustainability Strategy.			TBI	TBI	N H
All six regional NRM strategies and investment plans undertaking strategic and targeted biodiversity conservation by 2007.	**74.** Implement regional NRM strategies and investment plans which adequately provide for biodiversity conservation.	Level of biodiversity conservation funding.	Relevant indicators under regional NRM strategies and plans.	TBI	TBI	E H
State biodiversity strategy for climate change developed by 2009.	**75.** Develop and implement a State biodiversity strategy for climate change.	Measures as per final plan.	Indicators as per final plan.	TBI	TBI	N H
Twenty-five[12] local government authority biodiversity action plans developed by 2010. Seventy-five local government authority biodiversity action plans developed by 2015. All local government authorities develop and implement biodiversity plans by 2029.	**76.** Develop and implement local government biodiversity strategies and action plans.	Area of land covered by local government biodiversity action plans.		TBI	TBI	EEA H
Roadside conservation value maps and associated reports completed for all south-west rural shires by 2020.	**77.** Continue the work of the Roadside Conservation Committee to promote and provide guidance for the management of railway reserves and roadside native vegetation.			TBI	TBI	E
	78. Continue inter-agency fora, such as the various natural resource management senior officers' groups and interagency working groups, to ensure coordination and better integration of NRM across State agencies.			TBI	TBI	E H

[12] There are 142 local government authorities in WA

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Land use planning Objective: To maximise biodiversity conservation in the development of natural resources.						
	79. Continue to implement and improve the environmental impact assessment processes to ensure that impacts on biodiversity from natural resource extractive and development projects are minimised and that management of sites adequately provide provisions for biodiversity conservation, and that the full cost of projects is borne by the developer.	Number of proposals assessed.	Area of land/sea under active biodiversity conservation due to EIA processes.	TBI	TBI	EEA H
Biodiversity conservation offsets policy and guidelines developed by 2008.	**80.** Develop and implement a biodiversity conservation offsets policy and management guidelines for resource development and land use projects.	Area of habitat protected as the result of conservation offsets.	Number of threatened species/ ecological communities that improve in conservation status as result of conservation offsets.	TBI	TBI	E H
Reform agenda agreed by 2009.	**81.** Strengthen processes for statutory environmental planning and resource and land use development to better reflect requirements for biodiversity conservation.			TBI	TBI	EEA
	82. Implement State Planning Policies, Statement of Planning Policies and guidelines under the Planning and Development Act 2005 to encourage local governments to adopt biodiversity conservation requirements, and develop new statements under the auspices of the WA Planning Commission aimed at bringing about better provision and recognition of biodiversity conservation outcomes in land use planning.	Measures as per planning policies.	Indicators as per planning policies.	TBI	TBI	
All regional and local planning schemes reviewed by 2012.	**83.** Review and strengthen region and local planning schemes to ensure that there is sufficient biodiversity conservation.	Proportion of regional and local planning schemes reviewed.		TBI	TBI	N H
Other						
	84. Expand the role of innovative and sound technologies in pollution management to give priority to the use of such initiatives in addressing pollution in areas of high biodiversity significance.			TBI	TBI	EEA

4.4 Direct management for biodiversity

The following section outlines three inter-related key strategic directions that form the basis for direct biodiversity conservation management action.

- The establishment and management of the formal conservation reserve system, focusing on maintaining high biodiversity values.
- The recovery of threatened taxa and ecological communities, along with the management of other highly significant species and ecosystems.
- The conservation of landscapes and seascapes to ensure ecological process are maintained through a range of complementary mechanisms.

6

Key Strategic Direction 6:

Establish and manage the formal conservation reserve system

Establishment and management of the formal conservation reserve system[13] forms a major part of the key response to conserving biodiversity, where the primary aim is to maximise the effectiveness of retaining biodiversity *in situ*. This is achieved by setting aside the full range of ecosystems under a secure management regime in perpetuity.

Design of the conservation reserve system is based on the criteria of comprehensiveness, adequacy and representativeness[14], and follows the principles as agreed between the State and Commonwealth under the Interim Biogeographic Regionalisation for Australia (IBRA) and the Interim Marine and Coastal Regionalisation for Australia (IMCRA). It also meets the minimum standards for inclusion in the National Reserve System under the *Directions for the National Reserve System – A Partnership Approach*, which includes areas being given statutory protection for the primary purpose of maintaining of biodiversity and managed in a manner that is open to public scrutiny. This not only provides a secure basis for public investment for general management purposes, but it has the added benefit in many instances of providing long-term security for large scale biodiversity conservation initiatives, such as *Western Shield*, where there is a need to control system-wide threats at a landscape scale and maintain a sympathetic biodiversity management regime over millennia.

As well as being one of the most cost effective conservation mechanisms, to maintain and recover biodiversity, it also provides an 'insurance' strategy to retain future land and resource use options for public benefit, such as providing ecosystem services like clean air and water and sustainable nature-based recreation and tourism opportunities.

The conservation reserve system also includes critical habitats of threatened taxa and ecological communities, and ecosystems that are considered irreplaceable or rare.

Another fundamental criterion that forms part of conservation reserve system design is ecological connectivity, particularly in fragmented landscapes, that is the need to recognise continental scale ecological linkages of contiguous ecosystems and habitats to allow the natural flow of genetic material between populations, movement of biota and to help maintain ecological processes across landscapes and seascapes. With impacts on biodiversity as a result of human-induced climate change, the conservation reserve system increasingly provides an important adaptation strategy to accommodate future needs of biodiversity in responding to changing conditions.

Establishment of the conservation reserve system, as well as complementary private and indigenous protected areas, needs to form part of an integrated natural resource planning and management approach

[13] The formal conservation reserve system comprises the following categories under the *Conservation and Land Management Act 1984* (CALM Act): national parks, marine parks, nature reserves, marine nature reserves, marine management areas, conservation parks. Sections 5(1)(g) and 5(1)(h) reserves under the CALM Act may form part of the conservation reserve system, depending on their statutory purpose. Collectively these categories meet IUCN protected areas management objectives and form part of the National Reserve System and National Reserve System of Marine Protected Areas.

[14] **Comprehensive** refers to the inclusion of the full range of ecosystems recognised within and across each bioregion. **Adequate** means ensuring that sufficient proportions of each ecosystem should be included within a conservation reserve network in order to maintain ecological viability and integrity of populations, species and communities. **Representative** means that reserves need to cover the breadth of the biotic diversity of the ecosystems they are seeking to conserve.

at a whole-of-landscape or bioregional level. This will help maximise resilience of conservation reserves to deal with natural or human-induced disturbances. In effect, the formal conservation reserve system provides the 'building blocks' to optimise and achieve a landscape approach. Towards that end, Section 4.4 outlines primary actions to integrate the establishment and management of the formal conservation system and other protected areas with on-ground ecologically sustainable management and off-reserve conservation areas.

2029 key desired outcomes

- A system of terrestrial conservation reserves where the full range of ecosystems are represented and afforded the highest level of statutory protection in perpetuity, and managed to meet IUCN Protected Area Management Categories I, II or IV, and covering at least 15 per cent of the State's land area.
- A system of marine conservation reserves in all IMCRA bioregions in State waters, within which the full range of representative habitat is afforded the highest level of statutory protection and managed as sanctuary zones to meet IUCN Management Categories I or II and complemented by other management zones that meet IUCN Management Categories IV or VI.
- A terrestrial and marine conservation reserve system that forms the basis for continental scale ecological linkages and contributes towards ecosystem resilience, and which is complemented by a network of Indigenous and private protected areas where in perpetuity statutory protection and biodiversity conservation is the primary goal.
- Biodiversity condition targets under a State monitoring and evaluation program are achieved for the terrestrial and marine conservation reserve system.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Conservation reserve system creation **Objective: To consolidate and complete a formal terrestrial and marine conservation reserve system that meets the criteria of representativeness, adequacy and comprehensiveness, and contributes towards ecosystem resilience and continental scale connectivity.**						
Ten year State terrestrial protected area plan completed by 2008. Eighty per cent of extant ecosystems in each IBRA sub-region[15] represented in the formal terrestrial conservation reserve system by 2016, with initial priority being given to priority sub-bioregions under IBRA in the rangelands, Wheatbelt, forest areas and Swan Coastal Plain. One hundred per cent of extant ecosystems in each IBRA sub-region represented in the formal terrestrial conservation reserve system by 2029.	**85.** Develop and implement a 10-year rolling State protected area plan with targets to accelerate the establishment of the formal system of terrestrial conservation reserves that meet the minimum standards of the National Reserve System, and encourage the establishment of private and indigenous protected areas that meet the minimum standards of the National Reserve System.	Area of land in the formal conservation reserve system. Proportion of the State in the formal conservation reserve system.	Number of IBRA sub-regions where a representation of at least 15 per cent terrestrial ecosystems has been achieved.	TBI	TBI	E H
Marine parks and reserves are established at the Dampier Archipelago, Leeuwin-Naturaliste/Geographe Bay and Walpole-Nornalup Inlets by 2008.	**86.** Finalise the establish of marine conservation reserves in the Dampier Archipelago/Cape Preston, Leeuwin-Naturaliste/Geographe Bay and Walpole-Nornalup Inlets, and pursue reservation of high priority candidate marine conservation areas including the Recherche Archipelago, Fitzgerald River coast and Roebuck Bay/Eighty Mile Beach.	Proportion of the State waters in the formal conservation reserve system. Proportion of State waters in sanctuary zones.	Number of IMCRA bioregions where a representation of marine ecosystems has been achieved.	TBI	TBI	N H

[15] There are 54 IBRA sub-regions for WA.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Marine parks and reserves are established in the WA South Coast and Kimberley IMCRA bioregions, particularly the Recherche Archipelago, Fitzgerald River coast and Roebuck Bay/Eighty Mile Beach by 2012. A network of sanctuary zones in marine parks and reserves for IMCRA bioregions in State waters that are representative of the full range of habitats by 2029.	**87.** Accelerate establishment of the marine parks and reserves system in all IMCRA bioregions covering State waters, including establishment of a network of marine sanctuary zones.	Proportion of the State waters in the formal conservation reserve system. Proportion of State waters in sanctuary zones.	Number of IMCRA bioregions where a representation of marine ecosystems has been achieved.	TBI	TBI	EEA H
All formal reservations under the Forest Management Plan 2004-2013 (FMP) finalised by 2013.	**88.** Implement all reservation proposals in the FMP.	Area of each forest ecosystem by land category.	Representation of forest ecosystems in formal reserves.	TBI	TBI	E H
The remaining gaps in the level of comprehensiveness and representativeness are filled in the Gascoyne-Murchison Strategy (GMS) area, with at least an additional two million hectares added to the conservation reserve system in addition to the lands already purchased by 2010.	**89.** Continue to progress the creation of conservation reserves purchased under the GMS, and pursue further acquisitions to reach a comprehensive and adequate and representative reserve system for the GMS bioregions.	Area of land in the formal conservation reserve system. Proportion of the State in the formal conservation reserve system.	Number of IBRA sub-regions where a representation of at least 15 per cent terrestrial ecosystems has been achieved.	TBI	TBI	E H
Additional areas reserved or management agreement finalised by 2015.	**90.** Continue to negotiate with pastoral lessees over areas identified under the 2015 pastoral lease renewal program for inclusion in the conservation reserve system or excision under a conservation agreement.	Area of land in the formal conservation reserve system. Proportion of the State in the formal conservation reserve system.	Number of IBRA sub-regions where a representation of at least 15 per cent terrestrial ecosystems has been achieved.	TBI	TBI	E H
Where possible at least 15% of regionally significant ecosystems formally protected and/or under management agreements.	**91.** Continue the identification of significant areas across the Swan Coastal Plain under the Swan Bioplan for possible inclusion in the formal conservation reserve system, including in the Bunbury-Busselton area.	Proportion of Swan Coastal Plain in the formal conservation reserve system.	Proportion of native vegetation associations where at least 15 per cent are fully reserved.	TBI	TBI	N
Eighty per cent of Bush Forever sites formally protected by 2017. All of Bush Forever sites formally protected by 2029.	**92.** Provide formal protection for lands identified under Bush Forever[16] across the Perth Metropolitan area.	Area formally reserved.	Proportion of native vegetation associations where at least 15 per cent are fully reserved.	TBI	TBI	E H

[16] Bush Forever (2000) identifies 51,200 ha of regionally significant bushland to be protected in 287 sites.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Supporting mechanisms to the formal conservation reserve system						
State Indigenous Protected Area program established by 2009.	**93.** Establish a network of private and indigenous[17] protected areas that complements and builds on the formal conservation reserve system, and complements off-reserve conservation initiatives.	Area of land managed for biodiversity and protected in perpetuity.	Trends of biodiversity indicators in areas targeted by area plans.	TBI	TBI	N
	94. Establish and manage a network of Reef Observations Areas and Fish Habitat Protection Areas under the Fish Resources Management Act, which complements the marine conservation reserve system.	Area of State waters under Reef Observations Areas. Area of State waters under Fish Habitat Protection Areas.	Trends of biodiversity indicators for target areas.	TBI	TBI	EEA
Conservation reserve design Objective: To improve conservation reserve system design, including testing biodiversity surrogates and providing analytical tools.						
Development of adequacy principles and guidelines by 2008.	**95.** Refine design methodology for the establishment of the terrestrial and marine conservation system, including for a network of marine sanctuary zones for the temperate and tropical waters of WA, and refinement of adequacy and connectivity guidelines.			TBI	TBI	N H
Update of datasets by 2008.	**96.** Continue maintenance of database and information requirements to support the establishment of the formal conservation reserve system and complementary protected area network.			TBI	TBI	N H
Conservation reserve management Objective:To ensure the effective management of the conservation reserve system to maintain biodiversity values.						
	97. Active participation in the development of the National Reserve System and Representative Marine Conservation Reserve System.			TBI	TBI	E H
Communication plan developed by 2008.	**98.** Develop and implement a communication plan to increase public and decision makers' awareness and understanding of the roles and functions of the terrestrial and marine conservation reserve system.	Number of people targeted in communication. Number of park visitors.	Level of public understanding.	TBI	TBI	N H

[17] In this context, private and Indigenous protected areas need to meet the minimum standards of the National Reserve System. This includes areas of land or water under private ownership and leasehold areas managed primarily for biodiversity conservation and having long-term statutory protection.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Management plans developed at the individual conservation park/reserve level for 35 per cent of the area covered by the conservation reserve network by 2015. Fifty per cent of area of the current area of the conservation reserve system covered by management plans by 2020. One hundred per cent of the conservation reserve network covered by management plans, and monitoring for adaptive management implemented by 2029.	**99.** Continue to develop and implement management plans[18] for the terrestrial and marine conservation reserve system in accordance with the CALM Act on a priority basis.	Area of coverage of management plans.	Trends of biodiversity indicators in areas targeted by area plans.	TBI	TBI	E H
Initial review completed by 2009.	**100.** Review implementation of marine and terrestrial protected area management plans in terms of 'best practice' guidelines.	Number of plans reviewed.	Proportion of marine and terrestrial management plans reviewed.	TBI	TBI	EEA H
Terrestrial and marine database completed by 2009.	**101.** Develop and implement a conservation reserves database for conservation managers, which also include provision for monitoring and evaluation management effectiveness, and maintaining public reporting requirements.	Number of people accessing data.	Number of people using database.	TBI	TBI	N H
Management protocols and practices for protected areas are implemented to ensure adaptive management for biodiversity conservation by 2009.	**102.** Continue to participate in the development of a national code of management to ensure protected area management is of an appropriately high standard.		Trends of biodiversity indicators in areas targeted by area plans.	TBI	TBI	EEA H

[18] Management plans should identify the natural values of the area and threats to these values. The plan should emphasise the overall maintenance of indigenous ecological communities, species populations and natural ecological and evolutionary processes; protection of unique or unusual habitats or ecological communities; provide for recovery of threatened species and ecological communities; and identify actions necessary to abate or ameliorate key threatening processes. Allowance should be made for experimental adaptive management and adaptation responses to climate change based on best available knowledge should be included.

Box 7: WA's conservation reserve system

At 30 June 2006, WA had a terrestrial conservation reserve system comprising 97 national parks (covering 5,593,536 hectares), 843,155 hectares in conservation parks, 10,860,832 hectares in nature reserves and 133,154 hectares in miscellaneous conservation reserves under the *Conservation and Land Management Act 1984*. The total area of 17,430,677 hectares equates to 6.9 per cent of WA's land area. In addition, 5,244,774 hectares of former pastoral leasehold land has been acquired for conservation reserves as at 30 June 2006 but are yet to be reserved, and approximately 195,000 hectares of land tenure changes to conservation reserves are yet to be implemented under the *Forest Management Plan 2004-2013*. These areas are, however, being managed as if they were conservation reserves. Reservation of these areas will increase the total area of the conservation reserve system to around 22.87 million hectares, or 8.9 per cent of WA's land area. Furthermore, a total of more than 1.4 million hectares of land in the rangelands has been identified for exclusion from pastoral leases when the leases expire in 2015, and incorporation in the conservation reserve system.

At 30 June 2006, WA's marine conservation reserve system comprised nine marine parks, two marine management areas and one marine nature reserve, covering a total of around 1.54 million hectares, or 12.2 per cent of the State's marine waters. The Leeuwin-Naturaliste/Geographe Bay, Dampier Archipelago/Cape Preston and Walpole-Nornalup areas are currently in the planning phase for reservation as marine conservation reserves. The next priorities for the establishment of new marine reserves have been identified by the Marine Parks and Reserves Authority as (1) the Recherche Archipelago; Fitzgerald River coast; (2) Shoalwater Islands Marine Park and Carnac and Garden Islands extensions; (3) Shark Bay Marine Park, Dirk Hartog, Bernier and Dorre Islands extensions; and (4) Roebuck Bay/Lagrange Bay/Eighty Mile Beach.

Stand of paperbarks (*Melaleuca leucadendra*) with pandanus (*Pandanus spiralis*) in Prince Regent Nature Reserve, Kimberley. The formal conservation reserve system is an important cornerstone of biodiversity conservation. Photo – Keith Claymore

7 Key Strategic Direction 7:

Recover threatened species and ecological communities and manage other significant species/ecological communities and ecosystems

Threatened species[19] and ecological communities are organisms or ecological communities at risk from extinction. Threatening processes operate to both cause and accelerate species extinctions and degrade or destroy ecological communities. At global, national and State scales extinctions are irreversible and have evolutionary consequences as well as impairing ecosystem resilience. Avoiding extinction of species and complete destruction of ecological communities is an important strategy to conserve biodiversity.

Under accepted international (IUCN) criteria, species and ecological communities are assigned a threat category, which denote their conservation status in relation to its risk of becoming extinct. The conservation status categories are Critically Endangered, Endangered, Vulnerable, as well as the Presumed Extinct (or for communities, presumed destroyed) categories. In WA, there are also the additional categories of near Threatened/possibly Threatened species denoted as Conservation Dependant (P5) or 'priority' species (P1-P4), which do not satisfy the threatened criteria (including in some cases the detailed survey requirement), but which are worthy of special investigation on the basis they may be or become threatened in the near future.

Outside of those taxa and ecological communities that are considered at risk of extinction, there are other important species and ecosystems that have high biodiversity values. These include internationally significant wetlands for migratory birds, nationally important wetlands, and tuart and wandoo woodlands in the south-west of the State.

2029 key desired outcomes

- Improvement in the conservation status[20] of at least 100 threatened species through recovery action, including 20 species fully recovered and removed from the State's threatened species lists.
- Status of 50 per cent priority taxa and ecological communities[21] conservation is resolved.
- Twenty ecological communities improved in conservation status because of conservation action.
- No species or ecological community becomes extinct where conservation action is being undertaken.
- All Ramsar wetlands protected and improved in condition.
- Tuart and wandoo woodlands better protected and improved in condition.

A young woylie or brush-tail bettong (*Bettongia penicillata*). Woylies were once widespread and abundant across Australia south of the tropics. Today numbers and geographic range is restricted to a few populations. In WA, recovery of the woylie forms part of *Western Shield*. Photo – Adrian Wayne/DEC

[19] In this context species includes subspecies and other varieties; collectively referred to as taxa.

[20] Relates to the movement in direction of less threat, for example Endangered to Vulnerable.

[21] There are about 2250 priority taxa and about 140 priority ecological communities.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Threatened taxa and ecological communities recovery Objective: To recover threatened species and ecological communities, and resolve the conservation status of priority taxa and ecological communities.						
Annual review of Threatened taxa lists and Threatened Ecological Communities list.	**103.** Continue to support the work of the scientific committees in reviewing and listing threatened species and ecological communities.		Number of taxa/ecological communities reviewed and assessed.	TBI	TBI	E H
Three hundred recovery plans[22] are developed, including recovery plans for 100 per cent of Critically Endangered and Endangered taxa and ecological communities, and plans being implemented by 2012. Recovery plans are in place and being implemented for all listed threatened species and ecological communities (2007 levels) by 2029.	**104.** Accelerate the development and implementation of recovery plans[23] and wildlife management programs for all listed threatened species and ecological communities in priority order as determined by IUCN conservation status categories CR >, EN, > VU > priority[24].	Number and proportion of recovery plans being implemented.	Proportion of threatened species that have been moved to a lower category of threat according to IUCN criteria.	TBI	TBI	E H
Risk assessment framework developed and being implemented by 2008.	**105.** Develop a risk assessment framework for threatened taxa to determine priorities within threat classes			TBI	TBI	N H
Incentives program to be in place by 2009.	**106.** Establish a State incentives program to manage critical habitat on private and leasehold lands, and target provision of on-site technical information to relevant landholders.	Area of critical habitat under incentives program.	Trend in recovery of target threatened taxa.	TBI	TBI	N H
Western Shield program extended by 1.5 million hectares to cover 5 million hectares by 2012. *Western Shield* to cover 10 million hectares by 2029.	**107.** Continue the *Western Shield* program (3.5 million hectares) and expand into rangeland areas. Investigate technologies for control and expand to include other introduced animals such as feral pigs in the south-west.	Area covered by *Western Shield*.	Trend in recovery of threatened taxa under *Western Shield*.	TBI	TBI	EEA H
All areas of the State are surveyed for threatened ecological communities, and 50 per cent of priority flora is surveyed by 2029.	**108.** Undertake targeted biological surveys of threatened and priority taxa to resolve conservation status and determine threats.	Area of State surveyed. Proportion of priority taxa surveyed.	Number of threatened ecological communities, and priority flora resolved.	TBI	TBI	EEA H
75 per cent of ecosystems and ecological communities are mapped at an appropriate scale by 2011. All 2007 listed ecological communities are mapped by 2017.	**109.** Improve the identification process for ecological communities to determine conservation status, condition and threats.	Percentage of the State's ecosystems and ecological communities mapped.		TBI	TBI	N H

[22] Recovery plans cover both interim recovery plans and full recovery plans. There are 582 taxa and 66 threatened ecological communities currently listed as Threatened. The number of recovery plans in place is 243. In some instances, recovery plans may cover a number of taxa/ecological communities.

[23] Threatening processes are acknowledged as significant and important in the recovery and management of species and ecological communities. While not explicitly outlined under this strategic direction, amelioration or abatement of threatening processes would form a major part of recovery planning and implementation. Similarly, research is also considered part of the recovery process but not explicitly detailed. Generic threatening processes are dealt with under 4.4.

[24] CR = Critically Endangered; EN = Endangered; VU = Vulnerable.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
	110. Improve the coordination and management of the Threatened Species network.	Number of people involved in the network.	Uptake of information by Network members.	TBI	TBI	EEA
Conservation of significant non-threatened species and ecosystems Objective: To maintain the conservation status of significant species, such as migratory birds, and improve the condition of special ecosystems, including Ramsar and nationally significant wetlands, and tuart and wandoo woodlands.						
Management plans are in place and being implemented for 30 wetlands listed on the Directory of Important Wetlands[25] in Australia by 2017. Management plans covering 120 wetlands listed on the Directory of Important Wetlands in Australia by 2029.	**111.** Manage wetlands in the Directory of Important Wetlands in Australia and nominate new wetlands.	Number and proportion of plans for and nationally important wetlands. Number of new wetlands in Directory.	Trends in biodiversity indicators for areas under management plans.	TBI	TBI	EEA
Identification of priority waterways for conservation by 2012.	**112.** Improve understanding of WA waterways, via undertaking survey and assessment, and classification of waterways.	Area of State surveyed.	Degree of uptake of knowledge in management decision making.	TBI	TBI	N
Site management plans developed and being implemented for all Ramsar wetlands by 2012. Additional eight nominations for Ramsar listing by 2012. Management plans are developed and implemented for an additional eight Ramsar sites in WA by 2015. Management plans in place and being implemented for all Ramsar sites that meet the criteria of the Convention on Wetlands by 2029.	**113.** Develop and implement plans for Ramsar sites, and undertake investigations to nominate Ramsar sites.	Number of Ramsar sites listed for WA. Number of Ramsar sites with management plans. Proportion of Ramsar sites covered by management plans.	Trends in biodiversity indicators for areas under management plans.	TBI	TBI	N H
	114. Evaluation and prioritisation of Swan Coastal Plain wetlands for biodiversity conservation purposes.			TBI	TBI	E
	115. Continue assistance with the development of voluntary management plans and agreements for wetlands conservation; and development of incentives package, including expansion of Urban Nature and education and awareness programs to bring about wetlands conservation.	Area covered by voluntary management agreements.	Trends in biodiversity indicators for areas covered by voluntary management agreements.	TBI	TBI	EEA
	116. Ensure monitoring of abundance and distribution of seabirds, waterbirds woodland birds and shorebird/migratory species.	Number of collaborative ties with international migratory bird research and management organisations.	Trends in abundance and richness of migratory species in WA.	TBI	TBI	EEA

[25] There are 120 wetlands in the Directory of Important Wetlands.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Meet targets under relevant wildlife management programs, including kangaroo, crocodiles, turtle and dugong management and flora harvesting.	**117.** Continue to refine and implement wildlife management programs for non-threatened flora and fauna.	Measures under relevant plans.	Indicators under relevant plans.	TBI	TBI	E
Progress nomination of Ningaloo-Cape Range for World Heritage listing by 2007.	**118.** Ensure effective management of World Heritage Properties at Shark Bay and Purnululu National Park, and progress nomination of Ningaloo-Cape Range for World Heritage listing.		Trends in natural values in World Heritage sites.	TBI	TBI	EEA
Provision of report on candidate areas with potential World Heritage values by 2010.	**119.** Identify and progress potential new areas for World Heritage listings.			TBI	TBI	EEA
Tuart Conservation and Management Strategy finalised by 2007.	**120.** Finalise and implement the Tuart Conservation and Management Strategy and implement the Wandoo Recovery Research Strategy.			TBI	TBI	

Mulga (*Acacia aneura*) community, Mt Everard. Mulga occupies about 20 per cent of arid Australia and is a keystone species that dominates a large portion of WA rangelands. Mulga communities are repositories of significant productivity and biodiversity; they are resource 'hotspots' because of their ability to capture, retain and cycle precious sediments, nutrients and water. Photo – Bruce Maslin

Box 8: Gilbert's potoroo – Australia's most threatened mammal

The aim of the Gilbert's Potoroo Recovery Plan is to increase both the numbers of individual Gilbert's potoroos known to be alive in the wild and the number of locations in which they occur. Photo – Dick Walker/Gilbert's Potoroo Action Group

Gilbert's potoroo or nilgyte (*Potorous gilbertii*) was discovered near Albany in 1843 by John Gilbert, an English naturalist and collector working in WA for the zoologist John Gould. A number of specimens were later collected from the Albany region, the last being in 1874. This was the last official record of this marsupial, believed to be extinct by 1905, until it was rediscovered at Two Peoples Bay Nature Reserve, 35 kilometres east of Albany, in December 1994. Gilbert's potoroo is currently known in the wild within a small area of Mount Gardner promontory at Two Peoples Bay, where it is believed there are fewer than 40 animals in the population.

Gilbert's potoroo is listed as fauna that is likely to become extinct or is rare under the WA Wildlife Conservation Act 1950 and has been ranked as Critically Endangered by the WA Threatened Species Scientific Committee. It is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The most significant threats to the survival of the Gilbert's potoroo have been summarised as altered fire regimes, introduced predators including foxes and cats, native vegetation decline caused by *Phytophthora cinnamomi* and the clearing of native vegetation adjacent to Two Peoples Bay.

Primary recovery actions to conserve Gilbert's potoroo are to ensure that the single largest wild population persists in the wild by ameliorating the effects of threatening processes, identifying new locations at which the species may occur and establishing new populations in suitable habitats. There has been successful translocation of animals to Bald Island east of Albany. A recovery plan outlines management actions to support the recovery of Gilbert's potoroo from Critically Endangered to common status. Implementation of the recovery plan is overseen by the Gilbert's Potoroo Recovery Team.

8 Key Strategic Direction 8:

Conserve landscapes/seascapes for biodiversity (integrating on- and off-reserve conservation and managing system-wide threats)

Operating at landscape and seascape scales is essential to conserve biodiversity and ensure heterogeneity, ecological connectivity and functional ecosystems. This will require the effective management of system-wide threats, such as those resulting in habitat and species loss, and the successful implementation of other key strategies such as achieving sustainable use of natural resources, the establishment and management of the conservation reserve system, and recovery and management of significant species and ecological communities as outlined in key strategic directions 4-7. Hence, landscape/seascape scale approaches need to comprise a mix of complementary and integrated mechanisms that occur at a range of geographic and temporal scales.

In the highly fragmented south-west of the State it is imperative that macro-scale ecological linkages are developed. These will comprise a network of protected areas with complementary off-reserve initiatives.

2029 key desired outcomes

- Better targeting of biodiversity conservation effort at a scale that manages and recovers landscapes/seascapes and ecosystems of high biodiversity value and maintain ecological processes and the natural resources they depend on.
- Continental scale ecological linkages in place for the south-west to assist in a reduction of the effects of human-induced climate change and biodiversity decline.
- Key invasive animals affecting biodiversity in the rangelands to be reduced in extent by 10-30 per cent. This includes feral and unmanaged goat, feral camel, feral cat, feral pig and the European fox. Biodiversity should show an improvement in condition and status.
- A 90 per cent reduction in European starling populations and a reduction in the impacts on biodiversity values.
- The top 30 environmental weeds are contained.
- Ten 'sleeper' weeds are eradicated.
- Biodiversity decline is halted in 25 natural diversity recovery catchments in the agricultural zone of the south-west of the State.
- Containment in the extent of *Phytophthora* dieback in the south-west of the State.
- Priority marine pests are controlled.
- Appropriate fire regimes are in place for the north Kimberley, Karijini-Fortescue, Goldfields, arid-zone hummock grasslands, south-west forests and kwongan heathlands.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Landscape planning and management **Objective: To conserve biodiversity values and better focus management at a landscape/seascape scale (i.e. hundreds to thousands of hectares).**						
Four macro-scale ecological linkages are established in the south-west and form the basis of landscape conservation efforts and investments by 2012. Eight macro-scale ecological linkages are established in the south-west and form the basis of landscape conservation efforts by 2017.	**121.** Create and manage macro-scale ecological linkages in the south-west of the State to ameliorate or accommodate the effects of climate change on biodiversity, and to build ecosystem resilience and connectivity of the formal conservation reserve system and off-reserve initiatives that focus on managing high biodiversity values and contribute to restoring ecological connectivity and landscape reconstruction.	Area covered by ecological linkages.	Trends in biodiversity values in target areas.	TBI	TBI	NH

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Target landscapes and biodiversity hotspots for the south-west are identified, and a targeted incentive recovery program developed by 2009.	**122.** Determine high priority landscapes of high biodiversity values, including centres of endemism, for recovery and management in the south-west of the State, and establish a financial incentive program to ensure strategic biodiversity conservation action in such areas.	Area covered by target landscapes.	Trends in biodiversity values in target areas.	TBI	TBI	N H
Management protocols are in place for recovery and management of biodiversity on unallocated Crown land and unmanaged Crown reserves by 2010.	**123.** Develop effective management protocols for and undertake management on unallocated Crown land and unmanaged Crown reserves to ensure that biodiversity values are not diminished and are recovered where appropriate.	Area covered by program.	Trends in biodiversity values in managed areas.	TBI	TBI	N H
An additional 10 regional parks are established under statutory regional planning schemes by 2017, with priority for the Perth metropolitan, Peel and Bunbury regions. Thirty regional parks covering Perth metropolitan and regional centres are established by 2029.	**124.** Manage and expand the regional parks system,[26] where appropriate, in urban environments to assist in the protection and management of high biodiversity values at a landscape scale.	Area of land under management in the regional park network.	Indicators as per regional park plans.	TBI	TBI	EEA
Management of system-wide threats (invasive animals, weeds and pathogens)						
(i) Invasive animals **Objective: To lessen or address the effects of system-wide biophysical threats and pressures on biodiversity.**						
Abatement plans developed and implemented for feral hoofed animals in the rangelands by 2009, and reduction in target population extent by 10-30 per cent by 2029.	**125.** Establish and implement integrated control and research programs for the control of feral hoofed animals in the rangelands. • Ascertain the distribution and abundance of feral camels, unmanaged and feral goats, feral pigs, feral donkeys and horses and their impact on biodiversity. • Develop active adaptive management control programs, and establish monitoring of control. • Develop related effective public awareness programs.	Area covered by threat abatement plans.	Trends in threatened species and other key biodiversity values conservation status as a result of control of threatening processes. Trends in key biodiversity values, and target invasive animal species.	TBI	TBI	
Reduction in the spread of cane toads, and reduce the impacts on biodiversity values by 2012.	**126.** Continue the implementation of State Cane Toad Initiative, including biocontrol.	Area of potential range in WA kept free of cane toads.	Rate of spread of cane toad population.	TBI	TBI	E H

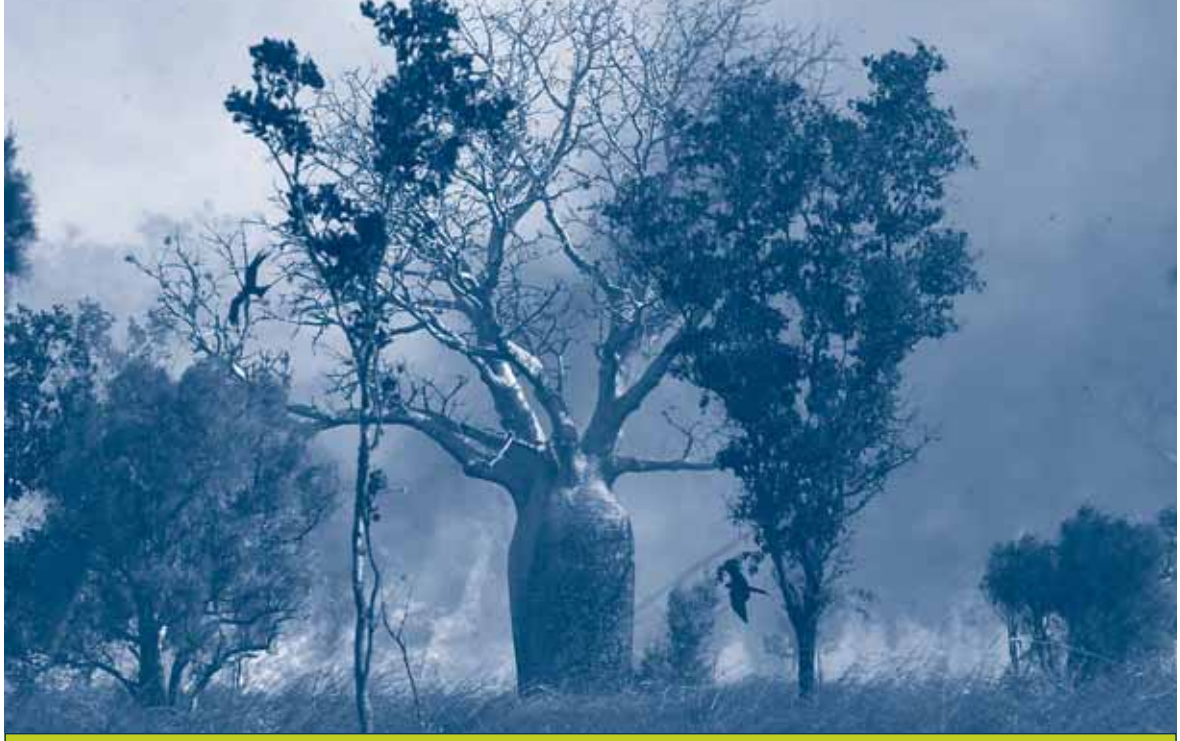
[26] There are currently 8 regional parks for the State, which are all located in the Perth Metropolitan area.

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
A 50 per cent reduction in starling populations by 2012, and amelioration of impacts on biodiversity values. A 90 per cent reduction in starling populations by 2029, and amelioration of impacts on biodiversity values. A 50 per cent reduction in rainbow lorikeet populations in the Perth metropolitan area by 2017, and amelioration of impacts on biodiversity values.	**127.** Continue the control of the European starling and other introduced avifauna, such as rainbow lorikeets, in the south-west.	Number of target bird populations eradicated.	Extent of target population, and number of populations.	TBI	TBI	EEA H
A 30 per cent reduction in feral bee populations by 2029, and amelioration of impacts on biodiversity values.	**128.** Develop and implement a feral bee and introduced invertebrate abatement plan.	Reduction in the number of feral bee populations. Reduction in target species.	Trends in biodiversity values in control areas.	TBI	TBI	N
Establish a marine pest control program by 2010.	**129.** Establish an integrated marine pests control program, including evaluation of known marine pests and their impact on biodiversity to determine priorities for control and eradication.	Reduction in the extent of target populations of marine pests.	Trends in biodiversity values in control areas.	TBI	TBI	N H

Feral cat (*Felis catus*). Feral cats are widespread and have impacted on island fauna and contributed to the extinction of many small to medium sized mammals and ground-nesting birds. Photo – Ray Smith/DEC

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
(ii) *Phytophthora* Dieback						
Establish an integrated *Phytophthora* Dieback Management Program by 2009. Establish a *Phytophthora* dieback control program covering 75 per cent of affected area by 2017. Establish a *Phytophthora* dieback management program covering 100 per cent of affected area by 2029.	**130.** Establish and implement an integrated management and research program for *Phytophthora* dieback management including: • a research program to improve an understanding of the development, survival, dispersal and control of *Phytophthora* dieback; • assessment of the spatial extent of dieback affected areas and impact on biodiversity values; and • continue and expand dieback management and control in targeted, high priority areas (both on- and off-reserve).	Extent of *Phytophthora* dieback.	Trends in relevant taxa and ecological communities.	TBI	TB	N H
(iii) Environmental weeds						
Environmental Weed Action Plan in place by 2009, and being implemented for the 34 high rated invasive weeds and top 20 weeds identified by risk analysis. Top 30 environmental weeds contained by 2029. Establishment of a statewide GIS for environmental weed incursions and control operations in place by 2009. Eradication of 10 'sleeper' environmental weeds by 2029.	**131.** Implement the State's Environmental Weed Strategy focusing initially on the 34 invasive weeds rated 'high' and 'sleeper' weeds, and undertake a risk analysis of environmental weeds to determine the top 30 environmental weed priorities for control. Develop and implement an environmental weeds action plan.	Extent of target environmental weeds.	Trends in biodiversity values and target weed species in control areas.	TBI	TBI	EEA H N H
Salinity management						
Management plans in place for six natural diversity recovery catchments by 2008. An additional five natural diversity recovery catchments established by 2011. 25 natural diversity recovery catchments established by 2017. Develop and implement management plans for all 25 natural diversity recovery catchments by 2029.	**132.** Continue with the management of six natural diversity recovery catchments under the State Salinity Strategy, and expand the program with a further 19 catchments.	Number and area covered by natural diversity recovery catchments.	Trends in biodiversity and secondary salinity and waterlogging in recovery catchments.	TBI	TBI	EEA H
Document established trends in aquatic biodiversity by 2012.	**133.** Continue to implement the south-west wetlands monitoring program.		Trends in aquatic biodiversity.	TBI	TBI	

Output targets	Primary actions	Performance measures	Performance indicators	L	S	P
Establish a program covering 30 per cent of Crown land in salinity susceptible areas by 2012. Establish a program covering 50 per cent of Crown land in areas susceptible to salinity by 2017. Establish a program covering 100 per cent of Crown land in areas susceptible to salinity by 2029.	**134.** Continue to implement the Crown Reserves program under the State Salinity Strategy.	Area of coverage by Crown reserves program.	Trends in biodiversity and secondary salinity and waterlogging in recovery catchments.	TBI	TBI	
Complete stage three of the Salinity Investment Framework stage by 2009.	**135.** Continue to implement and refine the Salinity Investment Framework to identify priorities for biodiversity conservation investment in the south-west of the State.			TBI	TBI	E
Establish commercial native vegetation industries, such as oil mallee, by 2012. Establish broadscale native vegetation supporting revegetation and remnant vegetation management programs by 2029.	**136.** Continue the development of commercially viable native species for broadscale planting to abate secondary salinisation and waterlogging in the south-west, complement biodiversity conservation activities and undertake trials and develop techniques for rehabilitation of native ecosystems.	Area of land under broadscale plantings.	Trends in biodiversity affected by secondary salinity and waterlogging.	TBI	TBI	EEAH
Fire management for biodiversity Objective: To bring about a fire regime that will maintain and recover biodiversity						
Framework for fire management plans for biodiversity at a bioregional scale to be completed by 2009. Ten fire bioregional scale plans are developed and implemented with emphasis on the rangelands by 2012. Appropriate fire management plans for biodiversity are implemented for all the State's 26 bioregions by 2017.	**137.** Develop and implement bioregional fire management plans that adequately provide for maintenance and recovery of biodiversity, with initial focus on tropical savannah woodlands and hummock grasslands, and south-west forests.	Area of coverage of fire management plans.	Trends in biodiversity.	TBI	TBI	N
Six large scale active adaptive management projects to determine suitable fire regimes are in place by 2009.	**138.** Develop and establish large scale active adaptive management trials in the north Kimberley, Karijini-Fortescue, Goldfields, arid-zone hummock grasslands, south-west forests and kwongan heathlands to determine suitable fire management regimes.	Area of project coverage.	Trends in biodiversity, in trial areas.	TBI	TBI	



Box 9: Altered fire regimes

Fire has been a natural element of the Australian landscape for millions of years. Consequently, WA's vegetation has evolved with fire and demonstrates a range of vegetative and reproductive traits that enable plants to persist, and in some cases depend, on particular fire regimes.

Before European settlement, Aboriginal burning over thousands of years was regular and thought to be widespread but mostly patchy, resulting in a fine-grained mosaic of native vegetation at different growth stages. This fine mosaic restricted the spread and intensity of wildfires and provided structural and floristic diversity in vegetation which in turn provided diversity in habitat and food for animals.

Fire regimes changed with European settlement, where initial management primarily became aimed at exclusion of fire to reduce the impact of wildfire on the environment, human life and property values. Current fire regimes are often different to what native vegetation and fauna have adapted to over millennia, being too frequent in some areas and too infrequent in others. Accordingly, these altered fire regimes can result in the floristic patterns and vegetation structure being altered, which in turn affects fauna that is reliant on vegetation.

Often coupled with the altering of the fire management regime are land use changes such as intensive grazing and the introduction of exotic species, particularly annual grasses. These exacerbate the effects of fire and changes to native habitat.

For example, the Kimberley region in the north of WA has experienced a marked decline in native vegetation condition and distribution of native fauna, especially medium weight range mammals, as a consequence of an altered fire regime but also through the impacts of over-grazing and the introduction of plants, such as birdwood grass and buffel grass, and predation from cats. Currently, the predominant fire regime in the Kimberley comprises frequent, widespread, hot and largely unmanaged late season fires. This is having severe impacts on fire-sensitive flora and vegetation, such as cypress pine (*Callitris intratropica*) and vine-thickets, and more extensively altering tropical savannah woodlands to more open with the understorey dominated with annual grasses. In time, this is likely to bring about irreversible changes for some landscapes and ecosystems, which in turn will impact on native fauna and flora. Evidence also suggests that significant soil loss can be associated with late dry season fires and heavy rainfall thereby increasing loss of nutrient and organic rich top soil.

The notion of using fire to maintain biodiversity and ecological processes is fairly new. Today, fire management should not only provide protection for human life and property, but also achieve a regime that will retain and recover biodiversity. An experimental adaptive management framework, where scientific knowledge and measuring the effectiveness of fire management become integral components with operational management, will be essential to maintain biodiversity values at a landscape scale.

5. Reviewing progress of the strategy

Implementation of a State strategy will require cooperation, coordination and commitment from all those responsible for the management of biodiversity or whose activities impinge upon biodiversity, including Government at all levels (State, local and national), industry, community-based groups and individuals.

DEC has been assigned by the Government as the lead State agency for monitoring the overall implementation of the strategy and its progress. A set of practical indicators has been outlined in the strategy. These will allow measurement of progress against targets in achieving the strategy's objectives. The Department will report through the Minister for the Environment on progress every five years. This reporting will coincide with State of the Environment reporting. The WA Biodiversity Audit will be used as a tool to assist in determining status and trends in biodiversity, as well as progress in management responses, and identification of knowledge gaps and management requirements.

As the lead agency for the strategy, DEC will also be responsible for undertaking a major review of the strategy every 10 years (or at lesser intervals if necessary) to make sure that it remains up-to-date and contemporary. These reviews will also determine the appropriateness and effectiveness of the range of strategies employed, and that accompanying actions and targets are relevant.

Organisations with primary responsibility for developing and implementing actions will be required to collect data and information on relevant performance indicators and measures, and report on progress of delivering primary actions and meeting targets. Agencies will need to incorporate and identify biodiversity conservation actions in their corporate plans.

The waters of the proposed Geographe Bay/Leewin-Naturaliste/Hardy Inlet Marine Park contain a wealth of marine life and provide the basis for a range of recreational and commercial opportunities. Photo – Mike Eidam

Opposite: Open eucalypt woodland with spinifex understorey, Mt Agnes. Photo – DEC

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Glossary

ameliorate

To make or become better; improve.

animal

(i) any living or dead member of the Kingdom Animalia (other than a human being);

(ii) any viable or non-viable progeny, larvae, embryo, egg or sperm of an animal or other part, product or genetic material of an animal from which another animal could be produced;

(iii) any part of an animal; and

(iv) the carcass of an animal.

anthropogenic

Of, relating to, or resulting from the influence of human beings.

apiculture

The raising and care of bees for commercial or agricultural purposes.

aquaculture

Cultivating marine or freshwater aquatic organisms under controlled conditions.

aquatic

Living or growing in, on, or near water (usually taken to mean freshwater, as opposed to marine).

biodiversity

The variability among living organisms and the ecosystems and ecological complexes of which those organisms are a part. Includes:

(i) diversity within native species and between native species;

(ii) diversity of ecosystems; and

(iii) diversity of other biodiversity components.

biodiversity asset

Threatened taxa and ecological communities, significant ecosystems or taxa.

biodiversity component

Includes habitats, ecological communities, genes and ecological processes.

biodiversity hotspot (international)

Regions that contain a great diversity of endemic species and, at the same time, have been significantly impacted and altered by human activities. Plant diversity is the biological basis for hotspot designation; to qualify as a hotspot, a region must support 1500 endemic plant species, 0.5 per cent of the global total. Existing primary vegetation is the basis for assessing human impact in a region; to qualify as a hotspot, a region must have lost more than 70 per cent of its original habitat. Typically, the diversity of endemic vertebrates in hotspot regions is also extraordinarily high. There are 34 biodiversity hotspots globally.

biodiversity hotspot (national)

Areas that are rich in plant and/or animal species, particularly endemic species, and also under immediate threat from impacts such as land clearing, habitat modification, development pressures, salinity, weeds and introduced animals. There are a total of 15 hotspots in Australia, eight of which are found in WA.

biogeographic regions (IBRA and IMCRA)

Interim Biogeographic Regionalisation for Australia (IBRA) is a framework for conservation planning and sustainable resource management within a bioregional context. IBRA regions represent a landscape based approach to classifying the land surface from a range of continental data on environmental attributes, including climate and geomorphology. Likewise, Interim Marine and Coastal Regionalisation for Australia (IMCRA) is a single, ecosystem-level regionalization of Australia's coastal and marine environments.

biological resources

Includes biochemicals, genetic resources, organisms, populations and any other biotic component of an ecosystem with actual or potential use or value for humanity.

biome

A major regional or global biotic community, such as a grassland or desert, characterised chiefly by the dominant forms of plant life and the prevailing climate.

bioprospecting

The collecting of biological samples (plants, animals, micro-organisms) to assist discovery of genetic or biochemical resources.

biota

All life, including plants, animals, and fungi.

Bush Forever

Bush Forever is a 10 year strategic plan to protect some 51,200 hectares of regionally significant bushland in 287 Bush Forever Sites, representing, where achievable, a target of at least 10 per cent of each of the original 26 vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region.'

CAR reserve

See comprehensive, adequate and representative reserve system.

catchment

Area of land drained by a river and its tributaries.

comprehensive, adequate and representative reserve system

A reserve system that is characterised by the following: comprehensiveness – inclusion of the full range of ecosystems recognised at an appropriate scale within and across each bioregion, adequacy – the maintenance of the ecological viability and integrity of populations, species and communities, and representativeness – the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive.

conservation

The protection, maintenance, management, restoration and enhancement of the natural environment.

conservation offsets

Beneficial activities undertaken to counterbalance an adverse impact to biodiversity conservation values, aspiring to achieve 'no net loss' or a 'net benefit to conservation' outcome.

critical habitat

Habitat critical to -

(i) the survival of a native species or ecological community where the loss of habitat of the species or ecological community would result in the native species or ecological community being eligible for listing as a threatened native species or a threatened ecological community; or

(ii) the survival of a threatened native species or a threatened ecological community.

[Adopted from EPBC Act without amendment.]

dieback

A symptom of disease in trees and other vegetation in which the foliage progressively dies from the extremities; commonly referred to with respect to native forests or woodlands. (See *Phytophthora* dieback and *Phytophthora cinnamomi*.)

ecological community

A natural assemblage of organisms that occurs in a particular type of habitat.

ecological process

Means any event taking place between -

(i) organisms that are native species; or

(ii) organisms that are native species and the natural abiotic components of an ecosystem, that contributes to the functioning of an ecosystem.

ecologically sustainable development

The principles of ecologically sustainable development are -

(a) that the decision-making process should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;

(b) that if there are threats of serious or irreversible environmental damage, the lack of

full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;

(c) that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

(d) that the conservation of biodiversity and ecological integrity should be a fundamental consideration in decision-making; and

(e) that improved valuation, pricing and incentive mechanisms should be promoted.

ecosystem

Means a dynamic complex of ecological communities and their abiotic environment interacting as a functional unit.

ecosystem services

The transformation of a set of natural assets, such as soil, plants, animals, air and water into services that are valued by humans. Examples include the provision of clean water, maintenance of liveable climates and atmospheres (carbon sequestration), pollination of crops and native vegetation, fulfilment of people's cultural, spiritual, intellectual needs, and provision of options for the future, for example though the maintenance of biodiversity.

endemic

Species naturally restricted to a specified region or locality.

ethnobiological knowledge

Knowledge of biota (particularly plants and animals) held by Indigenous people.

exotic

An animal occurring in a place that it is not native to.

fauna

Animals found in a specific area.

feral species

A domesticated species that has become wild, for example donkey, camel, horse, pig and goat.

flora

Plants found in a specific area.

genetic bottleneck

When population numbers are temporarily reduced to a level insufficient to maintain the diversity in the population.

habitat

Means the biophysical medium-

(i) occupied (continuously, periodically or occasionally) by an organism or group of organisms; or

(ii) once occupied (continuously, periodically or occasionally) by an organism or group of organisms, and into which organisms of that kind have the potential to be re-introduced.

in situ

Conserving species within their natural habitat.

interim recovery plans

Documents for the management and protection of threatened taxa or threatened ecological communities where no full recovery plan has been prepared. Interim recovery plans prescribe immediate actions that are necessary to halt the decline and commence recovery of a species or ecological community. (See recovery plans.)

introduced species

A species occurring in an area outside its historically known natural range as a result of intentional or accidental dispersal by human activities (including exotic organisms and genetically modified organisms).

invasive species

Species introduced deliberately or unintentionally outside their natural habitats where they have the ability to establish themselves, invade, outcompete natives and take over the new environments.

invertebrate

Any animal without a backbone (vertebral column) such as insects, squid, snails and worms.

International Union for the Conservation of Nature and Natural Resources (IUCN) categories I-IV

Areas of land formally protected for nature conservation values, including strict nature reserve/wilderness (managed for science or wilderness), national park (managed for ecosystem conservation and recreation), natural monuments (managed for conservation of specific features) and habitat/species management areas (managed mainly for conservation through management intervention.) This is contrasted with IUCN categories V and VI, which are areas of land formally protected for nature conservation values, including protected landscapes/seascapes (managed mainly for landscape and seascape conservation and recreation) and managed resource protected areas (managed mainly for sustainable use of natural ecosystems).

Land for Wildlife

Land for Wildlife is a voluntary program managed by DEC that recognises the conservation efforts of private landholders and managers and helps them to conserve biodiversity on their lands by protecting, managing or recreating suitable habitat.

landscape

A mosaic where the mix of local ecological communities and ecosystems or land uses is repeated in a similar form over a kilometre-wide area. In agricultural areas, a landscape unit that is repeated with a similar pattern of land use, including natural habitats. From a biodiversity perspective, the distances over which significant species occur should govern the upper size limit of a landscape for biodiversity planning.

marine

Inhabiting salt water in, or connected to, the sea.

marine sanctuary zone

An area within a marine park managed solely for nature conservation and low-impact recreation and tourism. Sanctuary zones provide the highest level of environmental protection of all areas within the marine conservation reserve categories (along with marine nature reserves).

Millennium Seed Bank Project

The Millennium Seed Bank Project (MSBP) is a global conservation program managed by the Seed Conservation Department at the Royal Botanic Gardens, Kew, which aims to collect and conserve 10 per cent (over 24,000 species) of the world's seed-bearing flora, principally from the drylands, by 2010.

native species

A species that is indigenous to Western Australia.

natural diversity recovery catchment

An area established as part of the Natural Diversity Recovery Catchment Program under the State Salinity Strategy to help recover and protect significant natural areas, particularly wetlands, from salinity and waterlogging. Selection is based on a number of criteria, including representative of nature conservation values and the likelihood of recovering and protecting areas from salinity.

natural resource management

Management of land, water, air and biodiversity resources of the State for the benefit of existing and future generations, and for the maintenance of life support capability of the biosphere. Includes use of natural resources by extractive and mining industries.

natural resource management sector

A particular body of people or organisations who are responsible for a specific aspect of natural resource management or use, for example agriculture, pastoralism, energy (including exploration, mining and other extractive industries), water, fisheries etc.

non-government organisation

Includes any not-for-profit organisation, other than Government agencies.

non-vascular plants

Non-vascular plants lack specialised tissues to carry water and dissolved food substances throughout the plant body. Examples include mosses, lichens and liverworts.

organism

Includes -

(i) part of an organism;

(ii) the reproductive material of an organism; and

(iii) an organism that has died.

perverse incentives

A policy or program not directed at biodiversity objectives but which has an unintended and adverse affect on the conservation of biodiversity.

pest

Any animal that has a negative effect on human or economic activities. They can include both introduced and native species.

***Phytophthora* cinnamomi**

A soil-borne organism (often referred to as a fungus) belonging to the Class Oomycetes or 'water moulds', known to cause root-rot disease in Australian flora species. (See dieback.)

***Phytophthora* dieback**

Death or modification of native vegetation caused by Phytophthora cinnamomi.

plant

Means -

(i) any living or dead member of the Kingdom Plantae;

(ii) a seed or spore, whether it is viable or non-viable;

(iii) a part, product or genetic material of a plant from which another plant could be produced; and

(iv) any other part of a plant (i.e. not referred to in (ii) or (iii) above, e.g. a "non-reproductive" part).

polluter-pays

Principle that those who generate pollution and waste should bear the full cost of containment, avoidance or abatement.

protected area

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and managed through legal means.

Ramsar sites

Areas on the List of Wetlands of International Importance, created by the Convention on Wetlands, signed in Ramsar, Iran, in 1971 (also known as the Ramsar Convention). The Convention is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 12 Ramsar sites in WA.

rangelands

Terrestrial and aquatic (non-marine) areas outside the south-west Land Division: comprises around 85-90 per cent of WA.

recovery plans

Documents that set out the research and management actions necessary to stop the decline, and support the recovery, of listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community. Recovery plans are appropriate for species or ecological communities where sufficient information is available to prescribe recovery actions with confidence (see interim recovery plans).

representative landscapes

Significant samples of sub-regional or regional biota. These samples will provide comprehensive, adequate (i.e. viable) and representative samples of the subregional or regional biota. The dimensions of representative landscapes will vary considerably, depending on the geomorphology and distribution of natural environments, and how they are repeated across a region or sub-region.

salinity

The concentration of salts in soil or water. Secondary salinity or salinisation (which takes the form of either dryland or irrigation salinity) is brought about by land use and management change, such as removal of deep-rooted vegetation. It leads to rising groundwater and the mobilisation of salts, which affects plant growth, and often leads to habitat loss.

species

A group of organisms that -

(i) interbreed to produce fertile offspring; or

(ii) possess common characteristics derived from a common gene pool;

and includes

(iii)a sub-species.

species relaxation

A process, often related to remnant vegetation or 'islands', where species are lost over time after initial isolation until an equilibrium is reached and there is no net loss of species. An alternative term is 'extinction debt'.

species richness

The number of species within a specified area.

stakeholder

A person, group of people, organisation or government with a share or an interest in an issue.

subterranean

Situated or operating beneath the earth's surface; underground.

sustainability

Meeting the needs of current and future generations through an integration of environmental protection, social advancement and economic prosperity.

target landscapes

A landscape-scale unit where populations of as many native taxa as possible have the greatest probability of remaining viable. Area of natural environment and its spatial configuration are the two key factors used to identify target landscapes.

taxon (taxa pl.)

A group or category, at any level, in a system for classifying organisms.

terrestrial

Living or growing on land.

threat abatement

Eliminating or reducing a threat.

threatened ecological community

An ecological community that is threatened by destruction and is formally listed as either vulnerable, endangered, critically endangered or presumed destroyed.

Threatened Species Network

A joint program between World Wide Fund for Nature Australia and the Commonwealth Government's Natural Heritage Trust that aims to involve the general public in recovery of threatened species and ecological communities.

threatened species/taxa

Species/taxa classified as being threatened by extinction and listed as either vulnerable, endangered, critically endangered or presumed extinct.

threatening process

A process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community.

Urban Nature

A program managed by DEC that aims to conserve and manage natural bushland and wetlands on the Swan Coastal Plain. It offers support to community-based groups on a range of bushland management topics and acts as a conduit for information, advice and best practice management.

user-pays

Pricing principle based on charging the user for the full supply cost of a product/resource.

vascular plant

Ferns and seed-bearing plants, in which the phloem transports sugar and the xylem transports water and salts.

wildlife

Native plant or animal.

Acronyms

AIMS Australian Institute of Marine Science

BOM Bureau of Meteorology

CAR Comprehensive, Adequate and Representative (see Glossary for further information)

CSIRO Commonwealth Scientific and Industrial Research Organisation

DAFWA Department of Agriculture and Food Western Australia

DEC Department of Environment and Conservation

DOET Department of Education and Training

DOF Department of Fisheries

DIA Department of Indigenous Affairs

DLI Department of Land Information

DOIR Department of Industry and Resources

DPI Department for Planning and Infrastructure

EIA Environmental Impact Assessment

FPC Forest Products Commission

GIS Geographic Information System

IBRA Interim Biogeographic Regionalisation for Australia

IMCRA Interim Marine and Coastal Regionalisation for Australia

IUCN International Union for the Conservation of Nature and Natural Resources (now World Conservation Union)

NGOs Non-government organisations

NRM Natural Resource Management

TWA Tourism Western Australia

WALGA Western Australian Local Government Association

WAM Western Australian Museum

White-bellied sea-eagle (*Haliaeetus leucogaster*). Photo – Keith Claymore

Appendices

APPENDIX 1: Summary of WA taxa and level of endemism

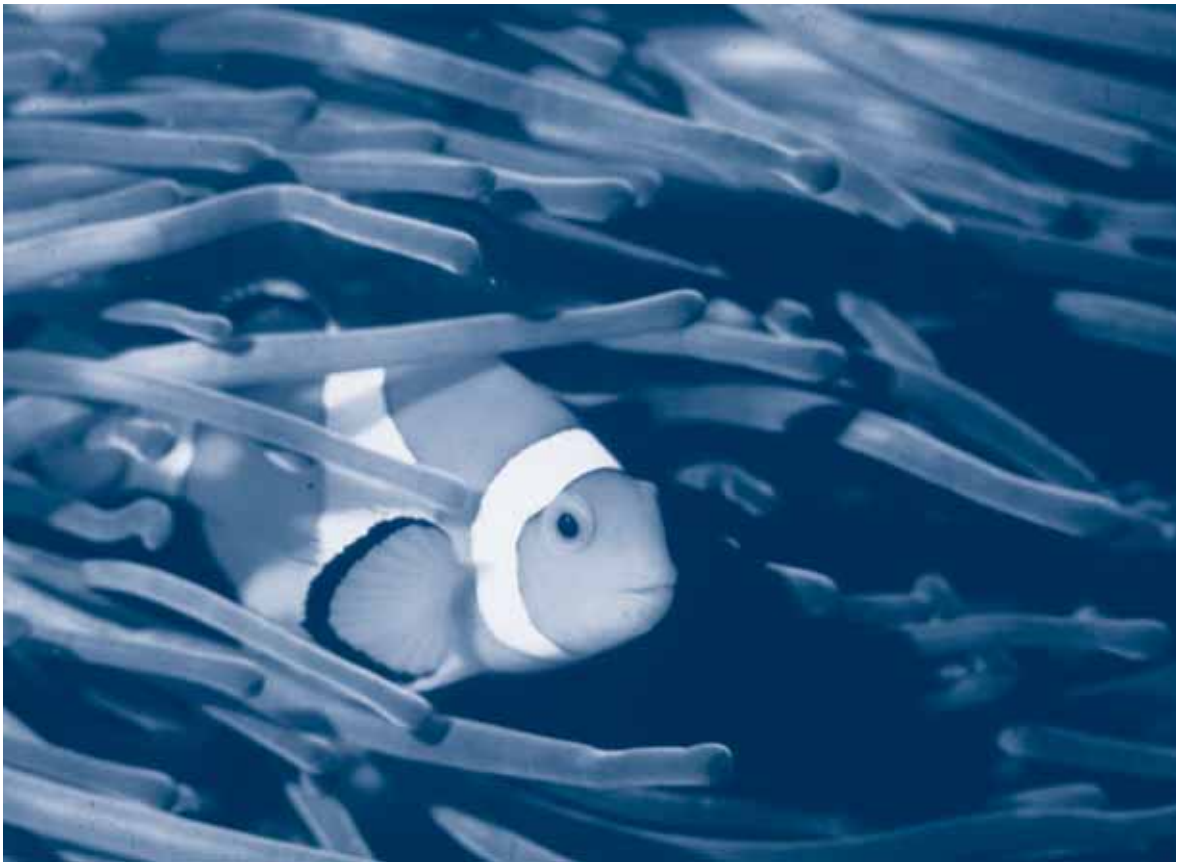
	Approximate number of described taxa in WA	Estimated total number of taxa in WA	% described taxa that are endemic to WA
ANIMALS			
VERTEBRATES			
Amphibians	77	87	53%
Birds	611	613	5.5%
Mammals	220	226	17.6%
Reptiles	510	560	42%
Fish (freshwater)	73	unknown	45%
Fish (marine)	2,955	3,600	Shallow water – approximately 10%; Inshore species of the southern temperate zone - approximately 85%; Neritic zone – 7.7%; Deep water - approximately 6.7%
INVERTEBRATES			
Insects	11,238	80,000	Unknown for whole group but butterflies 16%
Spiders	1,506	unknown	unknown
Crustaceans	4500	30,000++	Northern Australian Tropical Province 17-22% of brachyuran and anomuran decapod species; Southern Australian Warm Temperate Province 63% for decapod crustaceans
Molluscs (non-marine)	115	200	unknown
Molluscs (marine)	337	>2000	10%
Echinoderms	376	800	North-Western Australia –13%; Southern Australian Warm Temperate Province – 90%
Sponges	500	3000	2%
Other Invertebrates	804	unknown	unknown
PLANTS			
Vascular	11,500	14,000	Northern – 14% Eremaean – 50% South-West – 79% Whole of WA – 62% Non-vascular
Algae (freshwater and marine)	2633	9000	Freshwater - approximately 50% Marine – low, many species shared with other temperate or tropical areas
Mosses	353	400	unknown
FUNGI			
	2,609	140,000	Unknown for whole kingdom but 10.6% for basidiomycete macrofungi
Lichens	621	700	approximately 10%

Opposite: Morangup Nature Reserve . Photo – Keith Claymore

Data on current numbers of described taxa were obtained from WA Museum (WAM) Fauna Lists (vertebrate fauna), David Morgan, Murdoch University (freshwater fish), CALM surveys of Kimberley Rainforests, Southern Carnarvon Basin and Wheatbelt (invertebrate fauna), Diana Jones and Melissa Titelius, WAM (crustaceans), Morgan and Wells (1991) (molluscs and other invertebrates), Wilson and Allen (1987) (echinoderms and other invertebrates), Dr Jane Fromont, WAM (sponges), WA Herbarium (plants and fungi) Alex Chapman and Kevin Thiele, WA Herbarium (algae freshwater and marine, mosses and fungi).

Estimates of total numbers of taxa were obtained from Dr Ric How, WAM (vertebrate fauna), David Morgan (freshwater fish), Barry Hutchins, WAM (marine fish), Hopper et al. (1996) (invertebrates), Diana Jones and Melissa Titelius (crustaceans), Corey Whisson, WAM (molluscs), Dr Jane Fromont, WAM (sponges), David Coates, DEC (vascular flora), Alex Chapman and Kevin Thiele, WA Herbarium (freshwater and marine macro-algae, mosses, lichens and fungi).

Data on endemism were obtained from the same sources, with the addition of Mark Cowan at DEC (vertebrate fauna), Beard et al. (2000), Fox and Beckley (2005), Last et al. (2005) and May (2002).



False-clown anemonefish (*Amphiprion ocelloris*). Photo – C. Fleming

APPENDIX 2: International and national biodiversity hotspots in WA

APPENDIX 3: Policy context for WA's biodiversity conservation strategy

Primary mechanisms influencing or solely aimed at biodiversity conservation at a State level

International conventions and agreements	National legislation, and strategies	State legislation, policies and strategies	Regional and local strategies and plans
• Convention on Biological Diversity (1992) • Local Agenda 21 (1992) • Convention on Wetlands of International Importance (Ramsar 1971) • Convention on the International Trade in Endangered Species of Wild Fauna and Flora (1975) • Asia-Pacific Migratory Waterbird Conservation Strategy: 2001-2005 • Convention on the Conservation of Migratory Species of Wild Animals (Bonn 1979) • Japan Australia Migratory Bird Agreement (JAMBA 1981) • China Australia Migratory Bird Agreement (CAMBA 1988) • International Convention for the Regulation of Whaling (1946)	• *Environment Protection and Biodiversity Conservation Act 1999* • 2004-2007 National Biodiversity and Climate Change Action Plan • National Strategy for the Conservation of Australia's Biological Diversity (1996) • Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments (1999) • Biodiversity Conservation Research: Australia's Priorities (1999) • National Objectives and Targets for Biodiversity Conservation 2001-2005 • Directions for the National Reserve System: A Partnership Approach (2004) • Nationally Agreed Framework for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Australia (1997) • Wetlands Policy of the Commonwealth Government of Australia (1997) • The National Framework for the Management and Monitoring of Australia's Native Vegetation (2001)	• *Wildlife Conservation Act 1950* • *Conservation and Land Management Act 1984* • Proposed Biodiversity Conservation Act • Wetlands Conservation Policy for Western Australia (1997) • Environmental Weeds Strategy (1999)	

Other mechanisms supporting biodiversity conservation

International conventions and agreements	National legislation, and strategies	State legislation, policies and strategies	Regional and local strategies and plans
• Convention Concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention 1972)	• Australia's Oceans Policy (1998) • National Framework for Environmental Management Systems in Australian Agriculture (2002) • National Forest Policy Statement (1992) • National Principles and Guidelines for Rangeland Management (1999) • Commonwealth Coastal Policy (1995) • National Local Government Biodiversity Strategy (1998) • *Natural Heritage Trust of Australia Act 1997* • National Water Quality Management Strategy (1998) • National Action Plan for Salinity and Water Quality (WA signed 2003) • National Strategy for Ecologically Sustainable Development (1992) • National Weeds Strategy (1997)	• *Waterways Conservation Act 1976* • Waterways WA Strategy (draft) (2001) • *Planning and Development Act 2005* and Statements of Planning Policy • *Sandalwood Act 1929* • *Fish Resources Management Act 1994* • State Planning Strategy (1997) • State Coastal Planning Policy (2003) • *Environmental Protection Act 1986* and associated Environmental Protection policies and amendments • *Land Administration Act 1997* • Forest Management Plan (2004 - 2013) • WA Greenhouse Strategy (2004) • Hope for the Future: The WA State Sustainability Strategy (2003) • State Salinity Strategy (2000) • A Weed Plan for Western Australia (2001) • Nature Based Tourism Strategy (1997) • *Swan and Canning Rivers Management Act 2006* • *Agriculture and Related Resources Protection Act 1976* • Securing our Water Future: A State Water Policy for WA (2003) • State Water Plan: Draft Water Policy Framework Discussion Paper (2006) • Network City – a milestone in metropolitan planning (2005) • Policy for the Implementation of Ecologically Sustainable Development for Fisheries and Aquaculture within Western Australia (2002) • *Aboriginal Heritage Act 1972* • *Museum Act 1969* • Network City – a milestone in metropolitan planning (2005) • Proposed Biosecurity and Agriculture Management Act • Bush Forever (2000)	• Regional NRM strategies and investment plans • WA Planning Commission Regional Strategies • Regional Development Commissions Strategies • Local Government biodiversity plans

Notes

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