National Land & Water Resources Audit
An Initiative of the Natural Heritage Trust

TOWARDS A NATIONAL PROTOCOL FOR MONITORING AND REPORTING OF STATUS AND TRENDS IN SIGNIFICANT NATIVE SPECIES AND ECOLOGICAL COMMUNITIES

DSE5

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Executive Summary

This report is the result of a project commissioned as an adjunct to the second National Biodiversity Assessment. The objective was to draft a national protocol for monitoring and reporting of significant native species and ecological communities and ecological communities, based on a review of literature and consultation with stakeholders. The report provides an introduction to the project, a brief synopsis of the current national and international context. It outlines the consultation process undertaken and summarises the key findings. It establishes a set of design principles for a protocol and presents a brief discussion of some of the key issues surrounding biodiversity monitoring and reporting. A definition of 'significant' is proposed and an outline of potential indicators and sub-indicators is sketched.

The challenge is to develop and implement a protocol that provides a comprehensive, representative and reliable indication of the state and trends of significant native species and ecological communities. The protocol must be robust enough to operate at different geographical scales and to accommodate data based on a wide variety of parameters and of varying reliability. Above all, it must be able to be implemented without a major upheaval of existing monitoring programs, be cost effective and meet biodiversity outcomes.

The proposed approach is based on two elements:

1. Establishment and periodic updating of data in regard to the parameters that underpin the IUCN criteria (for taxa) and the relevant standards for extent and condition (for ecological communities), as a means of maintaining a current view of the state of significant native species and ecological communities.
2. Establishment and periodic updating of data in regard to observed or inferred trends for a) the occurrences of significant native species and ecological communities and b) the threatening processes that affect them. All observations and inferences would be supported by a detailed rationale and by an indication of their reliability. Summary data based on three trend categories (negative, stable, positive), coupled with reliability estimates, could then be presented in simple or more elaborate ways at local, regional, State or national scales.

This would provide an opportunity to analyse the data further to identify any patterns that might exist in relation to taxonomic group, land tenure, habitat or ecosystem type, bioregion, biome or threatening process. This would also provide an opportunity to examine the relationship between estimated or inferred trends for the biodiversity asset, the threats affecting it and the management activity associated with its occurrence.

In aggregate, this would provide *prima facie* evidence of causal relationships and hence contribute to the evaluation of management effectiveness. However, more structured, experimental approaches ('adaptive management') would still be required to provide more reliable evidence of causal relationships, if any, between management activities and outcome(s) observed for the species or ecological community.

The proposed monitoring and reporting protocol would require further development and refinement involving the key agencies and other stakeholders to realise its full potential. It does however provide sufficient direction and detail to function effectively.

Introduction

This section of the report provides some background to the project and describes the context within which the national protocol could operate. It includes a summary of current approaches being followed in selected English-speaking jurisdictions beyond Australia and summarises highlights and initiatives of the State and Territory Government agencies. Finally, it sets out the consultation process that has occurred to date and the findings of that consultation.

The Project

This report is the result of a project commissioned by the National Land and Water Resources Audit (NLWRA) as a component of the second National Biodiversity Assessment. The objective of the project is:

'To develop a national protocol for monitoring and reporting of status and trends in significant native species and ecological communities based on definitions of significance applied at national, state, territory and regional levels.'

The project's Terms of Reference, including additional information on the National Biodiversity Assessment can be found in Appendix I.

The project comprised the following tasks:

1. Review the requirements for the development of interim monitoring protocols for matters for target under the NM&EF.
2. Review the current knowledge base relating to monitoring and evaluating population trends in significant native species and communities
3. Review definitions of significant native species and communities and monitoring and reporting procedures for significant native species and communities at national, state, territory and regional levels.
4. Recommend a definition of significance for use in the protocol based on a critical synthesis of definitions following review and consultation.
5. Consult with national, state, territory and regional agencies and other key stakeholders to determine their requirements and seek their input to an interim protocol for national monitoring of extent, condition and trends in significant native species and communities.
6. Ensure the draft protocol is useful, relevant and able to be implemented at regional levels and also that the monitoring data can also be aligned with state and national reporting frameworks.
7. Draft the interim protocol for consideration by the Audit Advisory Council using the protocol template provided by the Audit.

Global context

The United Nations Convention on Biological Diversity (CBD) (Secretariat of the Convention on Biological Diversity 2005) was signed in 1992, reflecting widespread recognition of the need to address biodiversity loss. Australia is a signatory to the Convention and has made significant progress in addressing its obligations to develop national strategies and action plans to conserve and use sustainably the biological diversity within its jurisdiction.

Article 7 of this Convention provides the legal basis for biodiversity monitoring and associated activities, such as research and data management.

The following requirements of Article 7 are relevant:

- *Monitor, through sampling and other techniques, the components of biodiversity .... paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use.*
- *Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biodiversity, and monitor their effects through sampling and other techniques; and*
- *Maintain and organise, by any mechanism, data derived from identification and monitoring activities pursuant to subparagraphs ….. above.*

Many of the current activities occurring in nations across the world are as a consequence of commitments made under the CBD.

The target "to achieve by 2010 a significant reduction of the current rate of biodiversity loss" was agreed to by the Parties to the CBD in 2002. Also in 2002, the UN World Summit on Sustainable Development a commitment to achieve "by 2010 a significant reduction in the current rate of loss of biological diversity." The CBD 2010 Biodiversity Target indicators are reproduced in Appendix III.

World Conservation Union (IUCN)

The World Conservation Union (IUCN) is an international organisation comprising Government and non-Government member organisations and individuals. One of the key achievements of the IUCN has been to develop categories and criteria to assess species at risk. The IUCN Red List Categories and Criteria were first published in 1994. The categories and criteria *were developed to improve objectivity and transparency in assessing the conservation status of species, and therefore to improve consistency and understanding among users. The 1994 categories and criteria were applied to a large number of species in compiling the 1996 Red List of Threatened Animals. The assessment of many species for the 1996 Red List drew attention to certain areas of difficulty, which led IUCN to initiate a review of the 1994 categories and criteria, which was undertaken during 1998 to 1999. This review was completed and the IUCN Red List Categories and Criteria (version 3.1) are now published* (IUCN 2003).

This document provides:

- guidelines to the use of the categories and criteria;
- resolution of many of the concerns raised in the review;
- examples from various taxonomic groups to demonstrate the application of the criteria, and

- detailed explanations of the definitions of the many terms used in the criteria.

The guidelines should be used in conjunction with the official IUCN Red List Categories and Criteria booklet (IUCN 2001).

Europe

The European Union adopted the European Community Biodiversity Conservation Strategy (ECBS) in 1998. Four biodiversity action plans (natural resources, agriculture, fisheries and development), adopted in 2001, identified actions to be taken to implement the strategy.

A review of the implementation of ECBS was initiated in 2004 and led to a commitment to halt the loss of biodiversity by 2010. The Streamlining European 2010 Biodiversity Indicators (SEBI 2010) project was set up to monitor progress towards this commitment. The relevant indicators are:

- trends in the abundance and distribution of selected species.
- change in status of threatened and/or protected species.

United Kingdom

The following information is reproduced from the UK BAP and BARS websites (JNCC 2008).

The UK has developed a Biodiversity Action Plan (BAP) and an associated Biodiversity Action Reporting System (BARS). The UK BAP is the UK Government's response to the Convention on Biological Diversity (CBD) signed in 1992. It describes the UK's biological resources, commits a detailed plan for the protection of these resources. It includes the identification of Priority Species and Habitats. Three types of Action Plans have been developed (Species Action Plans, Habitat Action Plans and Local Action Plans) which set priorities for nationally and locally important habitats and wildlife. Each plan has costed actions and targets and reporting on the targets is done on a 3 - 5 year cycle.

The Biodiversity Action Reporting System (BARS) is a web-based information system that supports the planning, monitoring and reporting requirements of national and local Biodiversity Action Plans (BAPs). BARS enables everyone involved in BAP implementation to enter action plans and record progress towards targets and actions. BARS uses drop-down lists and quantitative fields to provide a standardised structure so that BAP information can be integrated across users. This information can be searched by members of the public to learn about BAP activities underway. A range of sophisticated reports is available to BAP users enabling them to generate summaries from their data and to set their work in the wider context.

In regard to trends, the BARS uses a similar approach to that proposed in this report. An example of a BARS report for species is proved in Appendix II, including a table and chart. The trend categories are as follows:

- Increasing
- Fluctuating - probably increasing
- Stable
- Fluctuating - probably stable
- Declining (slowing)
- Fluctuating - probably declining
- Declining (continuing/accelerating)
- Lost (since BAP publication)

- Lost (pre BAP publication)
- No clear trend
- Not a true species
- Unknown.

Trend information is maintained for each of the priority species and habitat. Accuracy is reflected in three categories based on the source of the trend information:

- Best guess
- Partial survey
- Sample or full survey.

New Zealand

The New Zealand Government produced *The State of New Zealand's Environment* in 1997 and the *New Zealand Biodiversity Strategy* in 2000. The Strategy was accompanied by a major funding initiative.

In 2001, the NZ Department of Conservation published the booklet *Making the Best Choices for Conservation* (DOC 2001). This publication was based on the concept of "Measuring Conservation Achievement". It assumed that by maintaining a full range of natural habitats and ecosystems populations of native species will be adequately conserved. Habitat or ecosystem are assessed to determine the extent to which their 'natural character' (the original pre-human condition) remains, measured on a scale from 0 to 1. Five attributes of natural character are quantified, based on ecological monitoring, scientific information and the judgement and experience of local staff. The attributes are plant and animal removal, pest pressure, weed pressure, resource modification and fragmentation. The relative cost-benefit of proposed management actions can then be evaluated on a basis of the degree to which the natural character would be restored. The natural character scores can also be aggregated across regions and nationally to provide an indicator of the state of biodiversity and trends over time.

The NZ Ministry for the Environment developed a set of environmental performance indicators, based on a pressure-state-response model. The relevant indicators included were:

- Change in the status of threatened species;
- Change in the distribution of selected threatened taxa, and
- Change in the biodiversity condition of selected terrestrial ecosystems.

It is not clear whether these protocols were adopted.

In 2005, Green and Clarkson (2005) undertook an independent review of the *New Zealand Biodiversity Strategy*. They concluded that progress had been unsatisfactory in two key areas relevant to monitoring: (a) the development and application of consistent measures and methods to monitor key changes in indigenous biodiversity throughout the country and (b) the compilation of monitoring results on conditions and trends into reports that are useful and relevant at local, regional and national scales for a variety of purposes.

They note that *DOC is continuing the development of a comprehensive and management-focused national inventory and monitoring framework for assessing biodiversity as well as development of its Natural Heritage Management System (NHMS). The latter will provide an integrated set of classification, decision support and inventory and monitoring tools that collectively move DOC to an outcome-based management approach. When it is operational NHMS should meet the reporting*

requirements of the Strategy and is also consistent with the mapping and tracking objectives of the Strategy (Green and Clarkson 2005).

Canada

In response to the CBD, the Canadian Government prepared the Canadian Biodiversity Strategy in 1994 (Environment Canada, 1994a). The Strategy includes the following strategic directions:

- *improve understanding of the current status of species and their populations, population trends and the causes of population and species changes in order to develop sound biodiversity conservation and sustainable use strategies.*
- *develop and implement monitoring programs to better understand the functional linkages in ecosystems, evaluate the success of conservation and sustainable use programs, and better integrate the monitoring of biotic and abiotic parameters;*
- *maintain and enhance bioclimate monitoring to track the effects of atmospheric changes on ecosystems, species and genetic diversity;*
- *investigate and implement means to enhance the collection, sharing, analysis, scope and distribution of data and information pertaining to the sustainable use of biological resources;*
- *develop and use biodiversity indicators that are meaningful, scientifically defensible, practical and compatible with regional, provincial, territorial, national and international programs.*

The Canadian Biodiversity Index (CBI) was developed to assess and convey biodiversity issues and management across Canada (Grosshans *et al.* 2006). The CBI is a tool for capturing and conveying credible information on the status and trends in biodiversity in a consistent manner and presents it in a composite index.

The CBI combines indicators from four components: species and genes, habitat or community quality and quantity, landscape and global influences, and human influences.

USA

There appears to be no national approach to biodiversity monitoring and reporting in the USA. However, the US Department of Agriculture (USDA) Forest Service has developed comprehensive guidelines for the development of protocols for assessment and monitoring of species (Vesely *et al.* 2006).

The USDA has also developed an approach to monitoring of biodiversity within its forest estate: the Multiple Species Inventory and Monitoring Protocol (MSIM) (Manley *et al.* 2006). The program is designed to provide a minimum of presence/absence and habitat data for a range of species using the Forest Inventory and Analysis systematic grid for sampling. It is designed to apply to both National Forest Service (NFS) and non-NFS lands at multiple scales for a variety of applications. Survey methods are described for taxonomic groups as follows: land birds, raptors, small mammals, medium and large mammals, bats, terrestrial amphibian and reptiles, vertebrate monitoring in aquatic ecosystems, plant species and habitat monitoring.

Australian context

The development of these protocols exists within a broader statutory, institutional and policy context. Historically, natural resource management in Australia has been primarily a responsibility of State and Territory Governments, with the role of the Australian Government largely restricted to import-export regulation and participation in international matters such as migratory bird agreements and the International Convention on Trade in Endangered Species (CITES).

Specific nature conservation legislation generally evolved in the 1970s although the WA *Wildlife Conservation Act 1950* was an early example. Most of this legislation dealt with the establishment of conservation reserves and the management of wildlife, including game species.

Threatened species legislation arose principally during the 1980s and 1990s. The passage of the *Endangered Species Protection Act 1992* (ESP Act) signalled an increasing role for Commonwealth, albeit with a focus on identification of threatened species, endangered ecological communities and key threatening processes, and the preparation of recovery and threat abatement plans. The role of the Australian Government was further strengthened when the ESP Act was replaced by the *Environment Protection and Biodiversity Conservation Act 1999* which included substantial environmental impact assessment and regulation powers in addition to the listing and planning provisions.

The 1990s also saw the emergence of major natural resource management programs that focused on community-based action. The National Landcare Program (NLP) commenced in 1992, based on the Victorian Landcare Program initiated in 1986. The Howard Government brought a range of national natural resource management programs together under the banner of the Natural Heritage Trust (NHT). Together with the National Action Plan for Salinity and Water Quality (NAP), the NHT drove the establishment of regional natural resource management bodies, of which 56 now exist across Australia.

The role of the regional bodies was to prepare a regional strategy to guide investment. In order to achieve accreditation (and therefore funding), the regional strategy had to address the ten matters for target (if relevant) and identify management action targets (MATs) and resource condition targets (RCTs) for each. Joint Commonwealth/State investment in the implementation of accredited regional strategies was governed by bilateral agreements and associated processes.

The emphasis on monitoring, evaluation and reporting increased over the life of the NAP and NHT, leading to the development of the National Monitoring and Evaluation Framework in 2003. This framework is to be replaced by the National Natural Resource Management Monitoring Evaluation Reporting And Improvement (MERI) Framework, which is to be finalised in the near future.

In 2008, the Rudd Government launched “Caring for Our Country” program to replace the existing NAP, NHT and NLP. (Australian Government 2008).

Coupled with the ‘regional delivery’ model adopted by the NAP/NHT programs, there has been an increase in the role of local government in natural resource management generally and biodiversity conservation in particular. This may be linked to the rise in community awareness and concern about environmental degradation and biodiversity decline which has occurred over the past 20 to 30 years and the associated influence on

planning and development issues. Many local government bodies now include biodiversity conservation objectives in their strategic planning.

The past decades have also seen an increasing role for non-government organisations such as Greening Australia and Conservation Volunteers, and for privately-funded organisations such as Australian Bush Heritage Fund and Australian Wildlife Conservancy which purchase and manage a range of substantial properties throughout Australia.

Biodiversity conservation research activities continue to occur across an institutional spectrum from the CSIRO, State and Territory conservation agencies and the university sector, supported by Australian Research Council grants and direct investment by governments. The advent of Co-operative Research Centres and Commonwealth Environment Research Fund 'hubs' has increased the level of strategic planning and collaboration in biodiversity conservation research.

Biodiversity strategies (or variants thereof) have been developed at the Commonwealth level (DEST 2006) and in most States and Territories.

Most jurisdictions also have a requirement for periodic State of the Environment reporting. The National State of the Environment Report produced in 2006 included 'Conservation status of nationally significant species and ecological communities, compared with previous years' amongst the indicators of the state of biodiversity.

The key conclusion is that nature conservation has moved from being centred in State and Territory agencies and focusing on public land and wildlife management to a far more complex arrangement of three tiers of government, regional NRM bodies, non-government organisations, and private institutions working across public and private land and focusing on aquatic as well terrestrial ecosystems.

State and Territory initiatives

New South Wales

The following information has been sourced from the NSW Department of Environment and Climate Change (DECC) website (DECC 2008).

DECC has developed the Priority Actions Statement (PAS). The PAS:

- *sets out the recovery and threat abatement strategies to be adopted for each threatened species*
- *establishes relative priorities to implement the above strategies*
- *establishes performance indicators to report achievements in implementing recovery and threat abatement strategies and their effectiveness*
- *contains a status report on each threatened species (where information is available)*
- *sets out clear timetables for recovery and threat abatement planning and achievement.*

DECC is also developing a NSW monitoring and evaluation program for threatened species, including measuring the response of individual species, populations, ecological communities and their habitats to action implementation. This response may be measured in terms of a positive, stable or negative change in the distribution or abundance of a species or population, or the extent of an ecological community; habitat

condition and the severity of the risk or threat. Measures will be incorporated to deal with uncertainty arising for detectability and stochastic factors.

Queensland

The Queensland Environment Protection Authority (QEPA) has developed the Back on Track initiative, including a scoring system to rank priority species for conservation management. The following is a precis of information from the QEPA website (QEPA 2008):

The 'Back on Track' framework is designed to prioritise all species, regardless of their current classification under the Queensland *Nature Conservation Act 1992* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, to better reflect the level of management required for conservation and recovery. The framework is used to score plant and animal species from marine, freshwater and terrestrial habitats. Multiple criteria are used to identify those species which are most in need of conservation action and have the greatest chance of recovery.

The process starts by identifying priority species, and then uses this information to identify the common threats and actions where invested resources will give the greatest conservation benefit. In this way, 'Back on Track' encourages a multi-species/ecosystem approach to conservation.

The 'Back on Track' framework increases the capacity of government, Natural Resource Management (NRM) bodies and communities to make decisions about where to focus on-ground action and investment to deal with threatened species and communities.

The 'Back on Track' species prioritisation framework is based on Marsh *et al.*(2006) Optimising allocation of management resources for wildlife (Conservation Biology published online November 2006). This method provides an opportunity for both scientists and decision-makers (managers) to provide input, and can be applied across a range of taxonomic groups.

QEPA has also commenced development of the Recovery Actions Database (RAD) which will, when implemented in late 2008, store recovery actions and record the results of implementation.

Regional ecosystems have been identified and mapped across Queensland. This information is publicly available through the QEPA website at http://www.epa.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems.

Northern Territory

The Northern Territory Department of Natural Resources, Environment and the Arts has recently prepared a report titled ‘Monitoring Biodiversity in the Northern Territory’ (Griffiths *et al.* 2008). The report reviews existing Department- and community-based monitoring programs and makes a series of recommendations regarding the development of a biodiversity monitoring framework.

South Australia

The South Australian Government has produced ‘No Species Loss - A Biodiversity Strategy for South Australia 2006-2016. The strategy has a timeframe of 25 years.

No Species Loss aims to promote strategic thinking for achieving its recommendations and targets, while encouraging ownership, engagement, partnerships and innovative

solutions. The framework for action to achieve the strategy's five goals is based in five strategic areas:

- Conserving South Australia's biodiversity;
- Addressing the impacts of climate change;
- Improving information, knowledge and capacity;
- Coordinating and integrating within the natural resource management sector, and
- Raising community awareness and participation.

Under the first strategic area there are six targets including halting decline, determining conservation status and establishing benchmarks against which progress can be measured.

Tasmania

There has been a series of initiatives undertaken by the Tasmanian Department of Primary Industries and Water, including:

- Development of the Natural Values Atlas;
- Publication of the *Threatened Species Strategy for Tasmania* (DPIWE 2000), which includes an action to monitor the condition of threatened species;
- Classification, description and establishment of benchmarks for native vegetation (TasVeg), and
- Publication of a technical manual for vegetation monitoring (Barker 2001).

Victoria

The following Victorian programs and initiatives are relevant:

- classification, conservation status assessment, mapping of current extent and modelling of pre-1750 extent of native vegetation;
- implementation of Victoria's Native Vegetation Management: A Framework for Action, including guidelines for assessment of vegetation condition using the "habitat-hectare" approach;
- development of modelling techniques to assess the extent and condition of native vegetation and estimate trends over time;
- development of information systems to track losses and gains in the extent and condition of native vegetation as a result of permitted clearing, associated offsets and investment program, and
- development of the Actions for Biodiversity Conservation (ABC) system in order to:
    - identify priority locations for threatened species & communities and priority management actions at those locations
    - communicate actions and priorities to land managers
    - monitor progress towards implementation by recording and reporting on results
    - prepare and review Action Statements and Recovery Plans
    - record and report on the state and trends for threatened species & communities

Information on the items listed above is available on the Department of Sustainability and Environment website (http://www.dse.vic.gov.au).

Western Australia

The WA Department of Environment and Conservation has produced *A Strategic Plan for Biodiversity Conservation Research 2008 – 2017* which includes the following targets:

- Within five years:
  - to provide the scientific basis for, and assist with, the development of cost-effective protocols for monitoring resource condition at various scales (landscape, ecosystem, protected area and species) and
  - to establish climate change monitoring protocols and priorities for 'at risk' species, communities and ecosystems.
- Within 10 years:
  - to assist with the development and implementation of a framework and cost effective protocols for monitoring resource condition at various scales (landscape, ecosystem, protected area and species);
  - to establish scientifically sound protocols and assist with the implementation of marine resource condition monitoring for all marine parks and reserves including sanctuary zones, threatened marine fauna, significant marine ecosystems and other benchmark areas and
  - to assist with the development of corporate monitoring data and information systems.

DEC (WA) has also initiated a resource condition monitoring program to be based monitoring protocols incorporated into a set of standard operating procedures. There also exists a well-established plant population monitoring database and a database for threatened ecological communities. DEC (WA) has also developed IUCN-style criteria for assessing the conservation status of ecological communities.

Consultation

Process

Consultation for this project was based around a 30 question questionnaire and six workshops. The questionnaire was circulated to members of the Biodiversity Assessment Working Group representing the six Australian States and the Northern Territory in November 2007. The purpose of the questionnaire was to elicit information on:

- the statutory and institutional responsibilities for monitoring and reporting on significant native species and ecological communities;
- the definition of significance (if any) used at a State and/or regional level;
- current and proposed indicators and targets for significant native species and ecological communities, and
- current and proposed monitoring and reporting activities for significant native species and ecological communities, and
- current and proposed information systems supporting monitoring and reporting activities for significant native species and ecological communities.

A copy of questionnaire is included in Appendix IV.

Subsequent workshops were held in each State capital city, commencing in Hobart (12/2/2008), followed by Perth (18/2), Adelaide (29/2), Brisbane (5/3), Sydney (6/3) and Melbourne (9/4). The workshops were organised in consultation with the relevant Biodiversity Assessment Working Group member. Wherever possible, invitations were extended to AGNRM facilitators and representatives of regional NRM bodies. State TSN Co-ordinators were represented at three of the six workshops.

The degree of consultation with regional NRM bodies was limited to some degree by the capital city location of the workshops. Additional scope for regional workshops would have benefitted the consultation process.

The workshops generally ran for three hours. The objectives of the workshops were:

- to increase awareness about the development of the protocol;
- to review the issues covered in the questionnaire, and
- to seek feedback from participants on the general approach being proposed.

A copy of the workshop agenda is provided in Appendix IV.

Findings

The following points summarise the general findings from the workshops:

- The term ‘significant’ is generally associated with threatened species and ecological communities;
- The term significant is not explicitly defined in any jurisdiction;
- Each jurisdiction maintains a statutory and/or formal (non-statutory) lists of threatened species and communities
- Definitions, listing categories and criteria are documented and published in each jurisdiction;

- The listing categories and criteria used are broadly consistent with the IUCN Red List categories and criteria;
- The concept of significance is widely applied at a national and State scale;
- The concept of significance is not widely applied at a regional scale, although there is interest in recognising biodiversity assets at this scale, especially among NRM bodies;
- There was general support for including (by exception) non-threatened species and ecological communities within the definition of significant, especially where the rationale was based on ecological or evolutionary attributes;
- There was some support for including socially or culturally significant species and ecological communities within the definition of significant;
- There was only modest support for including economically significant species within the definition of significant;
- Indicators and targets were generally based on the conservation status of species, assessed at a whole of species level; (not the case in Queensland or NSW where populations, subsp. etc are listed)
- Current monitoring programs focused on a relatively small number of species and were generally associated with recovery plan implementation;
- In most cases, these programs were focused on estimating the size of populations, although some included monitoring of threatening processes;
- There is likely to be a bias towards certain taxonomic groups (e.g. birds and mammals cf. invertebrates) and habitats (terrestrial cf. aquatic), and towards actively managed populations as opposed to 'unmanaged' populations;
- All jurisdictions were following a broadly similar approach to the classification of native vegetation types and to assessment of vegetation extent and condition
- Jurisdictions were all in the process of reviewing or developing information systems to assist with storage and retrieval of monitoring data;
- Some jurisdictions were also developing or proposing to develop information systems to assist in recovery planning, priority setting and reporting on management activity.

Design Principles

The proposed approach is based on a set of principles that reflect the most important elements of both the purpose of the protocols and the real-world constraints surrounding their implementation.

The protocol must be useful for reporting at a wide range of scales: local, regional, State/Territory–wide and national.

It is vital that the protocol is designed in a way that allows the data to be used for multiple uses at multiple scales. This will in turn encourage further investment in monitoring and reporting from other agencies and areas of government that are currently not investing in the collection of these data.

The protocol must enable data to be aggregated across species and geographic areas.

Given the enormous variation in the biology of native species that could be included within the definition of significant, it is vital that the protocol provides for a degree of aggregation of data, so that brief 'headline' information can be generated. At the national and State level, there will be considerable demand for clear 'take home messages', along the lines of '65% of significant native species are ……' This is why conservation status, based on the IUCN categories and criteria or other similar approaches, is so often used in high level reporting on threatened species outcomes, in spite of its shortcomings.

The protocol must provide data that are readily explicable.

It must be possible to drill down into the data to determine the basis for the reported information. It is likely that only summary information will be collated for reporting purposes, it must be possible to interrogate the source information to determine, for example, the specific monitoring methods used or the rationale for the delineation of a particular occurrence.

The protocol must provide data that are representative.

Ideally, the protocol should provide comprehensive data. At a minimum, the protocol must provide representative data. This means monitoring and reporting on significant native species and ecological communities from across the range of biomes, bioregions, and ecosystems, as well as (for species) across the range of taxonomic groups. In order to support evaluation, it will also be necessary to include 'unmanaged' examples.

The protocol must provide data that are reliable.

Ideally, the protocol should provide highly reliable data. At a minimum, the reliability of the data must be explicit and must survive the aggregation process, so that summary information still carries with it an indication of the reliability of the component data.

The protocol must make sense to a wide range of stakeholders..

The protocol has to provide information that is intelligible to Ministers, senior managers, board members of regional NRM bodies, agency staff, key non-government stakeholders and the informed public. The concepts and language must be as simple and unambiguous as possible.

The protocol must be able to be implemented cost effectively.

For cost effectiveness, it is important that maximum benefit is derived from existing monitoring programs. A totally novel approach requiring the establishment of new monitoring programs and information systems should be avoided.

The protocol must be flexible enough to allow for implementation to proceed from a relatively low base.

In some regions, there will be a paucity of information on the state and trends of significant native species and ecological communities. It is important that information deficiencies do not preclude the use of the protocol for monitoring, evaluation and reporting. Rather, the protocol should make it easy to start with relatively patchy and unreliable data but also provide incentives to progressively improve the representativeness and reliability of the data.

Key issues

Defining significance

For taxa, there is a strong emphasis world-wide on conservation status as the key criterion of significance. The IUCN Red List Categories and Criteria (IUCN 2001b) are the global standard and many jurisdictions use these as the basis for their biodiversity indicators. There is however much less emphasis on taxa which might be of ecological significance, either through their ecological function or their value as an indicator of ecosystem condition. An exception is the focal species approach (Lambeck 1997).

The cultural significance of taxa, especially among indigenous communities, is recognised in many countries. Cultural significance also applies more broadly where communities implicitly place a higher value on some species than others for social and/or economic reasons. It is much easier to raise community concern (and therefore resources for conservation) about 'charismatic' species such as the koala than about less charismatic species such as most reptiles or plants.

It is perhaps not surprising that the best studied population in Victoria is that of the Little Penguin at Phillip Island. This population is the focus of one of the premier tourist attractions, with nightly viewings of the penguin parade by hundreds of mostly international tourists. The population is therefore a very significant economic asset and hence the focus of excellent research and monitoring programs.

Marsh *et al.* (2006) developed and applied a system for ranking taxa based on threat category, consequences of extinction, and potential for successful recovery. *This approach provides opportunity for independent input by policy makers and other stakeholders (who weight the relative importance of the criteria) and scientists (who score the species against the criteria). Thus the process explicitly separates societal values from the technical aspects of the decision-making process while acknowledging the legitimacy of both inputs* (Marsh *et al.* 2006).

Redding and Mooers (2006) recommend the inclusion of phylogenetic distinctiveness as a factor in ranking species for conservation effort.

The assigning of significance to ecological communities is generally based on conservation status. While there is no equivalent to the IUCN Red List for ecological communities, most State and Territory conservation agencies have developed categories and criteria to determine the conservation status of ecological communities. These are generally based on the same broad themes used to determine the conservation status of taxa: rarity, historic depletion, ongoing decline in extent and/or condition, exposure to current or future risk.

For the purpose of reporting on status and trends of ecological communities, it is not necessary that all jurisdictions conform to the same rule set, provided that the rule-set they use is explicitly documented and consistently applied.

In summary, there appears to be a consensus that threatened species and ecological communities should be considered 'significant' as a rule. Further species and ecological communities could be included by exception within the definition of 'significant' on the basis of their ecological, evolutionary or cultural importance provided that they satisfied prescribed criteria. (Note that the criteria are still to be refined.)

Standard monitoring techniques – do we need them?

Some of the monitoring and reporting protocols for other matters for target are highly prescriptive in regard to the parameters to be measured and the monitoring methods to be applied. The measured parameter is highly specific and there exist standard monitoring methods that can be applied wherever the matter for target occurs. In some cases, this can be done at relatively low cost and can involve active participation by relatively unskilled community groups.

There are several reasons why this is not appropriate for significant native species and for some ecological communities. The first reason relates to the highly variable biology of the species concerned. It is not sensible (or indeed possible) to apply the same monitoring methods to Blue Whales and Golden Sun Moths. Even attempting to measure the standard parameters on which the IUCN criteria are based, such as estimating the number of mature individuals, is fraught with difficulty when dealing with highly cryptic species, such as the Spotted-tailed Quoll. For this species, simply to be confident that a recorded absence is a true absence requires very substantial survey effort. It is also difficult to determine the number of mature individuals in clonal species, especially if we are attempting to identify genetically distinct individuals. Other species have life cycles where mature individuals are not always present, such as many disturbance-adapted plant taxa.

The second reason relates to habitats and environments occupied by the significant native species and ecological communities. Aquatic environments generally present additional challenges for monitoring and require different methods. While monitoring in terrestrial environments is generally more straightforward, there will remain scale and accessibility issues to contend with. Ultimately, cost and feasibility will remain over-riding constraints on the range of parameters measured and the methods used.

It should be noted that the Australian Government and several State and Territory conservation agencies have developed or are developing a set of guidelines or standard operating procedures for biological survey and monitoring. These should be applied where relevant. In all cases, efforts should be made to ensure that, whatever monitoring methods are used, they will be most cost-effective in obtaining information that is relevant and as reliable as possible.

Given the above, the optimal monitoring program for a given occurrence of a significant native species or ecological community will be determined locally on the basis of biological characteristics and resourcing constraints. This is consistent with the findings of Campbell *et al.* (2002), who having reviewed monitoring components of 181 recovery plans, concluded:

- tracking population size was far more common than monitoring of other factors such as demographics or habitat features;
- the extent and nature of the monitoring reflected taxonomic biases;
- the biology of the target species was often poorly reflected in monitoring techniques applied, and
- monitoring efforts did not adequately target threats.

Campbell *et al.* recommended that "…species-specific attributes factor more prominently in the development of monitoring to avoid monitoring action that is otherwise unnecessary."

Is conservation status a good indicator of trends?

The commentary to Biodiversity Indicator 'Conservation status of nationally significant species and ecological communities, compared with previous years' in the Australian State of the Environment Report 2006 stated:

While changes in the conservation status of species and ecological communities tells us more about changes in the state of our knowledge, and community concerns than it does about the condition of species more broadly, it does provide some insight which particular species that are believe to be threatened, and allows us to focus on trends in those species as a surrogate indicator for trends in the condition of biodiversity more broadly. It should also be noted that conservation status may also change without any underlying change in the number or distribution of individuals or in the processes affecting them. This occurs when new observations result in a reassessment of area of occupancy, extent of occurrence, population size, threat status, trends in population size or other factors contributing to assessment of conservation status.

(Source: http://www.environment.gov.au/soe/2006)

Changes in the number of taxa in the various conservation status categories is widely used as an indicator of high order trends for significant native species, including, for example, in the CBD 2010 Biodiversity Target indicators and in the 2008 Australian Biodiversity Assessment.

However, the use of conservation status as an indicator has several shortcomings:

- most changes on lists of threatened species are the result of improved information especially in regard to distribution and abundance or as a result of taxonomic revisions and new discoveries that, on balance, are likely to increase the number of taxa recognised and disproportionately increase the number of rare, restricted and threatened taxa;
- changes in conservation status are usually determined at a whole of taxon scale, which tends to average, and therefore potentially conceal, any real changes that might have occurred at a regional or local level, limiting the value of this indicator in reporting at regional scales;
- conservation status categories are rather broad. Substantial change can occur in the state of a taxon without leading to a change in category. For example, the rate of decline in a species in terms of population size can double from 20% to 40% without causing a change in its categorisation against IUCN criteria.

The impact of the first point is greatest in regions that are relatively poorly surveyed and for relatively poorly resolved taxonomic groups; these impacts can be expected to lessen as Australia's biodiversity becomes better known. The impact can also be addressed, as has been done in the 2008 Biodiversity Assessment, by providing the reasons for change and then determining the status changes that are based on real changes rather than improvements in knowledge or understanding. The second shortcoming can be addressed by assessing the status of populations or occurrences and aggregating these to the whole of taxon level to enable continental or global status reporting, as recommended in the attached draft protocol.

Quayle and Ramsay (2006) reviewed provincial lists of species at risk in British Columbia and found that 65% of additions and deletions were due to improved knowledge, changed assessment procedures and changes to taxonomy. They also found that other status changes did not result in changes to the list and reported considerable

ambiguity about which baseline used for assessment. They discouraged continued use of indicators based solely on conservation status as a means of tracking biodiversity and recommended strategic indicators based on long-term monitoring data with 'deliberate and explicit' baselines.

Butchart *et al.* (2006) respond to Quayle and Ramsay's criticisms and argue in support of the use of the IUCN Red List Index (RLI) for this purpose:

The key strength of the RLI is its geographic representativeness, being based on information for nearly all species in a taxonomic group (worldwide or at the relevant subglobal scale). Its principal weakness is that it has a somewhat coarse temporal resolution: species may take some time to change in population size, trend, or range size sufficiently to cross the thresholds to qualify for placement in a higher or lower red-list category. Although population trend-based indicators show higher temporal resolution (greater sensitivity to status changes), such information tends to be available only for certain types of species in better-known (often biodiversity poor) regions. Hence the RLI and population-trend based indicators are highly complementary in terms of their geographic representativeness and temporal resolution.

Further debate in the literature has focused on the recognition of uncertainty in conservation status assessments. For example, Akçakaya *et al.* (2000), Todd and Burgman (1998) and Burgman *et al.* (1999) have discussed this issue and proposed means of addressing it. The 2001 Red List Categories (IUCN 2001) incorporate guidelines on uncertainty and the 2003 Guidelines for Application at Regional Levels (IUCN 2003) provide further detail.

Is expert opinion useful?

In many cases, expert opinion, usually based on ad hoc observations or anecdotal information, will be the only source of evidence for a trend or information for a status assessment. In some cases, expert opinion will be the most reliable source of information, as information based on structured data collection might have been limited in time or space. The Australian Centre for Risk Analysis (ACERA, see http://www.acera.unimelb.edu.au/) is undertaking a project which will:

… provide detailed guidelines for eliciting values and structures from experts that will make best use of framing, context, behavioural and numerical techniques, to arrive at the best possible expert assessment.

Given that expert opinion is likely to be a key component of status and trend reporting for the foreseeable future, it is vital that approaches are adopted that minimise the influence of subjectivity, bias and ambiguity in the gathering of expert opinion.

One approach which can combine expert opinion with real data is known as Bayesian analysis. Wade (2000) stated that:

Bayesian statistical inference provides an alternate way to analyze data that is likely to be more appropriate to conservation biology problems than traditional statistical methods.

The Victorian Department of Sustainability and Environment is currently developing the capacity to use Bayesian Belief Networks as part of its approach to monitor and report on trends for threatened species and ecological communities.

The use of expert opinion should in no way suggest that structured data collection and analysis is not essential to monitoring and reporting. The critical issue is that is should

be done well. Field *et al.* (2007) stress that when resources are made available for monitoring, it should be undertaken as rigorously as possible. They attribute current shortcomings to the failure of scientists, land managers and bureaucrats to work effectively together. McCarthy and Possingham (2007) advocate the use of adaptive management approaches, which provide the benefit not only of assessing the species or population in question but also assessing the effectiveness of management action and therefore improving the confidence with which future interventions can be planned.

The Applied Environmental Decision Analysis hub (AEDA) is funded by the Australian Government's Commonwealth Environment Research Facility (CERF) program. AEDA's focus is on:

- *optimal monitoring**:** examining why, what and how monitoring is carried out in order to ensure it is done effectively. This theme also examines how much money is spent on what.*
- *prioritisation and spatial planning**:** research on how resources are best applied in issues such as designing reserves or allocating funds for the management of threatened species.*
- *environmental decision making**:** investigating how we makes decisions. This theme overarches everything AEDA does. How do groups of people come to make decisions?*

(Source: http://www.aeda.edu.au)

Rigour versus representativeness

The most fundamental challenge facing the proposed protocol is the conundrum: :

- invest heavily in monitoring a small number of species or occurrences in order to obtain highly reliable state and trend information; or
- invest more broadly in monitoring and reporting on a wide range of species or occurrences in order to maximise representativeness, in terms of taxonomic groups, habitats, threats and management activity.

There is no correct solution or formula to deal with this conundrum.. Given the current, relatively modest proportion of funding for significant native species and ecological communities devoted to monitoring and reporting, it is likely that most agencies will adopt a compromise that is open to criticism from both the rigour and representativeness points of view.

In an ideal world, sufficient resources would be available to monitor Possingham et al

How do we reflect reliability in trend information?

There are a range of options for representing the level of reliability of trend information. Two are considered here: the first is to assign categories based on the source of the information, such as:

- expert opinion based on ad hoc observations or other sources of evidence;
- structured sampling or measurement of part of the population or extent of the ecological community with extrapolation, and
- structured sampling or measurement of the whole population or extent of the ecological community (without extrapolation).

These categories reflect reliability but can be a poor fit: some expert opinion will be highly reliable while in other cases, rigorous data collection and analysis will yield inconclusive results. However, this remains a simple option which has been used, for example, in the approach adopted in the United Kingdom (see Appendix II).

The second approach is to assign probabilities to each of the trend categories (positive, stable, negative) that reflect the reliability of the trend information, regardless of the source of the information. This approach is superior from a theoretical viewpoint but might be more difficult to implement and is prone to recorder variation.

Conclusions

1. In spite of legislative and policy commitments, monitoring and reporting of status and trends of significant native species and ecological communities remains a challenging task for all levels of government in Australia, including the regional natural resource management bodies.
2. Threatened species and ecological communities should be considered 'significant' as a rule. Further species and ecological communities could be included by exception within the definition of 'significant' on the basis of their ecological, evolutionary or cultural importance provided that they satisfied prescribed criteria. (Note that the criteria are still to be refined.)
3. A consistent national approach to monitoring and reporting would be highly beneficial in terms of avoiding duplication and achieving a better, more robust result.
4. It is vital that the reasons for undertaking the monitoring and reporting and ways the data would be used are explicit.
5. It is not feasible to develop or adopt standard monitoring techniques that could be applied to all species and ecological communities in all circumstances. Setting a national standard in a bureaucratic manner is likely to stifle rather than foster continuous improvement. However, the development, continuing improvement and promulgation of sound monitoring techniques should be encouraged.
6. The IUCN Red List categories and criteria should be used to maintain a national understanding of the conservation status of native species.
7. The IUCN Red List categories and criteria should only be used as an indicator of high level trends where changes in status are based on real changes in population or habitat parameters and not on improved knowledge (including better information on distribution and abundance, new discoveries or taxonomic change).
8. Trends in population and threat parameters, observed, inferred or estimated at the level of occurrences of species or ecological communities, should be used as the key indicator of trend. Trends should be based on the most appropriate parameters for the occurrence in question (in terms of feasibility and strength as indicators) and could also be based on a combination of parameters, integrated in an index.
9. Levels of reliability should be reflected in the data and should survive the aggregation process.
10. Expert opinion should be used in estimating status and trends but measures should be adopted to reduce the impact of subjectivity, bias and ambiguity as part of the data collection process.
11. Monitoring and reporting on management activity should be included
12. Further work is required to refine the protocol (if endorsed) in order to maximise the benefits arising from its implementation.
13. The consultation process undertaken as part of this project generally endorsed the approach adopted in the draft protocol.

Recommendations

1. That the draft protocol presented in Appendix I be endorsed as a major step forward.
2. That an informal working group including Australian Government representatives, State and Territory Government representatives and key researchers be established for 12 – 18 months to further refine the protocol and associated information systems and processes.
3. That the informal working group further develop and seek endorsement for:
   - Criteria for inclusion of species and ecological communities on the basis of their ecological, evolutionary or cultural importance.
   - Systems and processes for aggregating status and trend data.
   - Measures to address the representation of reliability and uncertainty.
   - Standards for access, use and interpretation of data at various levels.
   - Standards for recording management activity, status and trend information.

Glossary

Ecological communities

An ecological community is an assemblage of flora and fauna taxa occurring together in the wild. In many cases within the terrestrial biome, the definition of ecological communities will based on native vegetation and will align with national standards. However, there will also be ecological communities, such as the Cave Root Mat communities in Western Australia or the San Remo Marine Community in Victoria that are defined on a different basis. It might be necessary to develop national guidelines and standards for the identification and description of non-native vegetation based ecological communities to improve consistency between jurisdictions.

Evaluation

Evaluation is the act of assessing the value or worth of something. In NRM terms, evaluation is the process of determining the effectiveness of a given program or intervention in achieving specified objectives.

Monitoring

Monitoring is the act of observing or collecting and analysing data in regard to a particular item or process, usually repeated periodically and with the intent of detecting change, if any, over time.

Occurrence

An occurrence is a user-defined geographic unit within the distribution of a significant native species or ecological community. It might equate to a single population of a species or a stand of an ecological community. Equally, it might group populations or stands within a land management unit such as a National Park in order to simplify reporting. Conversely, it might be a subdivision of a widespread population of stand on the basis of land tenure or regional/bioregion boundaries. It is more an administrative construct than a biological concept.

Reported occurrence

A reported occurrence is an occurrence that is subject to monitoring and reporting.

Threat

A threat is factor that is or has the potential to have deleterious effects on a population or its habitat or on an occurrence of an ecological community. Threats include factors that are currently operating as well as risks that, while not currently affecting the asset, might lead, directly or indirectly, to future impacts.

Threat abatement

Threat abatement refers to management interventions designed to reduce or eliminate the impacts of one or more threats.

Trend

A trend is a direction of movement in the state of a parameter or condition over time.

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Appendix I: Proposed protocol

(Note: This proposed protocol is to be amended and formatted into the specified template for presentation to the AAC)

Definition of 'significant'

The term 'significant native species' includes:

- all taxa listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999*;
- all taxa listed as threatened under relevant State and Territory legislation;
- all taxa not included in the points above but included in authoritative lists of species of conservation significance published by State and Territory conservation agencies.

The term 'significant native species' may also include:

- specified taxa considered to be ecologically significant (e.g. on the basis of their ecological function or value as an indicator);
- specified taxa considered to be of evolutionary significant (e.g. primitive, relictual, unique etc.);
- specified taxa considered to be culturally significant for indigenous or non-indigenous communities;

It would be necessary to develop criteria for including taxa in each of these categories.

The term 'significant ecological community' includes:

- all ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*;
- all ecological communities listed as threatened under relevant State and Territory legislation;
- all ecological communities not included in the points above but included in authoritative lists of communities of conservation significance published by State and Territory conservation agencies.

The term 'significant ecological community' may also include:

- specified ecological communities considered to be ecologically significant (e.g. on the basis of their ecological function or value as an indicator);
- specified ecological communities considered to be of evolutionary significant (e.g. primitive, relictual, unique etc.);
- specified ecological communities considered to be culturally significant for indigenous or non-indigenous communities;

It would be necessary to develop criteria for including ecological communities in each of these categories.

The following proposal has three elements:

- management activity;

- status of significant native species and ecological communities (ie the asset), and
- trend of asset occurrence and threat.

Management Activity

Management activity refers to targetted interventions to manage threats or to maintain or increase the abundance or health of an occurrence of a species or the extent or condition of an ecological community. There will be a need to differentiate between interventions that are incidental to the asset (i.e. do not abate a specific threat to that occurrence) and those that are of direct benefit, regardless of whether they occur at a site-specific or landscape scale. In addition to on-ground activities such as fencing and pest control, management activities include survey, monitoring and research, planning, community engagement, captive management and so on. In order to evaluate program effectiveness, it is necessary to identify patterns of correlation between activity and outcome. Adopting a simple set of standards for monitoring and reporting on management activity is a relatively straightforward first step.

Indicator

The number of targetted threat mitigation and population enhancement activities completed or significantly progressed, expressed as a proportion of the total number of targetted threat mitigation and population enhancement activities scheduled to be undertaken.

Ideally, this would also be reported according to the relative priority of the management activities and should be based on approved recovery plans or similar documents. The data should be updated annually and reported as necessary to support regional, State and national reporting processes.

Minimum data requirements

The following list of minimum data requirements is provisional. A specific project would be required to finalise these in consultation with key agencies.

Asset identifier; Asset name; Asset type; Asset occurrence identifier; Asset occurrence name; Asset occurrence location; Activity name; Activity class; Activity year; Activity status; Contact person; Contact organisation.

Roles and responsibilities

The role of data capture and management should be undertaken jointly by NRM bodies and State/Territory conservation/land management agencies, preferably using a common system within each jurisdiction.

Status

Understanding the status of significant native species and ecological communities is valuable in the same ways as an individual knowing the balance of their bank accounts or the value of their home. It assists in painting a picture of the state of the Australian environment. The global standard for the status of species is the set of categories and criteria developed and maintained by the IUCN Species Survival Commission. In spite of the limitations of this approach (see below), it is nevertheless adopted as part of the proposed protocol.

Indicator - significant native species

Indicator:

- Conservation status at a national or regional scale based on the IUCN categories and criteria.

Component parameters (refer to IUCN 2004 for further explanation):

- Extent of range, expressed as a linear distance or an area in hectares.
- Area of occupancy, expressed in hectares.
- Extent of habitat, expressed in hectares.
- Condition of habitat, expressed as a decimal fraction of an approved habitat condition benchmark tailored to the species.
- Number of populations
- Number of mature individuals
- Rate of change in each of the parameters above, over 10 years or three generations, whichever is greater.

It will be necessary to include upper and lower 90% confidence limits to estimates in regard to each parameter, allowing for a most likely estimate plus best case and worst case scenarios.

Indicator - significant ecological communities

Indicator:

- The extent and condition of significant ecological communities.

Component parameters:

- The extent of the ecological community, expressed in hectares.
- The condition of the ecological community, expressed as a decimal fraction of an approved condition benchmark tailored to the ecological community.

It will be necessary to include including upper and lower 90% confidence limits to estimates in regard to each parameter, allowing for a most likely estimate plus best case and worst case scenarios. In jurisdictions where IUCN-equivalent classifications are used, such as WA, the conservation status could be used. It may also be possible to use other measures here, such as the number of occurrences, geographic range etc, although extent and condition appears to be most commonly used.

Roles and responsibilities

The collation and maintenance of data on the state of significant native species and ecological communities is the responsibility of Australian Government and State and Territory conservation agencies. The Species Profiles and Threats (SPRAT) database would be a logical repository for this information, with agencies co-operating to update data on a five yearly basis, or more frequently for particular species if required. State and Territory conservation agencies might need to maintain supporting systems in order to organise data

Trends

Together with the status of an asset, the direction and rate of change in status, based on a single parameter or on an index, provides a clear prognosis for the asset, and might be used to set or review priorities for intervention.

In this proposal, trends are viewed as the most useful indicator for aggregation at a range of geographic scales, especially where trends are assessed for occurrences of significant native species and ecological communities, rather than at the 'whole of asset' level.

It is proposed that, for each reported occurrence of a significant native species, trends be estimated or inferred for population parameters such as population size, area of occupancy, population structure and dynamics, health status of individuals and/or genetic integrity.

It is also proposed that, for each reported occurrence of a significant native species, trends be estimated or inferred for threat parameters such as predation levels, weed invasion, habitat loss, inappropriate fire regimes, together with extrinsic risk factors such a land tenure and site security, level of knowledge, community support, and so on.

The choice of the parameter or parameters that best reflect the status and trends for that occurrence will be left to those with the best understanding of the biology of the species and the threats affecting that occurrence. In turn, these choices, together will available resources, will dictate the selection of monitoring methods.

A similar approach is proposed for ecological communities, with extent and condition parameters in place of population parameters. Threat parameters would be approached in the same way.

Indicator

Condition and threat abatement trends for populations of significant native species and occurrences of ecological communities.

Sub-indicators for Significant Native Species

Principal Sub-indicators

The proportion of occurrences of significant native species that are included in reporting and for which for which an overall positive, stable or negative trend for population parameters is observed or inferred.

The proportion of occurrences of significant ecological communities for which an overall positive, stable or negative trend for threat parameters is observed or inferred.

Contextual Sub-indicators

- The proportion of occurrences of significant native species that are included in reporting and for which the overall trend for population parameters is highly reliable (say 80% or greater).
- The proportion of occurrences of significant native species that are included in reporting and for which for which the overall trend for threat parameters is highly reliable (say 80% or greater).
- The number of occurrences of significant native species that are included in reporting.

- The proportion of occurrences of significant native species that are included in reporting and that were the subject of concerted conservation management during or immediately prior to the reporting period.
- The proportion of all occurrences of significant native species represented by occurrences that are included in reporting.

Sub-indicators for Significant Ecological Communities

Principal Sub-indicators

- The proportion of occurrences of significant ecological communities that are included in reporting and for which for which an overall positive, stable or negative trend for community parameters is observed or inferred.
- The proportion of occurrences of significant ecological communities that are included in reporting and for which for which an overall positive, stable or negative trend for threat parameters is observed or inferred.

Contextual Sub-indicators

- The proportion of occurrences of significant ecological communities that are included in reporting and for which for which the overall trend for community parameters is highly reliable (80% or greater).
- The proportion of occurrences of significant ecological communities that are included in reporting and for which for which the overall trend for threat parameters is highly reliable (80% or greater).
- The number of occurrences of significant ecological communities that are included in reporting.
- The proportion of occurrences of significant ecological communities that are included in reporting and that were the subject of concerted conservation management during or immediately prior to the reporting period.
- The proportion of all occurrences of significant ecological communities represented by occurrences that are included in reporting.

Minimum data requirements

The following list of minimum data requirements is provisional. A specific project would be required to finalise these in consultation with key agencies.

Asset identifier; Asset name; Asset type; Asset occurrence identifier; Asset occurrence name; Asset occurrence location; Population trend; Population trend reliability; Population trend period; Threat trend; Threat trend reliability; Threat trend period; Contact person; Contact organisation.

In addition to the minimum fields above, each jurisdiction would be required to maintain data for each parameter regarding information source(s) and reliability, including details of any monitoring methods and results.

Roles and responsibilities

Regional NRM bodies, State and Territory conservation agencies and the Australian Government would need to collaborate extensively to establish systems and collect and collate data. The key role would be for State and Territory conservation agencies. A national database would not be necessary; it would suffice to collate data at a national

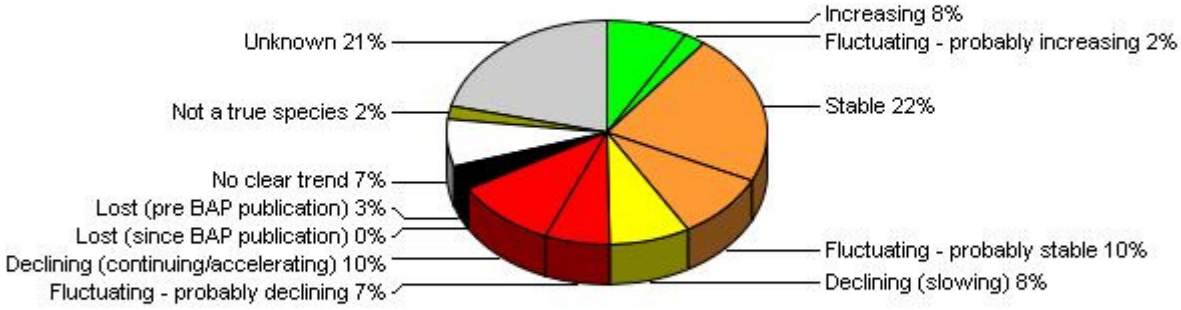
level when the need for reporting arose, for example, for national Biodiversity Assessments and State of the Environment reports.

Appendix II: Sample report from UK BARS

Country: England; Type: Species with grouped plans included; Post-2005 reporting trend estimates excluded

Species name	Common name	Trend	Accuracy	Data source / comments
Acaulon triquetrum	Triangular Pygmy-moss	Stable	Sample or full survey	
Acosmetia caliginosa	Reddish Buff	Stable	Sample or full survey	Butterfly Conservation's "Action for Threatened Moths Project"
Acrocephalus paludicola	Aquatic Warbler	Fluctuating - probably stable	Partial survey	
Acrocephalus palustris	Marsh Warbler	Declining (continuing/accelerating)	Partial survey	Unpublished reports of site surveys and unpublished records available to RSPB
Agabus (Gaurodytes) brunneus	Sharp's Diving Beetle	Declining (slowing)	Sample or full survey	
Alauda arvensis	Skylark	Declining (continuing/accelerating)	Sample or full survey	Raven, M.J., Noble, D.G., Baillie, S.R. 2005. The Breeding Bird Survey 2004. BTO Research Report 403. BTO, JNCC & RSPB. BTO, Thetford.
Alchemilla minima	a lady's-mantle	Stable	Sample or full survey	as UK
Alisma gramineum	Ribbon-leaved Water-plantain	No clear trend	Sample or full survey	
Alosa alosa	Allis Shad	Trend unknown		This depends on the time scale the tend is downwards over the long term (centuries) but is possible increasing with the recent reporting of Alosa alosa from the Tamar.
Anisodactylus poeciloides	Saltmarsh Short-spur	Stable	Best guess	Routine monitoring of key sites only began in 2005, but there are no indications to suggest a decline since plan publication.
Anostirus castaneus	a click-beetle	Fluctuating - probably declining	Sample or full survey	Of the two populations, one is probably fairly stable, but the other may be declining as sightings have become more scarce.
Anotrichium barbatum	Bearded Red Seaweed	Lost (pre BAP publication)	Partial survey	Maggs, C.A (2000). CCW Contract Science Report No. 397. Hardy and Guiry, (2003). A checklist and Atlas of the seaweeds of Britain and Ireland.

England trend for priority BAP species
Species with grouped plans included
(n = 368)



Appendix III: CBD 2010 Indicators

The 7 focal areas (I–VII) and the 22 headline indicators selected by the Convention on Biological Diversity (CBD) to assess progress toward the 2010 biodiversity target. (from Mace and Baillie 2007)

I. Status and trends of the components of biodiversity

1. trends in extent of selected biomes, ecosystems, and habitats
2. trends in abundance and distribution of selected species
3. coverage of protected areas
4. change in status of threatened species
5. trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance.

II. Sustainable use

6. area of forest, agricultural, and aquaculture ecosystems under sustainable management
7. proportion of products derived from sustainable sources
8. ecological footprint and related concepts

III. Threats to biodiversity

9. nitrogen deposition
10. trends in invasive alien species

IV. Ecosystem integrity and ecosystem goods and services

11. marine trophic index
12. water quality of freshwater ecosystems
13. trophic integrity of other ecosystems
14. connectivity/fragmentation of ecosystems
15. incidence of human-induced ecosystem failure
16. health and well-being of communities who depend directly on local ecosystem goods and services
17. biodiversity for food and medicine

V. Status of traditional knowledge, innovations, and practices

18. status and trends of linguistic diversity and numbers of speakers of indigenous languages
19. other indicator of the status of indigenous and traditional knowledge

VI. Status of access and benefits sharing

20. indicator of access and benefit sharing

VII. Status of resource transfers

21. official development assistance provided in support of the CBD
22. indicator of technology transfer