

Accounting for Nature

Australian Regional Environmental Accounts Trial

Technical Analysis

WENTWORTH GROUP OF CONCERNED SCIENTISTS
IN ASSOCIATION WITH NRM REGIONS AUSTRALIA

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Executive Summary

NRM Regions Australia, the Wentworth Group of Concerned Scientists and associated scientists, and experts in Commonwealth and state agencies undertook a trial to develop a set of regionally-based environmental accounts which measure the condition of environmental assets. The purpose of the trial was to test the operational aspects and institutional arrangements necessary for carrying out an ongoing national environmental accounts program, based on the Wentworth Group's *Accounting for Nature* model (2008).

Environmental asset condition accounts measure the attributes of the biophysical environment (assets) over time, allowing examination of trends in change in those attributes. The accounts use a common unit of measure, an index called the *Econd*, to describe the relative condition of an asset against its reference condition.

Australia's 54 natural resource management bodies (NRM regions) formed the institutional setting for the regional environmental accounts trial. Ten regions took part in the trial between 2011 and 2014. The NRM regions contributed towards the development of accounts through existing operational budgets. In-kind advice and expertise was provided by a number of individuals within research, management and government organisations (see **Supplementary Material 6**). No additional funding was attached to the trial apart from a coordinator position provided to the Wentworth Group of Concerned Scientists by The Ian Potter Foundation.

The result of the trial is presented in two reports. The first, an *Evaluation of the Australian Regional Environmental Accounts Trial* examines processes and operational aspects of the regional environmental accounting trial in order to inform the implementation of a national program. It can be found at www.wentworthgroup.org/programs/environmental-accounts.

This report, a *Technical Analysis of the Australian Regional Environmental Accounts Trial*, provides an analysis of the approaches used to compile the accounts, evaluates the methods and choice of indicators, and uses these insights to describe the institutional and scientific arrangements required to further develop regional (landscape scale) environmental asset condition accounting practices. This technical analysis is presented in two parts:

- **Technical Analysis** of each asset, discussing indicator selection and utility of the *Econds* for advancing asset condition accounting in Australia.
- **Supplementary Materials** including descriptions of and links to the *Regional Environmental Asset Condition Accounts* and *Information Statements*; *Accreditation Criteria* used to evaluate the accounts and *Accreditation Reports* which summarise the findings of the accreditation process; *Working Papers* which set out draft accounting standards for specific assets; committees and contributors; program logic and evaluation questions; and a *Glossary of Terms*.

Scope of the Technical Analysis

Each NRM region applied a Seven Step method that was developed for the trial, and published in *Guidelines for Constructing Regional Environmental (Asset Condition) Accounts* (Sbrocchi 2013). To evaluate the application of the method, accounts were assessed against a set of evaluation questions (described in **Supplementary Material 9**) for each asset in each region. This report provides a summary of the findings (below), and a more detailed description of the approaches in each asset chapter.

Summary of Findings

Assets

Assets within the trial accounts were drawn from regional strategic plans. The plans from which the assets were drawn represent a diverse set of landscapes, aspirations and different institutional arrangements for regional communities across Australia. These assets are valued for the services they provide, including, but not limited to, fresh water, food and fibre, areas of recreation, and habitat for threatened species.

There are approximately 35 environmental assets of value to Australia's 54 regional NRM communities, with roughly 15 assets in common across the regions. The trial piloted the *Accounting for Nature* methodology with 11 of these 15 assets, and seven of these exhibited sufficient documentation to allow analysis in this report.

Native vegetation is listed in 80% of regional plans, rivers in 73%, wetlands in 77%, native fauna (threatened species) in 68%, soil in 48%, and estuaries in 57% of regions. These assets provide the foundation for building a national set of regional-scale environmental accounts.

Indicators

Many indicators used in the trial accounts were sourced from existing monitoring programs. It was assumed that these monitoring programs were scientifically credible and had selected appropriate indicators for measuring asset condition.

Setting national protocols for indicator selection standards for each of the major assets is necessary to align and direct the use of indicators for regional and supra-regional (eg state, national or international) accounting purposes. To test the feasibility of the proposition, a protocol for developing a native vegetation account (which included standards for indicator selection) was developed for the trial, and was then used by each region to compile their native vegetation account.

Together with appropriate standards, the Seven Step process that was developed in the trials provides a consistent and robust methodology for systematically describing the quality, as well as the quantity of environmental assets.

Reference Condition

The use of a definition of reference condition to underpin the common unit of measure, the *Econd*, allows descriptions of the relative differences in condition between assets. For the regional environmental accounts, a reference prior to significant post-industrial human alteration was used. This is commonly used for reference condition benchmarking in Australia.

To achieve this, NRM regions collaborated with state agencies and research institutions to derive credible reference benchmarks for many assets, often where this information had not been previously estimated. The trial has highlighted that future accounts would benefit from advances in modelling to support these reference benchmarks. For example, the Queensland Murray-Darling regional soil account used a dynamic reference condition model to better understand and separate anthropogenic and natural variability.

Sourcing Data

Publicly available or other existing datasets were used wherever possible to populate the regional accounts. Much of the data used in the accounts came from existing monitoring programs (eg Bushland Condition Monitoring Program in South Australia, Sustainable Rivers Audit in the Murray-Darling Basin, Healthy Waterways Partnership in Queensland, Index of Wetland Condition in Victoria) where the confidence in data quality was high. Quality assurance ratings were used to describe the level of confidence in the data for their use in these regional accounts.

The NRM regions made commendable efforts to reuse and reanalyse existing data to construct their accounts. However, overwhelming evidence from the trial demonstrates that standardising assessment and monitoring programs is a fundamental prerequisite to producing meaningful information on the condition and trend of Australia's environmental assets. This finding has been echoed in other work, such as the Framework for the Assessment of River and Wetland Health and State of the Environment reports.

The trial has demonstrated there are many opportunities to reduce costs through a variety of mechanisms, such as optimising sampling design, using citizen science, remote sensing and telemetry, and working collaboratively with state or other agencies to maximise efforts. Studies are available which may assist regions and their monitoring partners with directing future monitoring efforts for specific assets, in selecting appropriate indicators and addressing sampling issues in a pragmatic way. There is also potential to reduce costs by building upon the wealth of historical data that exists. The trial found that project-based data collection is usually not sufficient for tracking trends in condition, as infrequent or one-off sampling is not capable of providing a meaningful condition assessment of assets in areas or species with high temporal variability, nor where a large sample size may be required to detect ecologically meaningful changes.

Another important step is to ensure that future monitoring programs use consistent metrics over their lifetimes, so that indicators from one sampling period can be compared with those from another sampling period. Several jurisdictional monitoring programs (eg Sustainable Rivers Audit, and the Index of Stream Condition) changed their measurement methods and indicator designs between sampling periods. Future assessment programs should ensure that changes in methodology are supported by side-by-side assessments to determine the effectiveness of the method used and the effects of the method used on trend analyses.

Indicator Condition Scores and *Econds*

The trial applied the *Accounting for Nature* concepts at the regional (landscape) scale. Indicator condition scores for each asset are calculated by measuring the level of departure of each indicator from the reference benchmark. The *Econd* for each asset is then calculated by combining the individual indicator condition scores in a meaningful way to provide a representation of the condition of the asset as a whole. An *Econd* describes the relative condition of any environmental asset as a composite index, where 100 indicates the condition of an asset in the absence of significant post-industrial human alteration, and 0 indicates system function is absent.

Regional *Econds* for each asset were calculated by aggregating *Econds* of individual asset types within the region. For example, a single regional native vegetation *Econd* for the Natural Resources Eyre Peninsula region in South Australia was created by aggregating *Econds* of the 23 native vegetation types that exist within the region.

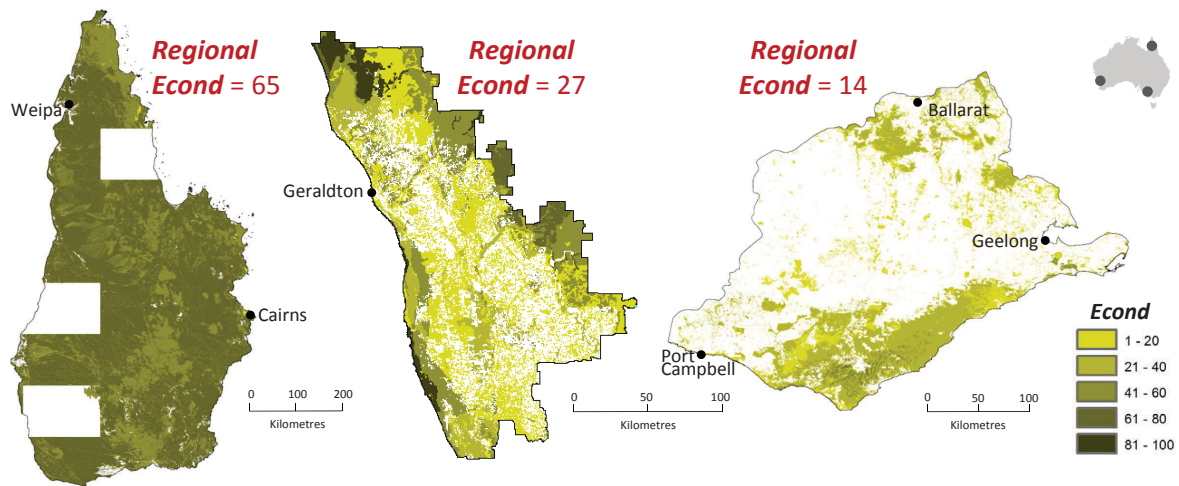
Integration methods used by an NRM region reflect the best understanding of how indicators represent the condition of an asset. In general, integration rules used by the jurisdictional assessment programs, where the majority of data came, were applied to the construction of *Econds*. For example, North Central and Corangamite Catchment Management Authorities in Victoria applied indicator weightings used in the Index of Wetland Condition, Habitat Hectares, and the Index of Stream Condition to construct *Econds* for each of their wetland, native vegetation and river assets respectively. With other assets no weightings were applied to individual indicator scores (eg Estuaries account for NRM North, Tasmania), and in others the lowest indicator condition score was used (eg soils accounts for the Queensland Murray Darling Basin). In nearly all cases, individual asset *Econds* were spatially weighted to form the regional asset *Econd*.

Individual and regional asset *Econds* present the best information available on the current understanding of relative condition of these assets through time. In many cases, this level of information was previously unknown to the region (eg native vegetation in the Northern Agricultural Catchments Council, Eyre Peninsula, Northern Gulf and Cape York, and SEQ Catchments regions). The consistent methodology used across each region enables the results to be used for targeting investment, management, communication and research at the regional and sub-regional level.

Aggregation

If the objective of environmental accounting is to better inform policy and investment decisions, there is also a need to look above the regional NRM scale to appreciate patterns of landscape change that drive decision-making at state and national scales. The *Accounting for Nature* model facilitates this outcome by proposing a scale-independent, common unit of measure, so that regional-scale asset condition information can also be used to inform policy and investment decisions at multiple scales.

While it was beyond the scope of this trial to undertake an analysis to quantify the degree to which this is possible for all assets, an assessment of the regional native vegetation account does suggest that if national protocols and data collection standards are put in place, it is possible to construct accounts that can inform policy and investment decisions at multi-jurisdictional levels. While different methodologies were used to construct regional native vegetation *Econds*, because they were produced to a single scientific standard, these regional accounts have been able to describe asset condition with sufficient confidence for regional and national scale decision making. **Figure 1** shows for example that the relative condition of native vegetation in Northern Gulf and Cape York (*Econd* 65) is in substantially higher condition than native vegetation in either the Northern Agricultural Catchments Council region in Western Australia (*Econd* 27) or native vegetation in the Corangamite region in Victoria (*Econd* 14).



Northern Gulf & Cape York, QLD Northern Agricultural Catchments, WA Corangamite, VIC

Figure 1: Broad comparisons on the differences in condition can be made between the regions with the use of the environmental condition index, the *Econd*. Higher scores represented by darker green indicate better condition.

Combining *Econds* for different assets at a jurisdictional level, such as for a region, a state or the nation, would be useful to assist the public and policy makers in understanding changes in condition of the environment, for example in future Measures of Australia's Progress, State of Environment, or the five yearly Intergenerational Report. It was however, beyond the scope of this trial to attempt such aggregation.

Conclusion

The regional trial of the *Accounting for Nature* model has shown that scientific information and expertise does exist within Australia which can be used to underpin a national set of regional-scale environmental accounts. It has shown the value of realigning existing information and monitoring programs across all levels of government, in order to measure the condition and changes in condition of our environmental assets through time.

The trial has demonstrated that working collaboratively with agencies and research institutions enables regions to access and organise data into a common accounting framework. Leveraging expertise builds capacity of the management organisation and the use of an accounting framework builds greater community understanding of the nature of environmental changes.

Regional synthesis of data through the accounting framework, use of the *Econd*, and the principles of the *Accounting for Nature* approach enable scientific evidence to be more visible and better used towards developing effective policy and investment decisions. The trial has established the processes and procedures required to embark on a program of environmental accounting, including the development of protocols for national indicator standards and accreditation. It has also highlighted important gaps in datasets.

Most importantly, the trial has shown that it is feasible to construct environmental asset condition accounts at a regional-scale, providing managers and policy makers at all levels of government with robust information that can inform the setting of measurable policy standards and inform the cost-effectiveness of investments aimed at meeting those policies.

Key Findings for Each Asset

Native Vegetation

- Seven NRM regions completed native vegetation accounts.
- A protocol and an indicator standard, hereafter referred to as the 'common standard', developed for the trial, provided a consistent methodology for regions to select indicators that best described the condition of native vegetation in different landscapes across different regions.
- The trial showed that practical and cost-effective methods can be developed by the regions, with assistance from experts in State and Commonwealth agencies, to meet the standards required by the protocol to generate high quality sub-regional-scale condition accounts for native vegetation assets.
- The regional accounts have highlighted the importance of measuring the quality of the native vegetation asset, because a simple quantity measure of native vegetation extent lacks an assessment of the quality and description of the biophysical condition of the native vegetation asset.
- The use of the common standard developed for the trials enabled broad comparison of the relative condition of native vegetation assets within and between regions. However, aggregation of regional native vegetation accounts is hindered by incompatible classifications of vegetation types at regional, state and national levels.

Soil

- The trial combined indicators of pH, soil carbon, water erosion and salinity to yield a regional soil condition account for the Queensland Murray Darling Basin.
- The account synthesised a range of data from multiple sources including historical maps, satellite imagery, field studies and a scenario model.
- The account defined a dynamic reference condition which recognises that reference benchmarks for some indicators fluctuate naturally through time. This dynamic reference approach could be applied to other assets.
- Soil condition assessments at regional-scale across Australia will be challenged by data paucity (in this trial we noted deficiencies in pH and soil salinity indicators in particular), which require investments in new technologies in regional soil monitoring.

Rivers

- Four NRM regions provided information for river asset accounts, based on existing and, in some cases, long-standing state and regional river monitoring programs.
- It is possible for existing state and regional river health monitoring programs to produce high quality environmental asset condition accounts for regional purposes.
- The four monitoring programs used different suites of indicators. This presents challenges for national accounting and highlights the need for a national river condition accounting standard, such as that proposed in the 2011 Framework for the Assessment of River and Wetland Health.
- Two of the three jurisdictional river assessment programs changed their assessment methods between sampling periods, making it impossible to establish a reliable trend. Future assessments should be designed to enable comparison between accounting periods.
- The use of different aggregation methods and differences in estimating reference conditions further limit the ability for jurisdictional monitoring programs to be compared between regions.

Estuaries

- Two NRM regions provided information for estuary environmental accounts, based on data collected for specific management-focussed programs.
- Indicators of condition include measures of water quality, foreshore vegetation and biological health. These indicators were shown to be useful in the calculation of *Econds* for both particular parts of estuaries and for the whole estuarine system.
- It is not possible to compare between the two regions because of differences in the selection of indicator types, particularly where human health indicators are used along with ecological indicators.
- There is an opportunity to assess changes in estuarine condition across NRM regions at a general level by reinstating the audit process used to sample 979 estuaries as part of the *Australian Catchment, River and Estuary Assessment 2002*.

Native Fauna

- Two NRM regions provided information for native fauna environmental accounts using a combination of survey data, threatened status and expert analysis.
- The trial has demonstrated that threatened species lists can be used to provide a broad understanding of the condition of vertebrate native fauna (mammals, birds, reptiles, amphibians, fish) at a regional-scale. They are not able to describe trend, nor are they suitable for regional-scale policy or investment decision making.
- It is possible to construct more detailed regional-scale accounts for native birds by assigning a condition score based on a combination of survey data, threatened status and expert analysis. For this method to produce reliable trend data, adjustments will need to be made to standardise existing bird survey programs.
- Rapid advances in remote sensing and telemetry technologies such as motion sensor cameras and audio recognition systems are currently being trialled at a property (reserve) scale by a range of organisations, and these technologies may improve the quality and viability of regional-scale native fauna monitoring in future.

Marine Fauna

- Two approaches were tested to evaluate condition of selected marine fauna in two NRM regions: single species accounts and a surrogate measure of habitat condition.
- The two accounts describing the condition of populations of southern right whales and dugongs have demonstrated that single indicators of condition are sufficient for asset condition accounting when they also represent elements of vigour and resilience of the species.
- Surrogate measures of condition of marine fauna are more problematic as they require a detailed understanding of a range of ecological factors.
- Reference condition benchmarks were established using historical information based on species observations of populations in the NRM regions.

Wetlands

- Three NRM regions provided information for wetland condition accounts, based on data collected for specific management-focussed programs.
- There are currently different wetland classification methods in use in Australia. Some are based on ecological processes, others on hydrological processes.
- SEQ catchments used a simple measure of wetland condition based on expert assessment. In Victoria, it was possible to compare between two regions because they both used a common assessment methodology (Index of Wetland Condition).
- The use of a national wetland classification system based on hydrological and ecosystem processes, such as that proposed by the Framework for the Assessment of River and Wetland Health provides the foundation for an accounting standard. If adopted by all regions, this system will enable a national comparison of wetland condition and allow for consideration of differing objectives that communities might hold for the management of these resources.