Accounting for the Condition of Environmental Assets

UN Committee of Experts on Environmental Accounting
Technical Meeting on Ecosystem Accounts
London, 5-7 December 2011

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Summary

Exponential economic growth over the past two centuries has led to dramatic improvements in living standards across many parts of the world, but it has also resulted in the depletion of natural capital at a scale that is approaching (and in many cases has already exceeded) the ability of biophysical systems to meet future demands on them.

This rapid expansion of the global economy is likely to continue into the foreseeable future. Over the next 40 years, a projected fourfold increase in global economic growth, coupled with the need to feed 9 billion people, and climate change, will place even greater pressures on the health of the world's natural resources.

If humanity is to live within the biophysical limits of nature, we need to develop policy responses which decouple economic growth from ongoing damage to the natural environment. This requires policies and economic tools that both enable society to increase economic efficiency in the use of natural resources, and that maintain environmental assets, including ecosystems, in a healthy condition indefinitely.

We need to measure the quantity of physical natural resources and their economic value so that we know how efficiently they are being used and how economic activity affects the stocks of those assets. We must also be able to measure the impact economic activity is having on the condition of the natural environment from which these resources are being extracted.

Accounting for the condition of environmental assets must confront two problems: first we do not have, nor will we ever have, enough money to systematically measure everything in nature; and secondly without a common unit of measure that places diverse scientific information into an accounting framework, it is not possible to link the health of the natural environment to economic decision making.

Economic accounts are built using a common currency which reflects the monetary value for the exchange of goods and services. It is the common currency that provides the platform for individuals, businesses and governments to build economic accounts, across a range of scales.

The starting point for building a system of environmental (ecosystem) condition accounts must be the creation of a common, non-monetary currency that describes the condition of any environmental asset, including indicators of ecosystem health, at any location, at any scale.

This paper describes such a methodology being trialled at a sub-national scale across Australia.

Environmental accounts constructed from a common environmental currency will put environmental information on a level playing field with economic information. Only then will it be possible for societies to make informed decisions.

1. Policy applications of environmental (ecosystem) condition accounts

Natural capital comprises both natural resources (eg land and mineral deposits which have an economic value)[1] and ecosystems.[2,3] Together these are described as environmental assets.

Articulating why we need accounts which measure the condition of these environmental assets (including ecosystems) and how they can be used to improve decision making, is the first issue that should be addressed in designing standards for environmental accounts.

We can only manage what we measure.

Throughout modern history, economic growth has been achieved in large part from the conversion of nature into products for direct human consumption. As the economy grows so does the impact on our natural capital.

As a consequence "*… humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history (and) this has resulted in a substantial and largely irreversible loss in the diversity of life on Earth"*.[4]

Exponential economic growth over the past two centuries has led to dramatic improvements in living standards across many parts of the world, but it also has also resulted in the depletion of natural capital at a scale that is approaching (and in many cases has already exceeded) the ability of biophysical systems to meet future demands on them.[5]

Rapid expansion of the global economy is likely to continue into the foreseeable future. Over the next 40 years, a projected fourfold increase in global economic growth[6], coupled with the need to feed 9 billion people[7], and climate change[8], will place even greater pressures on the world's natural resources.

Governments, businesses and individuals are now spending billions of dollars in an effort to manage these pressures. Because there is no system of condition accounts in place, we do not know whether these investments are repairing, or even maintaining the ecological fabric of the natural capital that underpins our economic wellbeing.

We are degrading natural capital at an unsustainable rate because accounting for economic output (GDP) does not include the costs of degradation to the natural capital on which much of our economic activity is based. It is unlikely that many of these costs will ever be 'priced' in markets, so it is very unlikely that environmental accounts will be fully embedded into GDP.

We use economic accounts to present a statistical picture of the structure of the economy and the processes that underpin it. This information is used by governments, businesses and individuals to guide economic and social policy and inform investment decisions.

If we are to achieve society's goal of sustainably managing the world's natural capital, we will need to apply the same principles to managing our environment. If you don't measure it, you can't manage it.

If humanity is to live within the biophysical limits of nature, we need to develop policy responses which decouple economic growth from those activities which lead to ongoing damage to the natural environment.

There is some evidence of a natural decoupling in recent decades as some economies transition from primary and secondary industries into the services sector, but even this research suggests that exponential economic growth is still accompanied by a significant increase in the absolute level of resource use.[9]

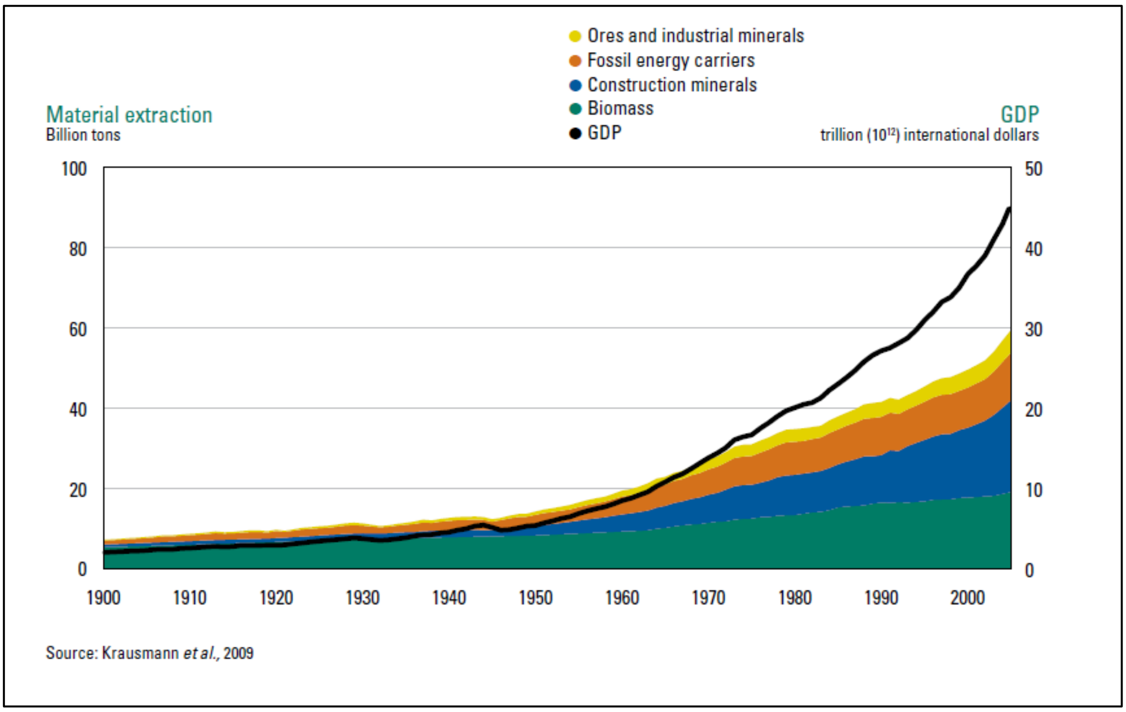

Figure 1 - Global GDP and Global Material Extraction, 1900-2005 [9]

There are many parallels between economic accounts and environmental accounts but there is one important difference. Economic policy is focused on improving living standards by continually expanding the value of the flows of good and services, whereas environmental policy is about maintaining the stock (condition) of natural capital, including ecosystems, so that they continue to provide services to humanity into the future.

Decoupling economic growth from on-going damage to ecosystems therefore requires policies and economic tools that both increase the economic efficiency in the use of natural resources, and that maintain environmental assets in a healthy condition indefinitely.

To achieve these policy objectives, environmental accounts need to measure:

- the quantity of physical natural resources;
- the economic value of those physical resources; and
- the condition (quality) of environmental assets, including ecosystems.

We need to measure the quantity of physical natural resources and their economic value (SEEA Volume 1[10]) so that we know how efficiently they are being used and how economic activity affects the stocks of those physical assets. We must also be able to measure the impact economic activity is having on the condition of the natural environment from which these resources are being extracted.

Environmental (ecosystem) condition accounts will improve the quality of decisions in a number of ways:

1. ***Information***: they provide a statistical picture of the health and change in the condition of environmental assets and ecosystems over time;
2. ***Informing Policy***: they provide a numerical measure which can be used to inform policy trade-offs (both positive and negative) between economic development and environmental health; and
3. ***Guiding Investment Decisions:*** with the construction of a common environmental currency, traditional decision tools, such as cost-benefit analysis and multi-criteria analysis, can be used to evaluate the cost-effectiveness of investments in environmental management and repair.

Accounts which measure the condition of environmental assets (including ecosystems) provide society with the tools we need to manage natural capital: how and where we produce our food and fibre, how we direct public and private investments to improve and maintain the health of our environmental assets, and guide us as we begin the challenge of adapting to the impacts of climate change.

2. The concept of a common currency for environmental health

Accounting for the condition of environmental assets must confront two problems:

- First, we do not have, nor will we ever have, enough money to systematically measure everything; and
- Second, without a common unit of measure that allows us to place diverse scientific information into an accounting framework it is not possible to link environmental health to economic decision making.

Economic accounts are built using a national currency to record and aggregate the value of goods and services. Before money was invented people exchanged goods and services on a barter system. Without a common currency of exchange (money) it would not have been possible to construct economic accounts.

The starting point for building a system of environmental (ecosystem) condition accounts must therefore be the creation of a common, non-monetary environmental currency, one that can be applied to any environmental asset and indicator of ecosystem health, at any location, at any scale.

An environmental asset is "any physical feature in nature that can be measured in time and space."[11] It can be a river or forest ecosystem, a fishery, or any other physical feature, such as groundwater or populations of individual species (eg whales or birds).

An ecosystem is "a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit."[12]

The *Accounting for Nature*[13] model developed in Australia in 2008, seeks to create a common unit of measure of the condition of all environmental assets, including indicators of ecosystem health that can be applied at any location, at any scale, irrespective of the unit of measurement.

Creating a common measure for the condition of environmental assets must address a number of challenges:

- no two environmental assets are the same;
- often different indicators are used to measure the same asset in different locations;
- the cost of data collection creates significant variation in the quality and frequency of information collected; and
- no single indicator can provide a complete picture of ecosystem health.

The *Accounting for Nature* model does this by using the science of reference condition benchmarking. This allows environmental accounts to adopt an economic accounting framework.

Environmental (ecosystem) condition indicators based on reference condition benchmarks are conducive to statistical accounting, because they create a standardised numerical unit capable of addition and comparison. They can assess and compare the condition of environmental assets across regions and between assets, and upscale and aggregate over multiple spatial scales.

Reference condition based indicators

Reference condition is a scientific method for standardising the measurement of environmental assets so that we can assign a numerical (non-monetary) value to describe the relative condition of one asset to another, such that information at different scales and for different assets may be aggregated into a set of accounts.

No two rivers, or two bushland patches, nor two coastlines are the same. Defining a common point of reference for each system resolves these differences, because it puts all assets on a common scale.

Applying a reference condition benchmark performs the essential function of allowing different landscapes to be measured with indicators that are specifically suited to a particular location. This avoids having to use one set of indicators for distinctly different landscapes.

The reference condition is a scientific estimate of the natural or potential condition of an ecosystem in the absence of significant human alteration.[14]

Reference condition based indicators are used extensively in the scientific literature to describe a standard or benchmark against which to compare the current condition of an environmental asset or an indicator of ecosystem health.[15] It can be a fixed point in time (for example, an estimate of its condition prior to industrial development),[16]observed at reference condition sites,[17] or a scientifically accredited model that estimates the naturalness of the biota in the absence of significant human alteration.[18]

Reference condition benchmarks stay the same over time and in doing so provide a reference point by which future changes in the condition of an environmental asset or ecosystem can be measured.

A reference condition score is created by comparing the current condition of an environmental asset or ecosystem relative to the reference condition benchmark. It is recorded as a number between 0 and 100, where 100 is the (reference) condition of an ecosystem as it would be had significant human intervention not occurred in the landscape, and 0 is where that ecosystem function is absent.

For example, one indicator of the condition of a terrestrial ecosystem is the extent of native vegetation cover. The change in percentage of native vegetation can be directly related to a change in biodiversity.[19] If there has been a decline in native vegetation in a region by 72% against a reference condition, that indicator would produce a 'condition score' of 28.

Reference condition metrics are used as a scientific benchmark for ecosystem management for several reasons:[20]

- ecosystems approaching conditions that prevailed prior to major periods of modification will generally better reflect the conditions to which persistent communities of native biota are adapted;[21]
- ecosystems are more resilient within their historical range of variation than ecosystems managed outside this range;[;22,23]
- it is a pragmatic approach for assessing and managing ecosystems where data for communities and species or processes are lacking, or such data cannot be collected within the constraints of rapid assessment;[24]and
- ecosystems are assessed in relative rather than absolute terms, thereby avoiding the perverse situation where ecosystems that are naturally more structurally diverse or species rich are always assessed as in higher condition than ecosystems that are naturally less structurally diverse or species rich.

Reference condition accounting does not imply or suggest that environmental assets should be returned to a pre-disturbance condition: it simply uses this information, in the same way national accounts are used, as a scientific standard to inform policy development through other processes and products that are derived from these accounts.

The advantages of such a benchmark metric are that:

- it creates a common environmental currency that allows us to evaluate the relative environmental improvement of one action over another from investments we are making; and
- they drive cost efficiencies in data collection, because they allow areas under intense environmental pressures to be measured with greater precision than areas under less pressure, without diminishing the ability to compare one asset or region with another.

Scale

The creation of a common currency of exchange (money) has revolutionised the world's economic system, because it enables the construction of economic accounts that inform financial decisions at all scales – individual, household, business, national and international.

Environmental accounts too, must provide meaningful information at these scales.

The *Accounting for Nature* model of constructing a common environmental currency is designed to, over time, work at all spatial scales (property, catchment, regional, national, and international), because it enables data that is collected from a diverse range of indicators at property or catchment (watershed) scales to be aggregated.

A common measure of environmental (ecosystem) condition

In order to describe the complexity of an environmental asset in numerical (non-monetary) values, several indicators may need to be integrated to generate a single measure that best describes the health of that environmental asset.[25]

No two rivers, or two bushland patches, nor two farms are the same, and often different indicators are needed to measure these assets. The establishment of an environmental currency will allow us to compare the relative health of one environmental asset with another: a sand dune with a river; an estuary with a rainforest, or one river system with another.

An environmental health index can be generated by selecting a range of indicators that, when combined, best describe the condition of that environmental asset at a particular location.

These environmental health indices can be used to create the common measure of condition for each environmental asset. This allows any asset to be compared relative to a similar asset at any location; it allows us to compare the rate of change between different assets, and it enables this information to be aggregated to produce environmental accounts at a range of spatial scales.

To avoid confusion with the condition score of an individual indicator, each environmental health index could be referred to as an ***ECOND***.

An ***ECOND*** is a scientifically accredited measure, metric or model which reflects the health of an environmental asset, and is created by combining (where appropriate) condition scores of environmental indicators based on a reference condition benchmark.[26]

The ***Econd*** describes the common environmental currency, in the same way a dollar ($) describes a financial currency.

Scientific accreditation

For environmental accounts to be accepted, statisticians, markets and decision-makers must have confidence that the common currency properly reflects the condition of the environmental assets that are being measured.

They need to be confident that the choice of indicators and the quality of the information being collected is scientifically robust, accurate and reliable, and that the accounts satisfy statistical standards.

A formal scientific accreditation process is therefore required to assure users that the environmental accounts contain appropriate measures of ecosystem health, are based on consistent quality data, and that this information can be aggregated to contribute to regional, national and international scale environmental accounting.

3. Constructing environmental (ecosystem) condition accounts

Environmental (ecosystem) accounts will contain a great depth of information, and can be summarised to display varying levels of detail according to need.

Environmental assets can be described under broad asset classes:

- Land
- Water
- Atmosphere
- Marine

Within each asset class there are a range of environmental assets. Biodiversity should not be a separate asset class, because biodiversity is an intrinsic part of all environmental assets.[27]

An environmental asset can be large or small, degraded or pristine, localised or dispersed. An asset can be a discrete thing (such as a particular wetland), or it can be a collection of smaller assets (such as a particular soil type occurring in different locations across a region).

Each asset class can be represented in a stock account, which has embedded the assets and associated ecosystem condition (***ECOND***) indicators that measure the health of that asset.

The most basic structure of an environmental account may be a summary table, describing the environmental asset classes, displaying each individual environmental asset (or ecosystem), and the environmental health indices (***ECOND***), generated for that time period and over time.

ENVIRONMENTAL ASSET CLASS	ENVIRONMENTAL ASSET	*CONDITION (ECOND)*		
		2008	2009	2010
LAND	Vegetation	40		
	Soils	60		
	Fauna	80		
WATER	Rivers	60		
	Wetlands	54		
	Floodplain	75		
	Groundwater	68		
ATMOSPHERE				
MARINE				

Table 1 – Example summary table of an environmental (ecosystem) condition account

Tables described in Appendix 1 demonstrate a way to house, compute and present this information for the environmental accounts.

There are 3 levels of tables:

- The first table summarises the ***ECOND*** (condition) for each asset.
- The second set contains the Asset tables, which describe the Condition Scores for each indicator, and calculate the ***ECOND'S*** for each asset.
- The third set contains the raw Data, which underpin the Asset tables.

These tables are all linked so that users can drill downwards through the cells and can also aggregate upwards. All show change over time.

4. Australian regional (sub-national) trials

Public policy decisions in Australia on population, water reform, climate change and food security are taking place in a vacuum because we have no accounting system in place that measures the impact these pressures are having on the long-term health of our environment.

Australia has come a long way in recent decades in our understanding of how our landscapes and ocean ecosystems function: world class scientific research, the evolution of the Landcare movement, the establishment of regional natural resource management institutions, and the allocation of significant levels of public and private funding to repair results of past decisions and practices.

Australian governments are now spending over $8 billion a year on the environment[28], and individual landholders and businesses invest considerable time and resources in an effort to manage these pressures. Yet because there is no accounting system in place we do not know whether these investments are repairing, or even maintaining the natural capital that underpins our economic wellbeing.

While there have been many attempts to systematically measure the condition of environmental (ecosystem) assets,[29,30] few have succeeded in providing comprehensive mechanisms that regularly measure and report on the health and change in condition of environmental assets or ecosystems.

As a consequence, those charged with managing the environment do not have the information they need to inform effective land use and environmental policy, nor make informed investment decisions.

In an effort to address this policy flaw, a trial of Regional Environmental Accounts is being conducted across Australia, using the accounting principles described in the *Accounting for Nature* model.

Australia has a regionalised natural resource (watershed) management system in place, with 56 regions established across a continent of 7.5 million square kilometres. In 2011, 10 of these regions, covering a variety of landscape types and varying levels of professional and technical capacity are undertaking a 'proof-of-concept' trial of the *Accounting for Nature* model.

These Regional Natural Resource Management bodies are being supported by the Australian Bureau of Statistics, Australian Bureau of Meteorology, CSIRO, the Wentworth Group of Concerned Scientists and other independent experts. Two technical committees have been established, one to accredit the science and one to ensure the information complies with an appropriate accounting framework.

We expect that these trials will inform the System of Environmental and Economic Accounts (SEEA, 2011)[31] process on the practical application of ecosystem condition accounting.

A regionally based reporting system is necessary because every region or catchment has unique environmental characteristics which need to be managed to cater for the specific pressures on these landscapes and environmental assets. As a consequence, it might be necessary for indicators of ecosystem condition to vary from region to region, so that they can best describe the health of an environmental asset in that locality.

Managing healthy and productive landscapes requires regional, landscape scale responses because the pressures on our landscapes and marine ecosystems vary considerably from region to region. It is at the regional scale where the management of our land, freshwater and marine resources needs to be conducted, so it is logical that it is at this regional scale that we build environmental accounts.

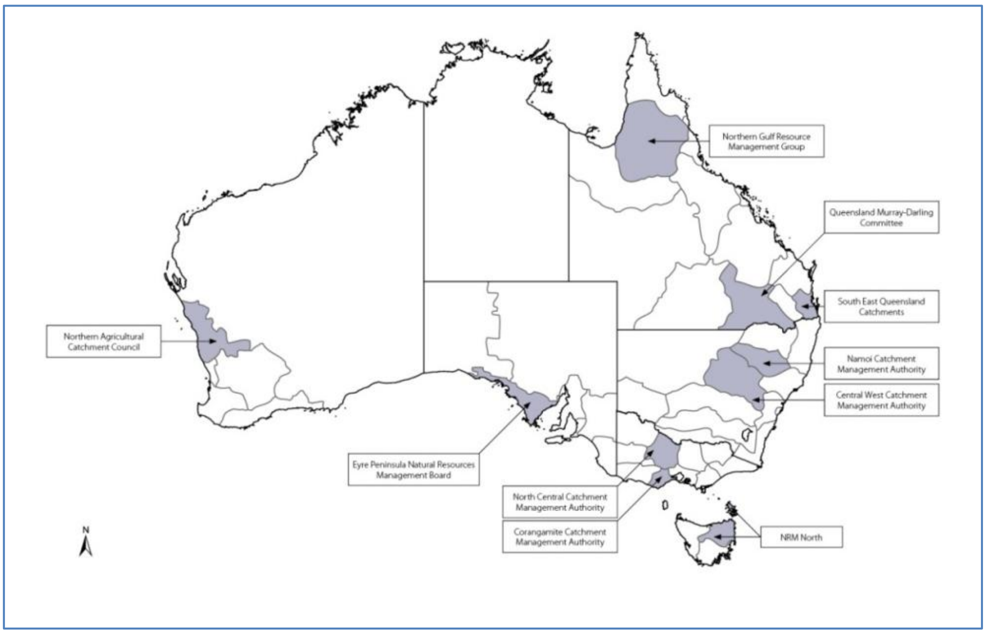

Figure 3 - Participating Regional Natural Resource Management Groups in Trial, 2011-2012

These trials will take existing information, both current and past (to establish trends), and use the reference condition benchmarking to create the common environmental currency.

They will test, at a regional (landscape) scale, whether the environmental (ecosystem) condition accounts framework described in this paper can be incorporated into the SEEA accounts, and whether regional (landscape scale) accounts can be aggregated to construct State and National Environmental Accounts.

Not only will there be 'headline' scores of the environmental condition of assets for each of the 56 NRM regions in Australia, which can be compared from year to year, but these could be aggregated to state and national scale or disaggregated within each region to reveal where and why the ***ECOND*** for the region has declined or risen as a result of remediation or removal of degradation pressures.

6. Conclusion

Modern technology has allowed us to acquire masses of information on just about every natural resource that we wish to exploit for direct human use, where it is, and in what volumes it is available, but we have very little useable information to measure the impact of these economic decisions on the long-term health of the natural environment.

Natural systems are complex, which is why measuring environmental quality is so difficult. If we don't have an accounting system that systematically describes the condition of environmental assets, it is not possible to measure the impact of an economic activity on the health of our environment, or trends in changes in those conditions, or to evaluate where to best invest resources to protect or improve the health of these assets and therefore assess the effectiveness and efficiency of investments in remediation.

There is no doubt that modern science is capable of providing the required information. There are decades of science dedicated to developing methods of measuring the health of environmental assets so that different assets and different indicators, at different scales, can be compared.

The science of reference condition based indicators provides what economics already has: a common currency to measure the condition of all environmental assets, including ecosystems.

In the same way national accounts developed from simple beginnings to the complex, sophisticated accounts we have today, so too will environmental accounts need to evolve from simple measures, from data that is available today. In time, they too will grow in complexity and sophistication, as more detailed information is required to resolve emerging issues.

At the moment societies are faced with impossible choices. If we are to live within the biophysical limits of our natural environment, we need to develop policy responses which decouple economic growth from ongoing damage to natural capital.

This requires policies and economic tools that both enable society to increase economic efficiency in the use of natural resources, and that maintain environmental assets in a condition that will sustain them indefinitely into the future.

Environmental condition accounts will put environmental information on a level playing field with economic information.

Only then will it be possible for societies to make informed decisions.

ACKNOWLEDGEMENT

This paper is a synthesis of the work of the many authors who have contributed to the development of three primary sources from which this paper is derived: *Accounting for Nature: A model for construction the National Environmental Accounts of Australia*, 2008; *A Common Currency for Building Environmental (Ecosystem) Accounts,* 2010[32]; and *Australian Regional Environmental Accounts Trials, 2011: Draft Guidelines.*

Appendix 1: Australian Regional Environmental Accounts Trials

Draft Environmental Asset Accounts Tables

(Version 6, November 2011)[33]

TABLE A - Environmental Account

ENVIRONMENTAL ASSET CLASS	ENVIRONMENTAL ASSET	*CONDITION (ECOND)*		
		2008	**2009**	**2010**
LAND	Vegetation	40		
	Soils	60		
	Fauna	80		
WATER	Rivers	60		
	Wetlands	54		
	Floodplain	75		
	Groundwater	68		
ATMOSPHERE				
MARINE				

Note: Colours and example ***ECOND***s derived from INPUT tables

TABLE B – Native Vegetation Asset

Native vegetation				Year 1		Year 2	
	Indicator	Unit	Reference Condition Benchmark	Year 1 measure	Condition Score	Year 2 measure	Condition Score
Econd TOTAL				40			
VA1 Econd							
	Vegetation extent						
VA1	Structure						
	Connectivity						
VA2 Econd							
	Vegetation extent						
VA2	Structure						
	Connectivity						
VA3 Econd							
	Vegetation extent						
VA3	Structure						
	Connectivity						
VA4 Econd							
	Vegetation extent						
VA4	Structure						
	Connectivity						

Notes: VA = vegetation association; summarised in Table A. Indicators are examples only.

TABLE C – Soil Asset

Soil				Year 1		Year 2	
	Indicator	Unit	Reference Condition Benchmark	Year 1 Measure	Condition Score	Year 2 measure	Condition Score
Econd TOTAL				60			
Soil type 1 Econd							
	pH						
Soil type 1	Carbon						
Soil type 2 Econd							
	pH						
Soil type 2	Carbon						
Soil type 3 Econd							
	pH						
Soil type 3	Carbon						
Soil type 4 Econd							
	pH						
Soil type 4	Carbon						

Notes: summarised in Table A; indicators are examples only.

TABLE D - Native Fauna Asset

Native fauna				Year 1		Year 2	
	Indicator	Unit	Reference Condition Benchmark	Year 1 Measure	Condition Score	Year 2 measure	Condition Score
Econd TOTAL				**80**			
Birds Econd							
	Diversity						
	Abundance						
	# threatened species						
Mammals Econd							
	Diversity						
	Abundance						
	# threatened species						
Amphibians Econd							
	Diversity						
	Abundance						
	# threatened species						
Reptiles Econd							
	Diversity						
	Abundance						
	# threatened species						

Notes: summarised in Table A; indicators are examples only

TABLE E – River Asset

Rivers			Year 1		Year 2	
	Indicator	Reference Condition Benchmark	Year 1 Measure	Condition Score	Year 2 Measure	Condition Score
Econd TOTAL			60			
Creek 1 Econd						
	Macroinverts					
Creek 1	Water flow					
	Riparian					
Creek 2 Econd						
	Macroinverts					
Creek 2	Water flow					
	Riparian					
Creek 3 Econd						
	Macroinverts					
Creek 3	Water flow					
	Riparian					
Creek 4 Econd						
	Macroinverts					
Creek 4	Water flow					
	Riparian					

Notes: summarised in Table A; indicators are examples only

TABLE F - Wetland Asset

Wetlands				Year 1		Year 2	
	Indicator	Unit	Reference Condition Benchmark	Year 1 measure	Condition score	Year 2 measure	Condition score
Econd TOTAL				54			
Wetland 1 Econd							
	Macroinverts						
Wetland 1	Water flow						
	Riparian						
Wetland 2 Econd							
	Macroinverts						
Wetland 2	Water flow						
	Riparian						
Wetland 3 Econd							
	Macroinverts						
Wetland 3	Water flow						
	Riparian						
Wetland 4 Econd							
	Macroinverts						
Wetland 4	Water flow						
	Riparian						

Notes: summarised in Table A; indicators are examples only

TABLE G - Floodplain Asset

Floodplains				Year 1		Year 2	
	Indicator	Unit	Reference Condition Benchmark	Year 1 Measure	Condition score	Year 2 Measure	Condition score
Econd TOTAL				75			
Floodplain 1 Econd							
	Vegetation						
Floodplain 1	Water flow						
	Water quality						
Floodplain 2 Econd							
	Vegetation						
Floodplain 2	Water flow						
	Water quality						
Floodplain 3 Econd							
	Vegetation						
Floodplain 3	Water flow						
	Water quality						
Floodplain 4 Econd							
	Vegetation						
Floodplain 4	Water flow						
	Water quality						

Notes: summarised in Table A; indicators are examples only

TABLE I – River Asset Data Table

Macro-invertebrate Indicators for Creek 1

Creek 1	Year 1
Indicator	Year 1 measure
Macroinverts	**20**
Sample 1	10
Sample 2	20
Sample 3	20
Sample 4	40
Sample 5	16
Sample 6	20
Sample 7	18
Sample 8	18
Sample 9	18

Notes: Linked to Table E

Notes and References

1 "Natural resources consist of naturally occurring resources such as land, water resources, uncultivated forests and deposits of minerals that have an economic value" – definition in the *System of National Accounts 2008*.

2 "Natural capital is the extension of the economic notion of capital (manufactured means of production) to environmental goods and services. A functional definition of capital in general is: "a stock that yields a flow of valuable goods or services into the future". Natural capital is thus the stock of natural ecosystems that yields a flow of valuable ecosystem goods or services into the future. For example, a stock of trees or fish provides a flow of new trees or fish, a flow which can be sustainable indefinitely. Natural capital may also provide services like recycling wastes or water catchment and erosion control. Since the flow of services from ecosystems requires that they function as whole systems, the structure and diversity of the system are important components of natural capital".

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27 Saunders D, 2011. Pers comm. The term "biodiversity" was coined by E.O. Wilson, as shorthand for biological diversity, meaning the variety of all life forms and their patterns in space – the different plants, animals and micro-organisms, the genes they contain and the ecosystems of which they form part. Importantly, it consists not only of the genes and the life forms themselves, but also includes the interactions between them and the environment. The term therefore covers a large array of ecological complexity and it is in general poorly understood. It is not short hand for native fauna and flora or endangered species, which is the most common misinterpretation. Nor

does biodiversity mean species diversity, as it is too often taken to mean. A narrow species-focused view of biodiversity gives rise to the notion that landscapes can be compartmentalised. For example, in agricultural landscapes, many people assume that biodiversity is found only on conservation reserves, however agriculture is totally dependent on ecosystem processes and functions which are all driven by interactions between elements of biodiversity.

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