STATE OF PLAY

BASELINE VALUATION REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES

DEPARTMENT OF ENVIRONMENTAL AFFAIRS
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INTRODUCTION

Africans have always had an ancestral connection to the Earth. Our indigenous people were land-based communities living in harmony with nature for generations. This spiritual attachment to the soil, the trees, the animals and the sun, has been the basis of our value system. Water, Food, Shelter and Energy are just some of the basic essential services derived from Nature which is the basis of life. In a modern day economy, where the accepted currency of value is money, global economies have seemingly been thriving and have garnered little attention outside fast tracked development, National GDPs and profit margins. This in effect has resulted in people becoming more and more detached from nature. This in turn has affected our inherent value system, which has subsequently led to the erosion of our biodiversity resources through unsustainable land-use practices, species loss, habitat loss, alien infestation and environmental changes attributed to climate change and subsequently the global financial meltdown. The crises, the Millennium Development Goals (MDGs) and the Millennium Ecosystem Assessment have – among other things – presented a stimulus for new thinking on the way the world's economic activities are organized.

Globally, the United Nations General Assembly has, with a view to engaging people from all around the world to safeguard the variety of life on earth, declared the decade 2011-2020 as the Decade on Biodiversity. This is part of a global communication strategy to make the "Case for Biodiversity" However, "*…the economic invisibility of nature's flows into the economy is a significant contributor to the degradation of ecosystems and the loss of biodiversity. This in turn leads to serious human and economic costs…and will be felt at an accelerating pace if we continue business as usual.*" The increasing intersection between economics and biodiversity conservation in the promotion of sustainable development has therefore become a critical issue.

At a meeting of the G8+5 Environment Ministers in Potsdam, Germany in March 2007, it was proposed that a global study on "the economic significance of the global loss of biological diversity" should be undertaken as part of a "Potsdam Initiative" for biodiversity. The proposal was subsequently endorsed by the G8+5 leaders at the Heiligendamm Summit in June 2007. This global study, which was entitled, "The Economics of Ecosystems and Biodiversity" (TEEB), was initiated by the European Commission (EC) and Germany in 2007 and was led by Pavan Sukhdev, a senior economist with Deutsche Bank. The final report of TEEB was presented at CBD COP-10 in 2010 with the ultimate objective of supporting global effort to reduce and halt the loss of biodiversity and achieve the Millennium Development Goals.

TEEB was successful in providing a broad foundation where evidence and examples were collated, elements of a biodiversity/ecosystem valuation framework identified, and long-standing issues such as ethics in making economic choices re-emphasised. To date, TEEB has focused on improving our understanding of the economic costs of biodiversity loss and ecosystem degradation and to communicate this understanding to key stakeholders. Although the TEEB project provides an excellent global overview of the current state of knowledge, there is a clear need for more site and sector specific information in order to improve decision making surrounding the environment and development. More focused TEEB efforts have been initiated around the world, including TEEB for India, TEEB for Brazil and TEEB for Agriculture, for example.

TEEB is also significant for South Africa, as we are the third most mega-diverse country in the world. It is a great challenge that our biological resources are being eroded by unsustainable practices such as illegal trade, unsustainable extractive use, habitat fragmentation and spiraling development, all exacerbated by climate change. The latest Rhino horn issue has raised awareness and sparked societal interest and the question for government is whether or not opening Trade will alleviate the Rhino horn issue. This in effect as an example will have major implications on the value of biodiversity. Further, species wealth in South Africa was promoted through our currency, with the Big Five represented on the Rand notes. This subliminally raised the value in society of our wildlife and our biodiversity. With the recent announcement by the Governor of the Reserve Bank to introduce new notes, this too would have implications on the way society values our biodiversity. The country therefore needs to find innovative ways to ensure conservation and sustainable use of natural resources so as to contribute to socio-economic development and

poverty eradication while reducing biodiversity loss. This has been augmented by Decision X/44 on Incentive Measures adopted by the Conference of the Parties to the Convention on Biological Diversity at its 10th meeting in Nagoya, Japan, which calls on Government, in accordance with national legislation, to take measures to account for the value of biodiversity and ecosystem services in public and private sector decision making. The case for expansion of the conservation estate via the establishment of protected areas and stewardship also needs to be underpinned by economic valuation. The case for Protected Areas as factories of ecosystem services needs strengthening amongst competitive land uses. In addition, the Nagoya Protocol on access and benefit sharing adopted at COP 10, under the Convention on Biological Diversity could possibly impact existing multilateral trade rules. Given South Africa's heterogeneous landscape and the country's status as an emerging market, it is therefore imperative to assess the value of biodiversity and unpack the associated ecosystem services on an ongoing basis in line with local value systems and global trade regimes.

It is to this effect that the valuation of Biodiversity and Ecosystem services has found its way into the Ministerial Delivery Agreement as Suboutput 4.4: Environmental costs in the form of provisioning ecosystem services determined by 2014

THE CONCEPT OF BIODIVERSITY AND ECOSYSTEM SERVICES

The collective term of natural capital is Biodiversity which constitutes the ecological infrastructure of society. According to the Biodiversity Act, Act 10, of 2004, **Biodiversity** is the variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems. The conservation of Biodiversity is critical to achieve sustainable development. Conservation efforts have focused on biodiversity pattern (structure and composition or the biophysical attributes of nature, i.e. trees, animals, insects, landscapes, the rivers, mountains and oceans etc) and the processes, i.e. ecosystem functioning. The end products of both biodiversity and ecosystem functioning constitutes ecosystem services.

Both natural capital and the services derived from nature have been considered by society as a right, a free service with no economic value. Attaching a quantitative value to biodiversity per se is generally recognised as a difficult and potentially highly misleading exercise. This is primarily because, while extremely important, it is very difficult to isolate or adequately 'compartmentalise' biodiversity in a conventional valuation exercise. It is thus best to understand the conservation of biodiversity as an important pre-requisite for ecosystem services to exist and flourish thereby giving rise to value streams. Biodiversity needs to be recognised and valued as a critical 'umbrella' service without which most other valuable ecosystems services would be diminished or may even become unavailable. These services together with the investment in people and infrastructure that accompany them, provide the backbone of economies and enhance human wellbeing. The Millennium Ecosystem Assessment made clear the environment and development nexus, linking ecosystem services and human well being and highlighting its role in poverty alleviation. The three main categories of ecosystem services are Provisioning, Regulation and Maintenance and Cultural (Table 1.)

Table 1: The common International Classification of Ecosystem Services (CICES; Haines-Young et al., 2009)

TYPE	CLASS	GROUP
PROVISIONING	Nutrition	Terrestrial plant and animal foodstuffs
		Freshwater plant and animal foodstuffs
		Marine plant and animal foodstuffs
		Potable water
	Materials	Abiotic materials
		Biotic materials
	Energy	Renewable biofuels
		Renewable abiotic energy sources
REGULATION & MAINTENANCE	Regulation of wastes	Bioremediation
		Dilution and sequestration
	Flow Regulation (Natural Risks)	Air flow regulation
		Water flow regulation
		Mass flow regulation
	Regulation of Physical Environment	Atmospheric regulation
		Water quality regulation
		Pedogenesis and soil quality regulation
	Regulation of Biotic Environment	Lifecycle maintenance and habitat protection
		Pest and disease control
		Gene pool protection
CULTURAL	Intellectual & Experimental	Recreation and community activities
		Information and knowledge

	Symbolic	Aesthetic, heritage
		Religious and spiritual

It is not possible to imagine a modern economy without a government that provides these backbone services. Society, including residents and visitors, pay the government to deliver these services. These payments take the form of tariffs and charges on services, property taxes, and some other smaller income streams such as fines. However, users alone, through these tariffs, charges and property taxes, are not paying the full amount required for nature to sustain delivery of these essential services. What are usually overlooked are the services provided by the ecological infrastructure, or natural assets. These 'free services' from nature flow to both residents and visitors, as in the case of other services such as utilities. The 'natural factories' that produce these services also need proper ongoing maintenance and, restoration in case of damage or repair. The field of ecosystem service research has seen an exponential increase in the number of studies exploring these links in the last 15 years. One of the key areas of ecosystem service research has focused on linking ecology with economics, and valuing ecosystem services. Consequently, well designed investments can actually enhance the value of the services flowing from these 'natural factories' or natural assets and improve the lives of indigenous communities and boost national economic development in the country.

KEY PRINCIPLES AND TOOLS OF ECONOMIC VALUATION

The economic valuation of biodiversity and ecosystem services falls within the scope of cost benefit analysis (CBA) of project alternatives, including the designation of protected areas. This requires the pricing of their economic value(s) and, more precisely, capturing their marginal economic value for trade-offs purposes (Braat & ten Brink, 2008). As argued by Ruhl et al. (2007),"failure to refine our understanding of their value, and the consequent inability to account for those values in regulatory and market settings and, more important, in the public mind, is unlikely to promote their conservation". In other words, coupling CBA with the valuation of biodiversity and ecosystem services would allow stakeholders of natural areas to better understand the trade-offs – at local, national and international levels – between the benefits of legitimate (authorised) consumptive and non-consumptive use of their ecosystem services, and the associated

management and opportunity costs. To that end, the total economic value of biodiversity, inclusive of that of ecosystem services (Kettunen et al., 2009b), is traditionally divided into its use values (direct use value, indirect use value, option value) and non-use values (existence value and bequest value), with a gradient of decreasing tangibility as one moves from direct use values to existence values. Several monetary ecosystem valuation methods may be used to assess the economic values of ecosystem services (Table 2):

Table 2: Valuation Techniques for Ecosystem Services (TEEB 2010)

	Method	Ecosystem Services which can be valued
Direct Market Prices	Market Prices	Provisioning services
Market Alternative	Replacement Costs	Pollination, water purification
	Damage cost avoided	Damage mitigation, carbon sequestration
	Product function	Water purification, freshwater availability, provisioning services
Surrogate Markets	Hedonic price method	Use values only, recreation and leisure, air quality
	Travel cost method	Use values only, recreation and leisure
Stated Preference	*Contingent valuation method*	All services
	Choice experiments	All services
Participatory	Participatory environmental valuation	All services
Benefit Transfer	E.g. mean value, adjusted mean value, benefit function	Whatever services were valued in the original study

1. The Market Price Method estimates economic values for ecosystem products or services that are bought and sold in commercial markets.

2. The Damage Cost Avoided, Replacement Cost, and Substitute Cost Methods estimate economic values based on costs of avoided damages resulting from lost ecosystem services, costs of replacing ecosystem services, or costs of providing substitute services.

3. The Production Function Method estimates economic values for ecosystem products or services that contribute to the production of commercially marketed goods.

4. The Hedonic Pricing Method estimates economic values for ecosystem or environmental services that directly affect market prices of some other goods. This is most commonly applied to variations in housing prices that reflect the value of local environmental attributes.

5. The Travel Cost Method estimates economic values associated with ecosystems or sites that are used for recreation. It assumes that the value of a site is reflected in how much people are willing to pay to travel to visit the site.

6. The Contingent Valuation Method estimates economic values for virtually any ecosystem or environmental service by asking people to directly state their willingness to pay form specific environmental services, based on a hypothetical scenario. This is the most widely used method for estimating non-use, or 'passive-use' values.

7. The Choice Experiments Method estimates economic values for virtually any ecosystem or environmental service by asking people to make trade-offs among sets of ecosystem or environmental services or characteristics. It does not directly ask for willingness to pay (i.e. this is inferred from trade-offs that include cost as an attribute).

8. The Benefit Transfer Method estimates economic values by transferring existing benefit estimates from studies already completed for another location or issue. Within the context of biodiversity hotspots, the key challenge lies in undertaking comprehensive assessments of all ecosystem services involved, using the appropriate combination of valuation techniques in a transparent way, so as to meaningfully engage stakeholders and build the case for their efficient protection and management.

OBJECTIVES OF THIS STUDY

The main aim of this study was to review existing ecosystem service valuation studies within South Africa, identifying sources of information for which there are monetary values, and most importantly identify gaps or areas for which there are no ecosystem service values. The intention here is to provide a Baseline of valuation of Biodiversity and Ecosystem Services, upon which future studies directing future valuation work can be conducted to address the deliverable in the Ministerial Delivery Agreement for outcome 10 and eventually mainstream the economic valuation of biodiversity and ecosystem services into National accounting.

APPROACH TO ESTABLISHING A VALUATION BASELINE FOR SOUTH AFRICA

An extensive search was undertaken of a variety of databases for both formal publications and grey literature pertaining to ecosystem services within South Africa. The approach of Le Maitre et al. (2007) searching the ISI databases for article titles and abstracts with the key words was initially followed: South or southern Africa, (or African), and ecosystem or environmental or ecological service and valuation. From the articles returned we read through all abstracts in order to identify studies which were relevant to the main focus of this research. Articles which valued ecosystem services were read and service values recorded. In order to capture studies that had not formally been published Google search engine was used to search the web using the same key words.

In addition to this method all known information on processes in government and in other partner institutions supplemented the study. Whilst the number of ecosystem service studies has increased dramatically, these terms have not been incorporated into all aspects of environmental assessment and valuation. Therefore additional processes searching for values according to habitat types were initiated. This was a lengthy process and is still in progress. The key principle here was to try to identify as many studies as was possible and not to be limited by search criteria.

In summarising and collating the findings a similar approach taken by the United Kingdom's, National Ecosystem Assessment (UK NEA 2011) was adopted, identifying nationally appropriate broad habitat types that supply associated services. Identified broad habitat units for South Africa were: marine, coastal, estuaries, wetlands, rivers, fynbos, thicket, forests, savannas, grasslands, karoo, succulent karoo, deserts, urban, cultivated, plantations, and mines. Each of these broad habitat units were associated with the 22 ecosystem services indentified by the TEEB study associated with the four service categories: provisioning services, regulating services, habitat services and cultural and amenity services (TEEB 2010). Identified values were assigned to these specific environments recording ecosystem service categories, specific services, the scale of the study, and the value reported. In addition to these broad habitat units a national category in the analysis was also included as some studies were focused at a national level. This approach enabled the study to identify gaps both in terms of services and environments.

CURRENT KNOWLEDGE ON THE VALUATION OF ECOSYSTEM SERVICES

Thus far in the analysis 40 studies were identified which have assessed ecosystem service values for or within South Africa. These fall into four groups of sources: 12 studies are published in formal scientific journals, two are Master of Science theses, 25 are reports (mostly for government departments), and one a presentation at a formal scientific conference. Whilst all of this work appears to be of a high quality, only the formally published studies have gone through a rigorous peer review processes, and therefore the defensibility of close to three quarters of these studies is in question.

Eight of these studies focus on national scale issues, whilst the remainder are focused at either a regional or local level. Aside for varying scales, different valuation approaches and methods have been adopted both for similar and different service assessment. In some instances services have been lumped together providing single values and in other instances services have been discreetly valued. In addition to this, reporting units vary across these studies, predominantly being reported as area or total per annum values.

The major emphasis within these studies has been on capturing provisioning service values, followed by regulating services and cultural services, with very little attention being focused on habitat services (Table 3). Within the provisioning services category the focus has been on identifying values related to raw materials and food. Raw materials form a fairly broad category, encompassing grazing, building materials, fuel and others, so this finding is not surprising given the TEEB typology that was used. Research efforts on regulating services have been more evenly spread with the focus on climate regulation (predominantly carbon sequestration), the regulation of water flows, and pollination. Opportunities for recreation and tourism are almost exclusively the focus of cultural service studies. Whilst following a similar pattern, consideration of national scale studies on their own, show a fairly even distribution across service types. When identified service values from a spatial perspective are considered, it reflects that research effort has not been evenly distributed across the broad habitat units. Those broad habitats that fall into the natural terrestrial category have received the most attention, followed by those in the marine category. Transformed habitats and fresh water habitats have received little attention. Within the natural terrestrial areas, the fynbos area has received the most attention in terms of the number of services valued, followed by the savannas, and the succulent karoo. The broad habitat unit estuaries encompass all the estuaries found within South Africa of which there are 291 (Van Niekerk & Turpie 2011). A variety of values for individual estuaries was found making this the habitat unit with the highest number of valuations.

Given the narrow focus of this study, where only valuations relating to specific service have been considered, studies which focused exclusively on restoration and relative improvements following this were not captured if they did not provide a discernable ecosystem service valuation. There were a number of such studies and clearly a great deal of research effort has been invested here.

KNOWLEDGE GAPS IN THE VALUATION OF ECOSYSTEM SERVICES

1. Where is the focus of attention in terms of services?

The ecosystem service categories where the least amount of information is available relates to cultural and amenity services, and habitat services. Within the cultural and amenity services category, there were no values for spiritual experiences, and only a few values for information for cognitive development, aesthetic information, and inspiration for culture, art and design. This is not entirely unexpected and speaks to the difficulties, relevance and appropriateness of placing monetary or economic values on these types of services. However, within the habitat service category, strong arguments can be made for valuing both the maintenance of genetic diversity and maintenance of life cycles of migratory species. Under the regulatory service there are also key gaps. Air quality regulation and the moderation of extreme events have received no attention. Air quality is a prominent issue in South Africa given its association with human health in a country with a high disease burden, and given the anticipated extreme events that will follow climate change, these are two clear gaps.

2. Where is the lack of attention Geographically

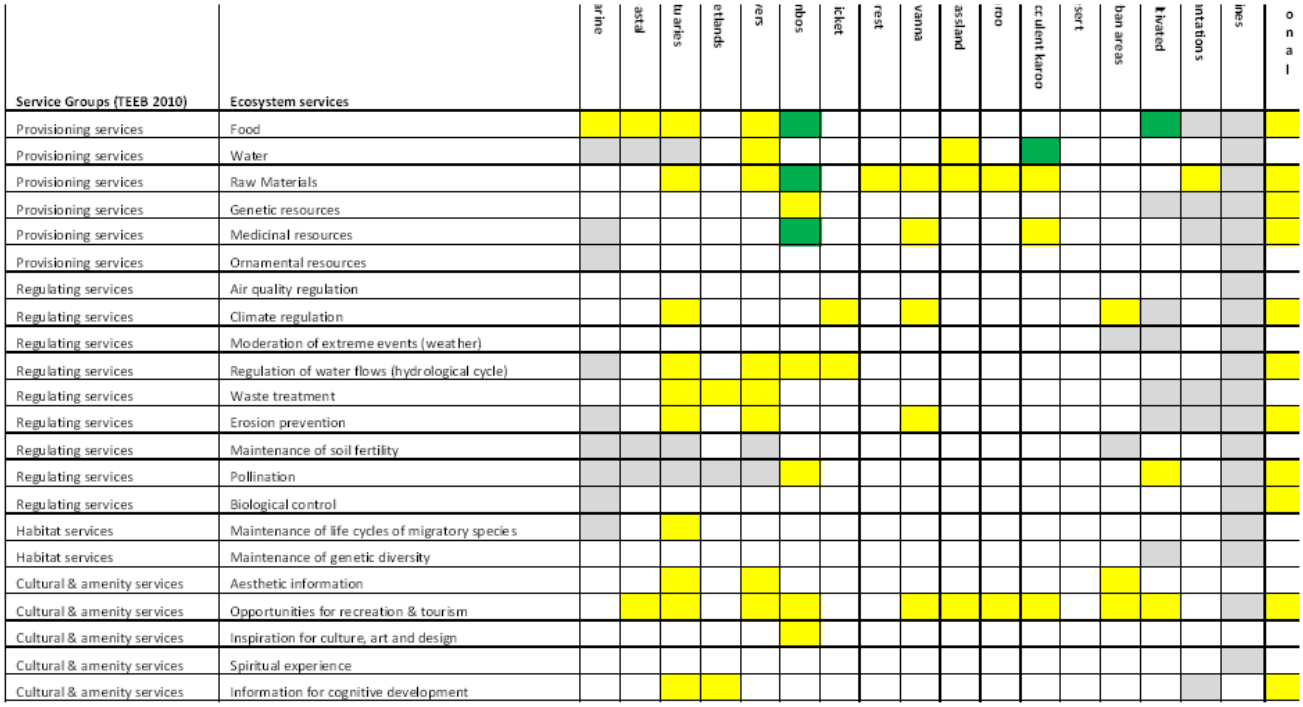
The broad habitats, rivers and wetlands standout as a critical geographical or spatial gap in this analysis. In the case of rivers, a single study was identified which has valued services for the Mfolozi Floodplain (Collings 2009). The values associated with fresh water ecosystems should be far more extensive given the critical and restricted nature of the fresh water resource in South Africa. Estuaries and coastal areas have also received little attention. Deserts stand out within the natural terrestrial category for the complete lack of any valuation studies having taken place here. Both broad habitat units within the marine category, coastal and marine areas have received little attention with only single valuation exercises reported here examining food as an ecosystem service. Within the transformed habitat classes, mine areas have received no focus. This is not

considered to be an issue of concern given that most services are not associated with this habitat unit.

3. What are the priorities in order to have a comprehensive assessment of the value of Biodiversity and Ecosystem Services

Each broad habitat area was considered in relation to the number and scale of studies (sampling saturation and intensity) and the key service flowing from each of these habitats were anticipated. Table 4 provides a summary of where little to no data of key services for each broad habitat unit is available. River systems, thicket, grassland and urban areas all emerge as needing research. Regulating water flows and moderating extreme events are two possible key areas for future research.

Table 3. Summary showing broad habitat units and ecosystem services information. Yellow shading denotes little to some valuation information, green shading denotes good to complete information.



Service Groups (TEEB 2010)	Ecosystem services	arine	astal	tuaries	etlands	ers	nbos	icket	rest	vanna	assland	no	culent karoo	sert	ban areas	ivated	ntations	ines	o c n i
Provisioning services	Food																		
Provisioning services	Water																		
Provisioning services	Raw Materials																		
Provisioning services	Genetic resources																		
Provisioning services	Medicinal resources																		
Provisioning services	Ornamental resources																		
Regulating services	Air quality regulation																		
Regulating services	Climate regulation																		
Regulating services	Moderation of extreme events (weather)																		
Regulating services	Regulation of water flows (hydrological cycle)																		
Regulating services	Waste treatment																		
Regulating services	Erosion prevention																		
Regulating services	Maintenance of soil fertility																		
Regulating services	Pollination																		
Regulating services	Biological control																		
Habitat services	Maintenance of life cycles of migratory species																		
Habitat services	Maintenance of genetic diversity																		
Cultural & amenity services	Aesthetic information																		
Cultural & amenity services	Opportunities for recreation & tourism																		
Cultural & amenity services	Inspiration for culture, art and design																		
Cultural & amenity services	Spiritual experience																		
Cultural & amenity services	Information for cognitive development																		

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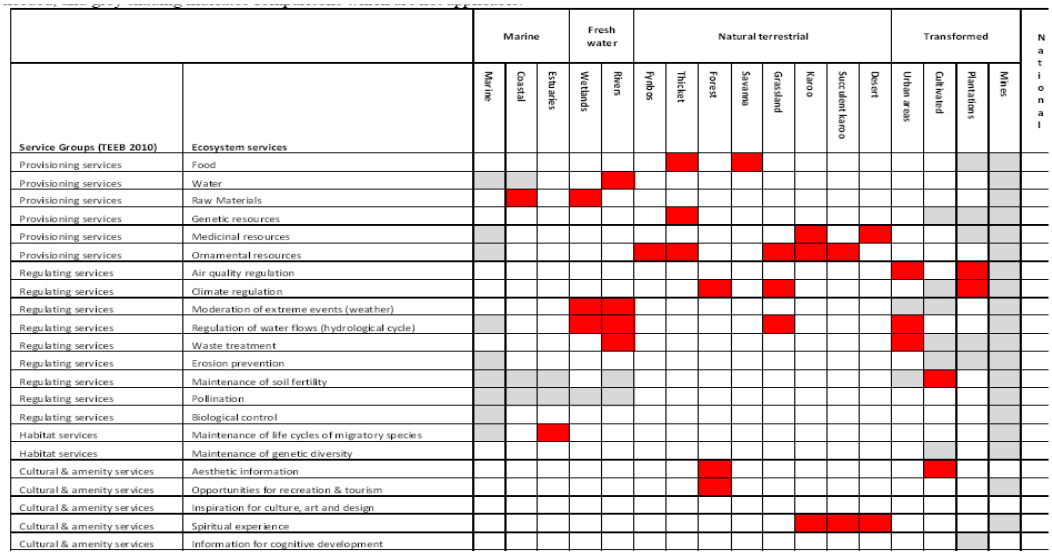
Table 4. Summary showing broad habitat units and ecosystem services information. Red shading denotes identified gaps were valuations studies are most needed, and grey shading indicates comparisons which are not applicable.



		Marine			Fresh water		Natural terrestrial								Transformed				Natural
Service Groups (TEEB 2010)	Ecosystem services	Marine	Coastal	Estuaries	Wetlands	Rivers	Fynbos	Thicket	Forest	Savanna	Grassland	Karoo	Succulent karoo	Desert	Urban areas	Cultivated	Plantations	Mines	
Provisioning services	Food																		
Provisioning services	Water																		
Provisioning services	Raw Materials																		
Provisioning services	Genetic resources																		
Provisioning services	Medicinal resources																		
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Cultural & amenity services	Spiritual experience																		
Cultural & amenity services	Information for cognitive development																		

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STATUS QUO AND THE WAY FORWARD

To date one of the most comprehensive valuation studies that have been undertaken in South Africa remains to be the Jane Turpie Study (2008), where the overall estimated value of ecosystem services are valued at approximately R**73 Billlion** contributing to 7% of the country's GDP per annum.(Table 5).

Table 5. Summary of the Valuation of Biodiversity and Ecosystem Services- Jane Turpie Study (2008)

TYPE	CLASS	Valuation (Amt in R Millions)
PROVISIONING	Grazing	18094
	Natural Resources	4895
	Bioprospecting	178
REGULATION & MAINTENANCE	Carbon Sequestration	8649
	Pollination)	5684
	Erosion Control	8319
	Flow Regulation	440
	Water Treatment	202
	Black Fly Control	77
	Crop Pest Control	4380
	Nursery Value	976
CULTURAL	Tourism	21 000
	Scientific	15
Overall Value	Biodiversity	**73 Billion**
		Approximately 7% of GDP

In 2009, the National Biodiversity Framework was published in terms of the Biodiversity Act (Act 10 of 2004). Section 35 of the Public Finance Management Act (PFMA), Act 1 of 1999 as amended by

Act 29 of 1999 which stipulates that, *new national legislation that assigns an additional function or power to, or imposes any other obligation on, an implementing agency, must, in a memorandum that must be introduced in the Parliament with that legislation, give a projection of the financial implications of that function, power or obligation to the implementing agency."* The total overall costs for the implementation of the NBF for all strategic objectives amounted to R7,6 billion. This figure is still applicable as it was a projection over five years. Hence, R7.6 Billion is required to manage and conserve biological resources and services worth R73 Billion. Given the assumptions and the gaps revealed in this study, this existing valuation requires a revisit as does the methodology for costing and valuation.

The most striking finding from this study is the inconsistent and piecemeal way valuation studies have been conducted in South Africa. Whilst these studies are valuable and provide important information, it is clearly time to develop an agreed and consistent framework for valuing services at a national level, and to launch a study to this effect. The TEEB valuation framework which provides guidelines and approaches to assessing each of the listed 22 services identified here could be a logical place to start. A key feature of such a framework would be that individual studies undertaken within such a framework would fit together thereby allow for the eventual construction of a national picture or "whole value" of ecosystem services. So a national level assessment of this nature would be a long term sum of all these parts. The findings from this Baseline suggest that is not starting from zero. This overview shows that considerable (albeit piecemeal) valuation work has been undertaken. These will serve as valuable 'pilot' studies for future work, allowing for cross validation of future studies.

Furthermore this current review identifies a number of well placed practitioners who are capable of undertaking valuation work of this nature. Given the time taken and costs of research of this nature, it would be advisable to undertake a prioritisation exercise, where stakeholders and interested parties would come to a negotiated agreement on which ecosystem services should be valued according to which broad habitat unit or defined geographic scale. This prioritisation exercise could also provide a platform for discussion on which, if any of the services should not be subject to valuation. Launching an SA TEEB study of this nature will require time and considerable investment.

Lastly it must be noted that this Baseline is an iterative process which is ongoing in order to provide a more coherent and accurate picture of the current situation regarding the valuation of Biodiversity and ecosystem services in South Africa.

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