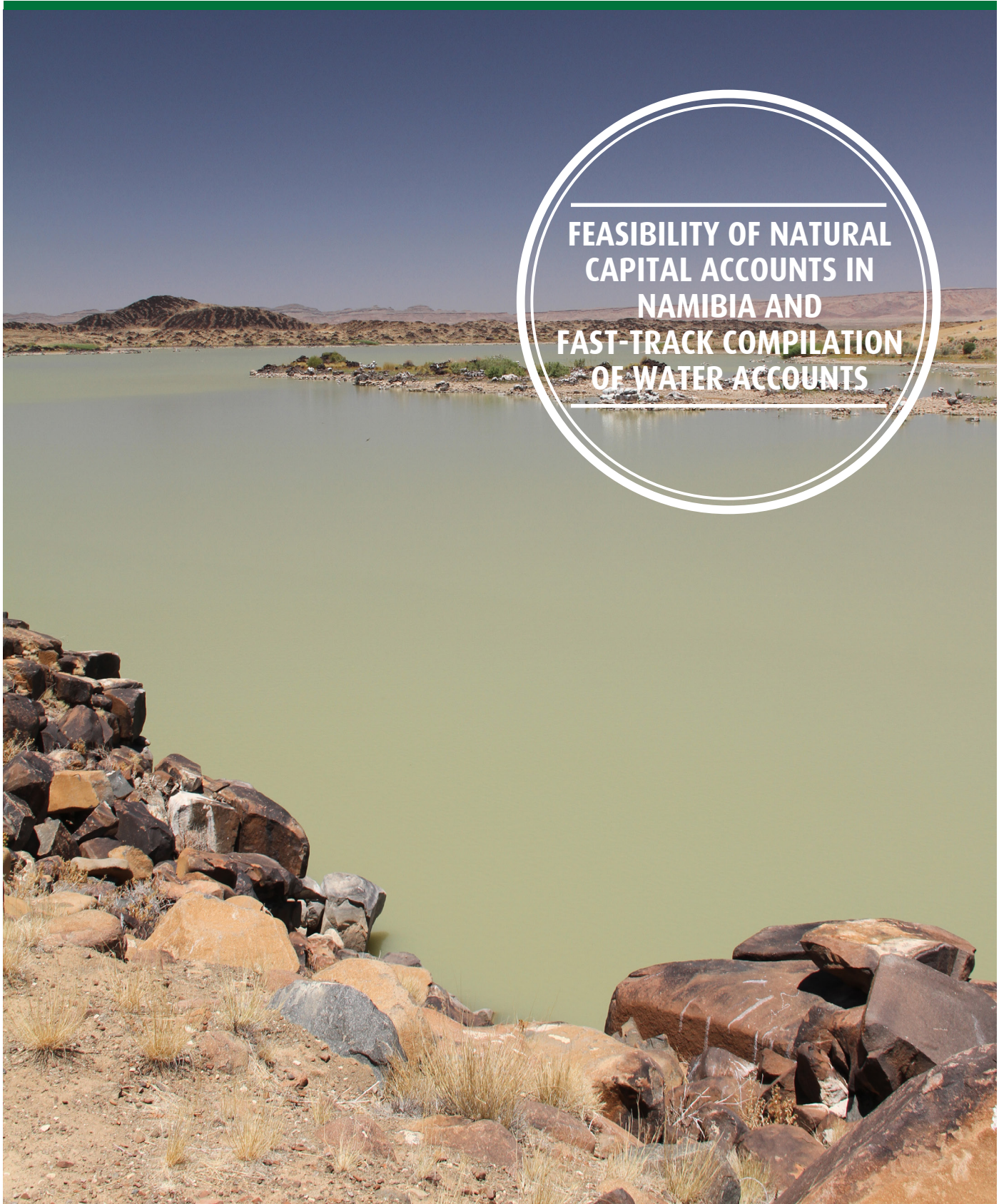**Republic of Namibia**

MINISTRY OF ENVIRONMENT AND TOURISM

FEASIBILITY OF NATURAL
CAPITAL ACCOUNTS IN
NAMIBIA AND
FAST-TRACK COMPILATION
OF WATER ACCOUNTS

Feasibility of Natural Capital Accounts in Namibia and fast-track compilation of water accounts
Final Report

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MINISTRY OF ENVIRONMENT AND TOURISM

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On behalf of:

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Environment, Nature Conservation,
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of the Federal Republic of Germany

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List of Acronyms

DWA   Department of Water Affairs
ECB   Electricity Control Board
GDSA   Gaborone Declaration for Sustainability in Africa
GIZ   Deutsche Gesellschaft für Internationale Zusammenarbeit
ISIC   International Standard Industrial Classifications of All Economic Activities
MAWF Ministry of Agriculture, Water and Forestry
MET   Ministry of Environment and Tourism
MFMR Ministry of Fisheries and Marine Resources
MLR   Ministry of Lands Reform
MME   Ministry of Mines and Energy
NCA   Natural Capital Account / Natural Capital Accounting
NDP   National Development Plan
NMS   Namibia Meteorological Service
NPC   National Planning Commission
NSA   Namibia Statistics Agency
NSDI   National Spatial Data Infrastructure
PPP   Purchasing Power Parity
RWS   Rural Water Supply
SDGs   Sustainable Development Goals
SEEA   System of Environmental-Economic Accounting
UNSD   United Nations Statistics Division

Executive Summary

One important approach for mainstreaming the environment and its value into broader governance processes is by compiling natural capital accounts (NCAs). Over the last two decades UN Statistics has developed the System of Environmental Economic Accounts (SEEA). SEEA outlines the methodology for and the application of NCAs, and has become as a statistical standard in 2012. With SEEA, countries now have comprehensive guidelines as to how to measure and evaluate the total value that nature provides to the economy – and how to better integrate the use of the environment into policy making and development planning.

Namibia has been compiling NCAs since the 1990s, but efforts have mostly quieted since the mid-2000s. Based on these earlier efforts, this report has two aims: 1) provide a feasibility study on NCAs in Namibia, and 2) develop fast track accounts for water.

In the **feasibility study**, we have analyzed different types of natural capital – namely water, fisheries, land and energy & minerals – with respect to:

- The feasibility of compiling NCAs, based on existing data,

- The added benefit that NCAs provide beyond existing ways to aggregate and analyze environmental-economic data, and

- Potential priority areas for implementing NCAs – which may then form a basis for decision makers to choose which NCAs should actually be implemented.

We conducted the feasibility study by literature research, by interviewing 63 decision makers and stakeholders from the governmental sector, the private sector, and research and international organizations. Additionally we reviewed the central policy documents, literature, research and databases in a desktop exercise. We reach the following five conclusions:

1. The fast track accounting structures we developed for water can serve as blueprint for implementing other NCAs such as energy or land. In addition, compiling different NCAs with similar methodologies would permit an easy link of different NCAs.

2. Beyond water[1] , land is a prime candidate for NCAs. Land data are (partly) of good quality, but scattered among institutions and not available in a one framework. NCAs would allow in-depth statements on the impact of land management on ecosystems.

3. Energy is another prime candidate for compiling NCAs. Energy data are of good quality, but likewise scattered among different institutions. NCAs for the energy sector can provide guidelines for strategic decisions for different energy sources and their environmental impacts. Given a likely upcoming shortage of energy, NCAs would thus permit better planning to combat that shortage.

4. Collaboration among institutions is key for natural capital accounting, since necessary data are typically collected and process by different institutions. A clear process for collaboration with responsibilities has to be defined in order to compile NCAs. An example of such an institutional analysis is given for the water sector. It is recommended to commence NCA compilation with an institutional and stakeholder map and to include data sources, data exchange and interfaces between institutions.

5. MET should coordinate the set-up of the process described above, since MET has a good working knowledge across many fields. Once the process has been implemented it should be handed over to the identified owner.

The **fast-track water accounts** we developed are based on existing data in Namibia. They contain stock accounts as well as supply and demand accounts which may regularly be updated and ultimately be developed into full accounts. Our development of fast-track water accounts can be summarized in three major findings:

1. In 2015/2016 Namibia has reached a tipping point: Water demand projected by water planning at the Department of Water Affairs exceeds available developed surface and groundwater resources. Therefore, policies need to be implemented to increase available resources, manage demand or increase water use efficiency.

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[1]   Water has already identified as a priority area prior to our study

2. The assessment of available stocks of surface water and especially of groundwater should be a standard procedure for future water accounting in Namibia because groundwater depletion is a serious threat in Namibia. Water accounting that only focuses on developing flow accounts cannot adequately capture and address this threat.

3. An institutional framework that defines participating institutions as well as data sources, processing and coordination has to be implemented (as with NCAs for other resources, see Conclusion 4. above). The present institutional setup in Namibia with respect to water management is complex with many institutions, interest groups and councils taking part in the decision making process. In consequence, data and information flows are insufficiently coordinated, which impedes the development of operational water accounting. We propose an expanded institutional framework based on an institutional analysis with stakeholders and experts.

We summarize that natural capital accounts can provide macro-economic and environmental indicators to guide governance of the environment. Our feasibility study and fast-track accounts demonstrate that NCAs may readily be compiled on a project basis. However, in order to provide continuing guidance, NCAs have to be compiled regularly (if possible annually) under the auspices of appropriate institutions and according to standardized methodology and procedures. The major bottleneck is cooperation between different ministries and institutions for data aggregation, integration and processing. Thus, making NCAs operational requires implementing inter-institutional structures and assigning clear responsibilities for compiling and maintaining NCAs.

1

Introduction

1 **Introduction**

1.1. **Motivation**

An important approach for mainstreaming biodiversity and bringing its value into broader governance processes is to compile Natural Capital Accounting (NCA). Furthermore, natural capital accounting contributes to disclose the value of the environment for the society and to highlight the relationships between the economy and the environment. For this purpose, over the last two decades, the United Nations Statistics Department (UNSD) in cooperation with several other institutions[2] has developed the System of Environmental-Economic Accounting (SEEA) which provides both a systematic framework and guidelines for compiling NCAs for various natural capital goods. NCAs serve as satellite accounts[3] to the conventional System of National Accounts (SNA) which is the internationally agreed standard set of measures of economic activity.[4] NCAs organize "statistical data for the derivation of coherent indicators and descriptive statistics to monitor the interactions between the economy and the environment and the state of the environment".[5] Thus, they provide a powerful information basis for depicting, tracking and forecasting the state of the environment and interactions between the economy and the environment.

Furthering the use and application of NCAs in Namibia is one of the tasks of the Resource Mobilization for Effective Implementation of the Updated Biodiversity Strategy and Action Plan (ResMob) Project. This project is being implemented by the Namibian Ministry of Environment and Tourism (MET), in partnership with the German Development Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit, GIZ) and commissioned by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

1.2. **Objectives of this report**

The ResMob project commissioned konsekwent GmbH and the Lübeck University of Applied Sciences to carry out the following objectives during the period of July - December 2015:

1. Conduct a feasibility study that will provide information to inform decision-making on priorities for natural capital accounting based on the SEEA,

2. Compile a fast-track water account to showcase the possibilities of environmental-economic accounting based on the SEEA-water framework, and

3. Improve the capabilities of MET staff and selected environmental economists in compiling NCAs focused on water (which took place on 11/12 November 2015)

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[2] These other institutions were the European Union, the FAO, the International Monetary Fund, the OECD and the World Bank.

[3] Satellite accounts cover aspects that are either not covered or insufficiently detailed by the conventional national accounts, (e.g. tourism or environment). As satellite accounts have the same structure as national accounts, information in satellite accounts can readily be linked to information in national accounts. This allows, for example, for the generation of combined indicators.

[4] This refers to the version of the year 2008.

[5] Source of quote: http://unstats.un.org/unsd/envaccounting/seea.asp

1.3. Structure of this report

This final report details the approach and preliminary findings and is structured as follows:

Chapter 1 provides the introduction to the report.

Chapter 2 provides the background on the development of NCAs, country-specific developments and experience with NCAs in Namibia and neighboring countries.

Chapter 3 details the approach, methods and results of the feasibility study of NCAs in Namibia.

Chapter 4 presents the fast-track developed water accounts.

Chapter 5 provides recommendations for further implementation of accounts and provides a roadmap.

Chapter 6 concludes and details next steps.

In addition, three appendices are listed at the end of this report.

2

Background

2 **Background**

In order to achieve sustainable development with respect to People, Planet, Prosperity Peace and Partnership[6], governments have an interest to equitably meet economic and environmental needs of present and future generations. In addressing development and growth aspirations, it is up to policy makers, regulators and affiliated national bodies to balance these aspirations with a corresponding use of the environment. As for Namibia, overarching guidance is given by the Namibian Constitution, where Article 91(c) specifies the duty (of the Ombudsman)

> *"to investigate complaints concerning the over-utilization of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia"*

and where Article 95(l) includes in the Principles of State Policy

> *"the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future."*

The environment serves as the foundation for life and for society and all human activities including economic development (see Figure 1). Stocks in the environment, like forests or rivers, generate natural inputs such as timber or water which "flow" into the economy. Here industries and businesses process these inputs, transforming them into products which are consumed by households and governments.[7] In the course of this process, residuals such as emissions or return flows are generated, "flowing" back from the economy into the environment. While some of these flows between the economy and environment often have positive outcomes and long-term economic benefits for people (e.g. all the food people extrac from the environment), at the same time others may have adverse impacts upon the environment (e.g. CO_2 emissions).

Figure 1: Interdependency of environment and economy. Source: SEEA - Central Framework, 2014.

Statistical frameworks have been developed to capture these environmental-economic interactions. One such prominent example is natural capital accounting. In this chapter, an internationally recognized standard for compiling NCAs is introduced (Chapter 2.1). The chapter also provides a country profile which focuses on policies that are related to NCAs (Chapter 2.2) and details experience with NCAs in other African countries (Chapter 2.3).

2.1. The System of Environmental Economic Accounts (SEEA)

An important international standard that defines the methodology for compilation of NCAs is the System of Environmental Economic Accounts (SEEA) developed by the United Nations Statistics Division (UNSD). The concept and methodology is detailed in the so-called SEEA Central Framework.[8]

The SEEA Central Framework provides a basis for depicting and tracking the state of the environment and interactions between the economy and environment. Moreover, the framework enables an analysis of the development of stocks and flows in the economy and environment. The accounts can be used for compiling indicators or in depth-analyses such as forecasts or modelling exercises. By improving the decision-basis the accounts bring substantial benefit to national planning, for example, when defining strategies, visions and National Development Plans (NDPs).

2.1.1. Conceptual structure of the SEEA

The SEEA framework follows a similar accounting structure to the UNSD System of National Accounts (SNA), using concepts, definitions and classifications consistent with the SNA (see also Chapter 2.1.2). Accordingly, the SEEA framework helps to organize and incorporate the information on the various stocks and flows of the economy and the environment into a series of tables and accounts.

The SEEA central framework comprises the following four types of accounts:

1. **Supply and use tables** in physical and monetary terms show flows of natural inputs, products and residuals, (e.g. physical flows of materials and energy within the economy and between the economy and environment);

2. **Asset accounts** for individual environmental assets in physical and monetary terms show the stock of environmental assets at the beginning and at the end of each accounting period and the changes in the stock;

3. A sequence of **economic accounts** highlight depletion-adjusted economic aggregates; and

4. **Functional accounts** record transactions and other information about economic activities undertaken for environmental purposes.

In the following paragraph, the first two of the above mentioned types of accounts will be characterized as they hold a primary focus for the majority of this report.

2.1.1.1. Supply and use tables

Supply and use tables can be differentiated into physical tables and monetary tables (Table 1). Physical supply and use tables measure physical units of natural flows within in the economy and from and to the environment. More precisely, the SEEA Central Framework states that "[these tables] assess how an economy supplies and uses energy, water and materials, as well as examine changes in production and consumption patterns over time".[9]

Tables are divided into two parts, the supply table and the use table which depict the flows from two opposing points of view. Taking a balance sheet approach, the total supply of each product must equal the total use of each product.

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[8] Food and Agriculture Organisation of the United Nations, European Commission, Organisation for Economic Co-operation and Development, United Nations & The World Bank (2014): System of Environmental-Economic Accounting 2012 - Central Framework. 378 pages.

[9] Ibid, p.17.

Table 1: Basic form of a physical supply and use table. Reprint from SEEA Central Framework.

	Industries	Households	Accumulation	Rest of the world	Environment	Total
Supply table						
Natural inputs					Flows from the environment	Total supply of natural inputs
Products	Output			Imports		Total supply of products
Residuals	Residuals generated by industry	Residuals generated by final household consumption	Residuals from scrapping and demolition of produced assets			Total supply of residuals
Use table						
Natural inputs	Extraction of natural inputs					Total use of natural inputs
Products	Intermediate consumption	Household final consumption	Gross capital formation	Exports		Total use of products
Residuals	Collection & treatment of waste and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals

Note: Dark grey cells are null by definition. Blank cells may contain relevant flows. These flows are explained in detail in Chapter 3.

Monetary tables complement the physical tables (see Table 2). These essentially capture the valued physical flows within the economy in monetary terms. Valuation of flows is typically based on market prices. Similar to physical tables, monetary tables are subdivided into supply and use tables which are linked by balancing the total of supply and use.

Table 2: Basic form of a monetary supply and use table. Reprint from SEEA Central Framework.

	Industries	Households	Government	Accumulation	Rest of the world	Total
Supply table						
Products	Output				Imports	Total supply
Use table						
Products	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Gross capital formation (incl. changes in inventories)	Exports	Total use
	Value added					

Note: Dark grey cells are null by definition.

Both physical supply and use tables as well as monetary supply and use tables operate on an identical structure.[10] In this manner, changes in productivity and intensity in the use of natural inputs can be identified.

2.1.1.2. Asset accounts

While the above discussed supply and use accounts depict physical flows (e.g. total amount of wood used in an industry in tonnes) and monetary flows (e.g. economic values of the wood used in a specific industry in US dollar), the asset accounts cover the corresponding natural stocks (e.g. total amount of forest area). An asset account starts with the opening stock of environmental assets and ends with the closing stock of environmental assets. Assets experience changes between the beginning and the end of any accounting period. The physical measurement of assets therefore records either additions to the stock or reductions in the stock. The SEEA Central Framework further states that "in monetary terms, the same entries are made but an additional entry is included for the purpose of recording the revaluation of the stock of environmental assets. This entry accounts for the changes in the value of assets over an accounting period that are due to movements in the price of the assets."[11] A basic form of an asset account is presented below in Table 3.

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[10] The system e.g. runs a column for the environment, and rows for natural inputs and residuals.
[11] Ibid, p. 19.

Table 3: Basic form of an asset account as per SEEA.

Opening stock of environmental assets
Additions to stock
Growth in stock
Discoveries of new stock
Upward reappraisals
Reclassifications
Total additions of stock
Reductions of stock
Extractions
Normal loss of stock
Catastrophic losses
Downward reappraisals
Reclassifications
Total reductions in stock
Revaluation of the stock*
Closing stock of environmental assets

* Only applicable for asset accounts in monetary terms

2.1.1.3. The connections between supply and use tables and asset accounts

Asset accounts are tightly connected with the supply and use tables and vice-versa. These connections highlight the fact that the SEEA Central Framework is an integrated system. For demonstration purposes, one can imagine the system as a matrix, whereby the vertical reflects both a monetary and physical supply and use table and whereby the horizontal reflects asset accounts (physical and monetary terms) including an opening stock and closing stock. Altogether, supply and use accounts and asset accounts cover the relevant stocks and flows in an environmental-economic system, as depicted in Figure 1 (p. 12).

2.1.2. SEEA and its linkages to the UNSD System of National Accounts

The UNSD implemented the System of National Accounts (SNA) as the internationally agreed standard set of measures of economic activity.[12] The SNA states that flows measure changes in economic value over a period of time. Stocks appear in the balance sheets and related tables. SNA supply and use tables are the basis for important indicators such as the GDP.

The definitions, guidelines, accounting rules and practical approaches of SNA are also applied to the SEEA-based NCA. This allows stock and flows from the environment to the economy to be captured in such a way that they may easily be linked to the standard economic statistics depicted in the SNA.

2.1.3. SEEA sub-types for different natural capitals

The SEEA framework entails different sub-types of natural capital accounts (see Figure 2). Both water and energy have been identified by UNSD as a priority area. SEEA-Water has been designated as an interim international standard.[13] SEEA-Energy is under development.[14] Other sub-types include Land and Ecosystems Accounting and the SEEA Agriculture, Forestry and Fisheries (so-called "SEEA AFF").[15]
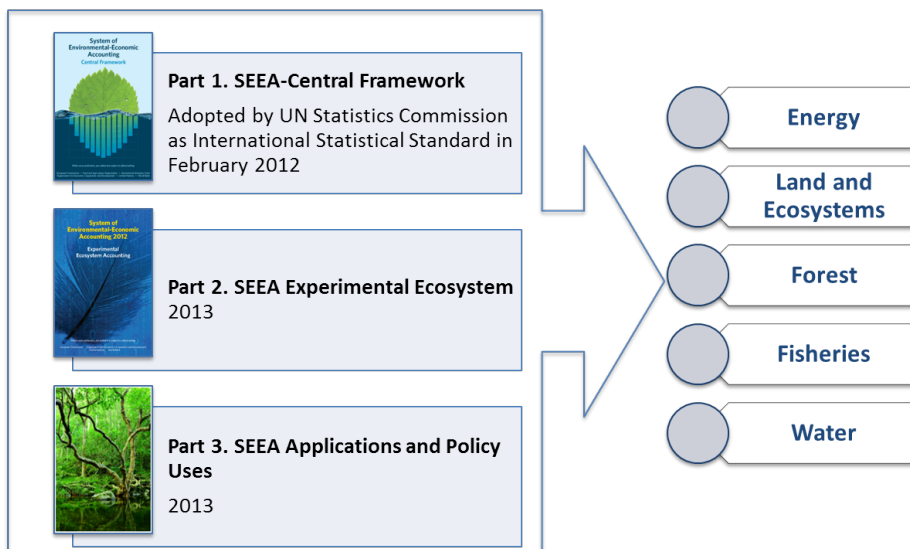
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[12] This refers to the version of the year 2008

[13] http://unstats.un.org/unsd/envaccounting/water.asp

[14] http://unstats.un.org/unsd/envaccounting/energy.asp

[15] http://unstats.un.org/unsd/envaccounting/seea.asp

Figure 2: The UN SEEA including sub-types of natural capitals accounts. An asterix denotes a sub-account under development. Source: WAVES program, 2014.

2.1.4.   Policy relevance of the SEEA

The SEEA covers a broad range of environmental-economic topics, especially if combined with conventional economic statistics. The SEEA accounts typically incorporate information from various thematic areas and, thus, break-up the traditional "silo approach" typically found in governmental structures where one line ministry only produces and reports statistics in its specific thematic area. Within the SEEA framework, statistics may readily be reported at three levels of aggregation (see Figure 3):

1. Data contained within the SEEA can be used, in combination with data from the SNA, for environmental-economic modelling to assess various scenarios and set policy priorities;

2. Data tables, such as supply and use tables, may pinpoint the state of the environment and key drivers of change, and offer a richer understanding of policy issues; and

3. Summary information in the form of aggregates and indicators as headline numbers can help to frame discussions.

Figure 3: Integrated production process for development indicators. Source:[16]
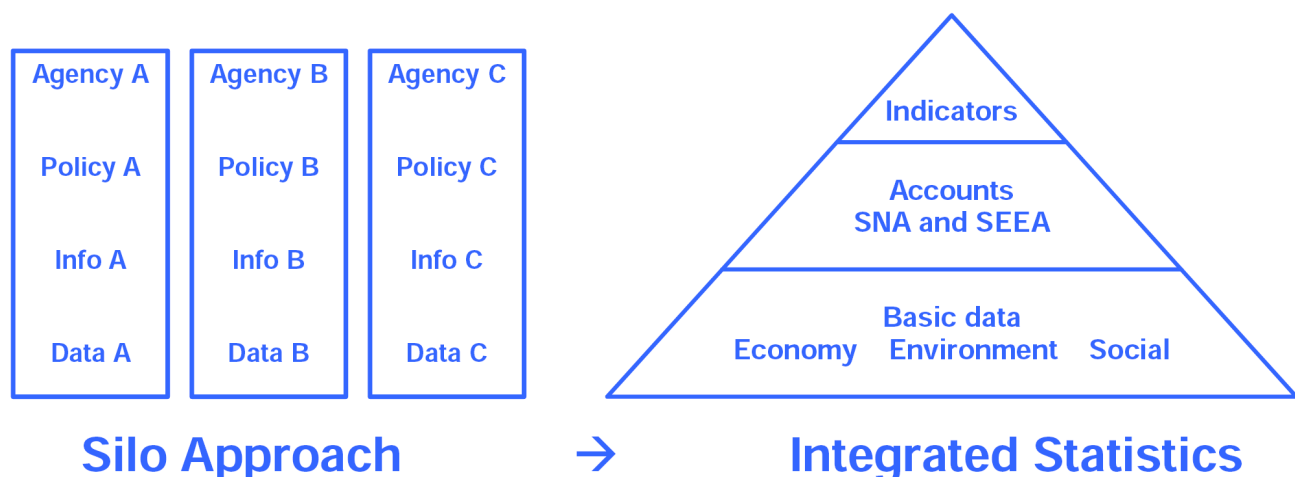
Decision makers as well as the public are typically most interested in summary information and, more specifically, indicators. The SEEA is suitable for providing environmental-economic indicators such as:[17]

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[16] United Nations Statistics Division: The SEEA and the SDGs Indicators. Presented by Ian Ewing, Chair of the UNCEEA, at the Side Event 46th session of UN Statistical Commission. New York, 3 March 2015

[17] Food and Agriculture Organisation of the United Nations, European Commission, Organisation for Economic Co-operation and Development, United Nations & The World Bank (2014): System of Environmental-Economic Accounting 2012 - Applications and Extensions. White cover publication, pre-edited text subject to official editing. 131 pages.

- resource use and environmental intensity of the economy (e.g. water and energy productivity, waste and emission intensity),

- production, employment and expenditure relating to environmental activities (e.g. contribution of environment-related activities to GDP, contribution of different sectors to the recovery of the costs of supplying the wastewater treatment service),

- environmental taxes, environmental subsidies and similar transfers (e.g. total environmental taxes to GDP),

- environmental assets and their role in the economy (e.g. changes in stocks of natural resources, depletion adjusted value added for extractive industries, provision of water).

Given that the SEEA Central Framework was adopted as an international standard relatively recently, evidence on its impact on policy relevance of this is still sketchy (see Chapter 3.1 for previous experience with SEEA in Namibia). However, the SEEA provides all the tools and methodology to better inform and structure policies with relevance to the environmental-economic dimension.

2.1.5.   Sustainability Developmental Goals and SEEA

The Sustainable Development Goals (SDGs) are an intergovernmental set of 17 aspirational goals with 169 targets. The Goals were ratified by a United Nations Resolution of 25 September 2015 to aim at a 15-year global plan of transformation. SDGs and SEEA cover in part similar issues (as detailed in Table 4).

Table 4: Sustainable Development Goals and linkage seen with Natural Capital Accounting. Asterixes denote extent of overlap between SDGs and NCAs: * moderate overlap, ** high overlap, * very high overlap. Targets specify the SDG targets with overlap to the SEEA**

No.	Sustainable Development Goals	Linkage to SEEA	
		Extent	Targets
1.	Poverty - End poverty in all its forms everywhere		
2.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture		
3.	Health - Ensure healthy lives and promote well-being for all at all ages		
4.	Education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		
5.	Women - Achieve gender equality and empower all women and girls		
6.	Water - Ensure availability and sustainable management of water and sanitation for all	***	6.1-6.6a
7.	Energy - Ensure access to affordable, reliable, sustainable and modern energy for all	***	7.2-7.b
8.	Economy - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	**	8.1-8.4
9.	Infrastructure - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		
10.	Inequality - Reduce inequality within and among countries		
11.	Habitation - Make cities and human settlements inclusive, safe, resilient and sustainable		
12.	Consumption - Ensure sustainable consumption and production patterns	**	12.1-12.5, 12.b
13.	Climate - Take urgent action to combat climate change and its impacts	**	13.1-13.3, 13.b
14.	Marine- ecosystems - Conserve and sustainably use the oceans, seas and marine resources for sustainable development	***	14.1-14.2, 14.4.-14.5, 14.a
15.	Ecosystems - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and reverse land degradation and halt biodiversity loss	***	15.1-15.5, 15.9-15.b
16.	Institutions - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels		
17.	Sustainability - Strengthen the means of implementation and revitalize the global partnership for sustainable development	*	17.18- 17.19

The table shows that there is overlap between the goals / targets and NCA especially with regards to water, energy, climate, and marine and terrestrial ecosystems. Moreover, SDGs reflect multiple dimensions of development (health, decent work, climate, etc.) simultaneously. Policy thinking must integrate these dimensions if progress is to be achieved. In this respect, the SDGs represent an extension over NCAs (which do not directly cover aspects such as health) – but NCAs may constitute an important contribution to the national monitoring of SDGs by providing comprehensive and recent data and by providing a tool to monitor the progress of SDGs.

2.1.6. Implementation of and compliance with SEEA

The UN currently pursue the implementation phase of SEEA. One goal is to generate comparable statistics and indicators across countries. To that end, a set of standard[18] accounts and tables are envisioned in order for countries to report on these tables and accounts. Beyond generating comparable statistics and indicators, such a standardization will also allow compliance with the SEEA framework to be monitored.

Discussions are also ongoing with respect to a label or certification scheme for a country's compliance with the SEEA Central Framework with respect to the compilation of environmental-economic statistics. Such undertakings would help to run an independent quality check. The UN Committee of Experts on Environmental-Economic Accounting is presently investigating this issue. A final outcome is not yet publically available, but it becomes clear that such a certifications scheme may provide a big push at the country level in terms of international credibility for its environmental-economic accounts.

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[18] Even though the general methodology for compiling accounts and tables is fixed in the SEEA, the framework allows for flexibility in the scope of individual accounts and tables. Standardizing these accounts and table would provide a fixed structure for countries to report in.

2.2. Namibia: Country profile and policy landscape

2.2.1 Country profile

Namibia is located in south-western Africa. The country shares borders with South Africa (to the south), Botswana (east), and both Angola and Zambia (to the north). Namibia has a population of 2.1 million and a land area of 823,290 km[2]. The terrain is mostly high plateau, and the climate ranges from arid in the Namib Desert (along the coast in the west of the country) and Kalahari Desert (in the east), to subtropical in other parts of the country. It is considered one of the driest countries in southern Africa and the world with extremely variable rainfalls.

Whilst surface and ground water resources are scarce, Namibia has extensive mineral and ecosystem resources. According to Ruppel and Ruppel-Schlichting, Namibia is in a good position due to its pristine natural environment and rich biodiversity, good governance and sound environmental management.[19] However, Namibia at the same time faces challenges especially related to poverty, climate change, desertification and flooding / erosion.

Surface and ground water resources:

The availability of fresh water is a concern for future economic development, but also, increasingly, for human consumption: a number of water reservoirs around the country are running low at present.[20] Responsibility for water management lies with the Department of Water Affairs at the Ministry of Agriculture, Water and Forestry (MAWF) which overlooks the total of about six hundred and sixty-five (665) boreholes that supply ground water as well as more than 50 gauging stations of surface water in the country. Other stakeholders in water management include NamWater, local authorities and other government ministries such as the Ministry of Environment and Tourism (MET) and the Ministry of Lands Reform (MLR).

Mineral resources:

Namibia possesses rich mineral deposits, which are a basis for economic growth. Exploration is ongoing for various minerals including precious stones (value of production N$7,859 million), uranium (N$5,454 million) and base metals (N$3,201 million).[21] Data from 2014 indicate that turnover of member companies of the Chamber of Mines exceeded N$21,610 million (for total economic contribution see Chapter 2.2.2).[22]

Wildlife and biodiversity:

Namibia has rich wildlife. Inscribed on the World Natural Heritage List by UNESCO is Twyfelfontein (2007) and the Namib Sand Sea (2013). In Namibia, biodiversity-based enterprises, including the capture and trade in bush meat, skins and other products, hunting etc., contribute to the economy. The environment-based tourism is a fast growing and significant industry (for total economic contribution see Chapter 2.2.2). The conservancy approach has resulted in increases in wildlife populations, generation of income for local communities and creation of new jobs.[23]

Environmental management:

The Republic of Namibia accords high priority to environmental protection for sustainable development, hence it has adopted a number of policies since 1990 to manage and preserve the environment. It recognizes that environmental management is both an enabler and driver of economic development. The issue of environmental management is firmly anchored in Namibian laws and policies which are based on the Namibian Constitution.[24] The Constitution refers to the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources in a sustainable manner for the benefit of all Namibians, both present and future. In the early stages, the focus was on conservation, but it has since moved towards to climate change as new environmental challenges have emerged. Other environmental challenges include the ever increasing human-wildlife conflicts (such as poaching) as both the human population and the wildlife populations are increasing, thus increasing the demand for farming and grazing land for the humans and their domestic livestock.[25]

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[19] Ruppel O. Ruppel-Schlichting K. (2011): Environmental Law and Policy in Namibia. Hanns Seidel Foundation 2011

[20] Republic of Namibia: Namibia's Fourth National Development Plan

[21] Year 2012, data by the Namibian Statistical Agency

[22] Chamber of Mines of Namibia (2015): Annual Review 2014

[23] Republic of Namibia, Ministry of Environment and Tourism (2009): Climate Change Strategy and Action Plan. Proposed document. 99 pages.

[24] Republic of Namibia: Namibia's Fourth National Development Plan

[25] Human wildlife conflict in Namibia: http://wwf.panda.org/what_we_do/where_we_work/project/projects_in_depth/hwc_namibia/ Accessed on 16. November 2015

Poverty:

Approximately 2.1 million people live in Namibia.[26] 54.3% of the population lives in rural areas, while 28.7% of the population lived below the poverty line in 2010.[27] Much of the population depends on natural resources for their livelihoods (agriculture, fisheries, nature-based tourism, and indigenous natural plant products).[28] Around 70% of the population is directly dependent on natural resources for income.[29] This group is particularly vulnerable to climate change and land degradation. Poverty in Namibia continues to exhibit an urban-rural divide. A number of regions fail to provide safe drinking water and basic sanitation systems.[30]

Climate change:

Climate in Namibia is inherently highly variable. Climate change is therefore an added stressor on this variability. Recent historical trends of climate in Namibia reveal that there has been a consistent increase in daily maximum temperatures. While a more variable pattern of rainfall is predicted for Namibia, climate change will cause increased aridity due to the combined effect of variable rainfall and increased evaporation 2020. There will also be increased frequency of hot days, heat waves, drought, heavy rainfall events, etc.[31]

Altogether, climate change is predicted to have numerous impacts on Namibia.[32] These include, but are not limited to, the following: livestock losses, reduced grain/ crop production and yields and severe water scarcity due to droughts and increased temperatures.[33] Presently, Namibia is experiencing a water crisis in Windhoek and central Namibia because it has not received good rains since 2011.

Land degradation and desertification:

Land use in Namibia faces several external and man-made challenges. Foremost among them is environmental degradation, particularly in areas in the periphery of mining activities and in the form of bush encroachment in both commercial and communal livestock farming areas which reduce the carrying capacity of rangelands. Furthermore, under the effects of a changing climate it is predicted that there will be a spatial shift in the distribution of dominant vegetation types in some ecosystems such as replacement of grassy savannah by a more arid-adapted desert and arid shrub land vegetation type. One potential outcome is further pressure on livestock farming and other land uses. Finally, to a minor extent and related to the north of the country, there are challenges related to deforestation.

Coastal and marine resources:

Situated at the shores of the Atlantic Ocean, Namibia has access to rich marine resources. Accordingly, national interests are committed to sustainably managing fish stocks living within the jurisdiction of the exclusive economic zone. Major fish and crustaceans that are harvested include Hake, Horse Mackerel, Pilchards and Monk Fish. The total marine harvest in 2012 exceeded 500,000 metric tonnes.[34]

Energy:

Namibia is provided with rich energy resources, of which the most abundant source is solar energy. Its considerable energy yield ranks amongst the best in the world. Namibia's excellent sunshine regime allows annual energy yields of between 1,600 kWh/kW in coastal areas, up to about 2,100 kWh/kW in certain locations in southern Namibia. However, electrical energy consumed in Namibia to date is still generated in the conventional ways. The Ruacana hydro-electric power station for example contributes dominantly to local supply.[35] The power station is dependent on the availability of water in the Kunene River, which varies from month to month, and year to year. There is no large-scale dam at or near Ruacana and only a small reservoir is available to manage water over a 24-hour period. Consequently, there is no effective buffer that ensures water availability and can be used to regulate flow during the dry period. This implies that electricity generated at Ruacana will remain dependent on rainfall water which mostly flows from south-western

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[26] Latest census available under http://www.gov.na/population

[27] CIA Factbook (2015) Namibia. Available online: https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html. Accessed 15. November 2015

[28] Convention on Biological Diversity (2015) Namibia – country profile. Available online: https://www.cbd.int/countries/profile/default.shtml?country=na#facts Accessed 15. November 2015

[29] Convention on Biological Diversity (2015) Namibia – country profile. Available online: https://www.cbd.int/countries/profile/default.shtml?country=na#facts Accessed 15. November 2015

[30] National Planning Commission: Namibia Poverty Mapping. ISBN: 978-99945-0-085-7.

[31] Reid, H., L. Sahlén, J. Stage, J. MacGregor (2007). The economic impact of climate change in Namibia: How climate change will affect the contribution of Namibia's natural resources to its economy. Environmental Economics Programme Discussion Paper 07-02. International Institute for Environment and Development, London.

[32] Ibid.

[33] Republic of Namibia, Ministry of Environment and Tourism (2009): Climate Change Strategy and Action Plan. Proposed document. 99 pages.

[34] Ministry of Fisheries and Marines Resources (2014). Annual Report 2012-2013. p. 22.

[35] Other plants include: The coal-fired van Eck power station near Windhoek, and Paratus and Anixas in Walvis Bay.

Angola. This might change as a result of long-term climate change as well as new and additional uses of Kunene River water in Angola.[36] Besides local generation of electricity, there is a heavy reliance on electricity imports from neighboring countries that form the Southern Africa Power Pool.[37] The current energy outlook shows that energy consumption is projected to increase by 2.2% percent year on year from 2016 to 2017 and by 4 percent year on year from 2018 to 2020.[38] Other available modeling scenarios with low, medium and high growth for the years 2015 to 2030 suggest that electricity consumption in 2030 is forecasted to be 50% to over 100% higher than in 2010 depending on the growth scenario.[39] In contrast to the demand side, the supply covers different generation scenarios currently approached by the Ministry of Mines and Energy.

Based on a census in 2011, Namibia holds a tiny reserve of natural gas and oil,[40] but it is believed that Namibia's offshore areas may hold manifold hydrocarbon resources – albeit not easy to exploit.

With regard to energy, the government has begun to work on a comprehensive legal framework to pave the way for renewable energy technology. The Ministry of Mines and Energy is currently working on a number of projects, such as the review of the White Paper and the New Energy Regulatory Framework, which will eventually provide for renewable energy integration. Apart from that, two acts of parliament are in preparation, namely the Renewable Energy Act and an overall Energy Efficiency Act.

2.2.2   Brief macro-economic profile

Namibia is considered an upper middle income country though its economy remains vulnerable to world commodity price fluctuations and drought.[41] Namibia's 2013 GDP is estimated to have been USD$13.11 billion and the 2014 GDP per -capita (PPP) was USD$10,800.[42] Real GDP growth is approximately 5% per annum.[43] In 2014, the largest contributors to Namibia's GDP were: services (64%), industry including mining (30%), and agriculture (6%). Further breakdowns suggest that the mining industry makes a direct contribution of approximately 13% to the country's GDP, and tourism contributes approximately 15.7% (directly and indirectly) to GDP.[44,45] , The relatively small contribution of agriculture is, amongst others, explained by fact that primary productivity of land resources is low due to semi-arid conditions and low soil fertility.

2.2.3   Policy landscape and entry points into NCAs

For the purpose of this report, an initial but scattered assessment of the policy landscape is presented. Its scope is limited to selected development issues and environmental policy. The overview will help to better understand entry points for Natural Capital Accounting activities within the general policy landscape.

Namibia's Vision 2030 and National Development Plans:

The Vision 2030 was launched by the Founding President, Dr. Sam Nujoma, in June 2004 and is closely tied to the National Development Plans (Figure 4). The Vision's rationale is to provide long-term alternative policy scenarios on the future course of development in the country at different points in time up until the target year of 2030. This key development strategy sets the direction to sustainable use of natural resources in the country: "The vision is designed to promote the creation of a diversified, open market economy, with a resource-based industrial sector and commercial agriculture"[46]

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[36] NamPower

[37] During the past decade, the single largest external contribution to Namibia's electricity supplies came from South Africa's electricity utility, which contributed between 38% and almost 53% to the total electrical energy sold by NamPower.

[38] National Planning Comission (2013): Energy Demand and forecasting in Namibia.

[39] VTT Technical Research Centre of Finland (2013): Energy Policy, Regulatory Framework and Energy Future of Namibia, p.31.

[40] International Energy Agency (2012: Natural Gas Information.

[41] CIA Factbook (2015) Namibia. Available online: https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html Accessed 15. November 2015

[42] CIA Factbook (2015) Namibia. Available online: https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html Accessed 15. November 2015

[43] CIA Factbook (2015) Namibia. Available online: https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html Accessed 15. November 2015. Another source refers to an average real growth of 4% per annum for agriculture; see NDP4, Detailed Action Plan, p. 125-127

[44] Chamber of Mines of Namibia (2015): Annual Review 2014.

[45] Namibia Tourism Board (2013): Namibia Tourism Satellite Account. 4th Edition. Accounting for direct and indirect impacts.

[46] Vision 2030, Foreword, p. 8

Figure 4: Framework of the NDP4 and Vision 2030. The sidebar illustrates how specific goals of both NDP and Vision 2030 may be supported by activities of Natural Capital Accounting.

The vision is designed to promote the creation of a diversified, open market economy, with **a resource-based industrial sector and commercial agriculture,**

Vision 2030, Foreword, p. 8

A strong and synchronized data collection and analysis capacity that will provide adequate information to ensure that **accurate data is available during planning process.**

NDP4, Executive Summary, p. xviii

- Namibia is the most **competitive tourist destination** in Africa
- identifying & developing **economic activities** in the minerals sector
- **Agriculture** experiences average **real growth of 4%** per annum

NDP4, Detailed Action Plan, p. 125-127

Vision 2030 regards the sequential five-year National Development Plans (NDPs) as the main vehicles for achieving its long-term objectives. NDPs require a "strong and synchronized data collection and analysis capacity that will provide adequate information to ensure that accurate data is available during planning process."[47] To date, Namibia is implementing the 4th NDP for years 2012-2016. It has three major goals: high and sustained economic growth; increased income equality; and employment creation. In terms of strategic areas, it focuses on logistics, tourism, manufacturing and agriculture. Development targets of the NDP4 – especially those that rely on tourism, agriculture and fisheries – may well be reached by 2016 if there is a joint approach based on inter-ministerial collaboration.[48]

Altogether, the Vision 2030 and the NDP 4 make first tentative steps towards recognizing the importance of natural capital and a sound and comprehensive data basis (see Figure 4). However, natural capital and it monitoring is still not sufficiently covered. For example, the biodiversity expenditure review of the Namibia Nature Foundation on behalf the ResMob project revealed that biodiversity was underrepresented in the NDP4. As a consequence the total real biodiversity expenditure was estimated to decrease from N$1,181 m (N$ 1.18 billion) in 2014/15, by 23% to N$906m in 2020/21. Thus, it should be one priority for the upcoming NP5 to better reflect natural capital and the establishment of an adequate data base.

National Biodiversity Strategy and Action Plan:

The key biodiversity policy document in Namibia is the second National Biodiversity Strategy and Action Plan (NBSAP2, 2013-2022), focusing on implementing the Aichi Biodiversity Targets at national level. The NBSAP2 aims to mainstream biodiversity by demonstrating the value of biodiversity and ecosystem services in Namibia for sectors other than the environmental sector.[49] The NBSAP2 also seeks to capitalize on Namibia's existing areas of comparative advantage in natural resource management, nature-based tourism and environmental protection. In this respect, NBSAP2 will contribute directly to Namibia's National Development Goals (as set out in NDP4), through the targets outlined in Table 5.

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[47] NDP4, Executive Summary, p. xviii

[48] See also fulfilment or compliance related to international conventions on biodiversity (UNCBD), desertification (UNCCD) and climate change (UNFCCC).

[49] Ministry of Environment and Tourism (2014): Namibia's second national biodiversity strategy and action plan 2013-2022. Ministry of Environment and Tourism: Windhoek, Namibia.

Table 5: Namibia's biodiversity targets from 2013-2022, as outlined by NBSAP2. Asterixes denote extent of overlap (as estimated by the consultants) between biodiversity targets and NCAs: * moderate overlap, ** strong overlap, * very strong overlap.**

No.	Namibia's biodiversity targets from 2013-2022	Linkage to NCA
1.	By 2020, at least 75 per cent of surveyed key target groups know the meaning of biodiversity and can identify important reasons for biodiversity conservation	*
2.	By 2018, biodiversity values and prioritized ecosystem services are quantified, monitored and mainstreamed to support national and sectoral policy-making, planning, budgeting and decision-making frameworks	***
3.	By 2018, selected incentives for biodiversity conservation and sustainable use are in place and applied, and the most harmful subsidies are identified and their phase out is initiated.	*
4.	By 2022, the rate of loss and degradation of natural habitats outside protected areas serving as ecological corridors or containing key biodiversity areas or providing important ecosystem services is minimized through integrated land use planning	***
5.	By 2022, all living marine and aquatic resources are managed sustainably and guided by the ecosystem approach	***
6.	By 2022, Principles of sound rangeland and sustainable forest management, and good environmental practices in agriculture are applied on at least 50 per cent of all relevant areas	***
7.	By 2022, pollution, including from excess nutrients, has been brought to levels that are not detrimental to biodiversity and ecosystem health and functioning	***
8.	By 2015, National review of invasive alien species in Namibia from 2004 is updated (including identification of pathways), and by 2018 priority measures are in place to control and manage their impact	*
9.	By 2016, ecosystems most vulnerable to climate change and their anthropogenic pressures are identified, and by 2018 appropriate adaptation measures are developed and implemented in priority areas genetic diversity	**
10.	By 2018, existing terrestrial protected areas (national parks) are conserved, effectively and equitably managed, within an ecologically representative and well-connected system, and by 2020 coastal and marine areas, of particular importance to biodiversity and ecosystem services are identified and measures for their protection initiated	**
11.	By 2016, threatened and vulnerable species lists are updated and measures implemented by 2019 to improve their conservation status	*
12.	By 2020, Genetic diversity of cultivated plants and farmed animals is maintained and enhanced	*
13.	By 2022, ecosystems that provide essential services and contribute to health, livelihoods and well-being are safeguarded, and restoration programs have been initiated for degraded ecosystems covering at least 15 per cent of the priority areas	***
14.	By 2015, national legislation giving effect to the Nagoya Protocol is in force and by 2018 fully operational to ensure that benefits are fair and equitably shared from the conservation and sustainable use of biodiversity	*
15.	By 2020, Traditional knowledge and the innovations and practices of indigenous and local communities relevant to the conservation and sustainable use of biodiversity are recognized, respected and promoted	*
16.	By 2022, knowledge, science base and technologies relating to biodiversity and ecosystem management are improved and made relevant to political decision makers	***
17.	By 2022, mobilization of financial resources from all sources has been increased compared to the period 2008-2012 to allow for the effective implementation of this strategy and action plan	**

Source:[50]

The table, by means of the column on the right hand side, underpinned that NCAs may support the achievement of many of Namibia's biodiversity targets either directly or indirectly. For example, linkages with strong overlap were identified for the targets of NBSAP2 on loss/degradation of natural habitats, marine and aquatic resources, rangeland and forest management, pollution patterns, ecosystem services and scientific management. Moderate overlap was identified for a further 3 biodiversity targets.

Alongside NBSAP2, a National Steering Committee has been established. It convened for the first time in May 2012. The Committee was originally established to oversee the formulation of NBSAP2 but its mandate was extended so that it also coordinates the implementation of NBSAP2, including its monitoring and evaluation. Membership Structure of the

[50] MET(2014): Fifth National Report to the Convention on Biological Diversity (2010-2014). March 2014. https://www.cbd.int/doc/world/na/na-nr-05-en.pdf

NBSAP Steering Committee includes Government Ministries (e.g. Ministry of Environment and Tourism (Chair); Ministry of Agriculture, Water and Forestry; National Planning Commission), the Academic Community (Polytechnic of Namibia University of Science and Technology, University of Namibia), indigenous and local communities (Aodaman Traditional Authority), Non-Governmental Organizations (Desert Research Foundation of Namibia), Private Sector (Chamber of Mines) and Donor Agencies (UNDP, GIZ).[51]

Gaborone Declaration for Sustainability in Africa (GDSA):

The Gaborone Declaration arose from a 2012 summit in the Gaborone, Botswana. Namibia and ten other African countries[52], together with international organizations (incl. UNEP and IUCN), and (?) announced the prioritization of accounting for natural (and social) capital.[53] Presently, the GDSA endorsement communique is finalized and the signature of the Namibian Government is awaited. The endorsement is expected to state the country's priority areas for implementation under the Gaborone declaration for the next four years, which will include implementing Natural Capital Accounting and developing internationally- agreed guidelines on ecosystem accounting.

2.2.4   Links between Namibian institutions and NCAs

In the previous chapter, institutions were identified which play a key role for the NBSAP2. The same institutions are recommended to play a key role in implementing NCAs.

Important Government Ministries were identified on the previous page and. It was also found, that the Ministry of Environment and Tourism (MET) has good potential for a coordinating role. Not listed were the Ministry of Lands Reform, the Ministry of Industrialization, Trade and SME Development and the Ministry of Urban and Rural Development that are further relevant institutions. Moreover, the institutions of the National Planning Commission (already mentioned) and the Namibia Statistics Agency are likely to play an important role under an institutional NCA process.

The academic community was identified on the previous page; other relevant institutions include the Desert Research Foundation and the National Botanical Research Institute of Namibia. With respect to Non-Governmental Organizations / statuary bodies further players are the Agronomic Board the WWF. Finally, there are a few more relevant players within the private sector / among the parastatals including (amongst others) the Namibia Agricultural Union, NamWater, NamPower, and Agra Co-operative Ltd.

An overarching issue regarding the Namibian policy landscape is further a 5 year strategic plan for the Namibia National Spatial Data Infrastructure (NSDI) developed and executed by the Namibia Statistics Agency.[54] Benefits of this initiative will enable a consistent and comprehensive digital accounting by means of standardized and aligned digital spatial data. NSDI will enable all governmental organizations to deploy consistent spatial data (e.g. maps, GIS information) which will facilitate cross-collaboration between ministries and agencies. Based on such aligned digital spatial information NSDI is an enabler for NCA.[55]

2.3. Experience with NCAs in neighboring countries

Beyond examining the situation in Namibia, lessons learned in neighboring countries with NCAs are informative for the development of NCAs in Namibia (Figure 5). In this sub-chapter, we briefly highlight the main developments in other countries of Southern Africa.[56]

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[51] MET(2014): Fifth National Report to the Convention on Biological Diversity (2010-2014). March 2014. https://www.cbd.int/doc/world/na/na-nr-05-en.pdf

[52] Botswana, Gabon, Ghana, Kenya, Liberia, Mozambique, Namibia, Rwanda, South Africa, Tanzania.

[53] http://www.gaboronedeclaration.com/, accessed 25. November 2015
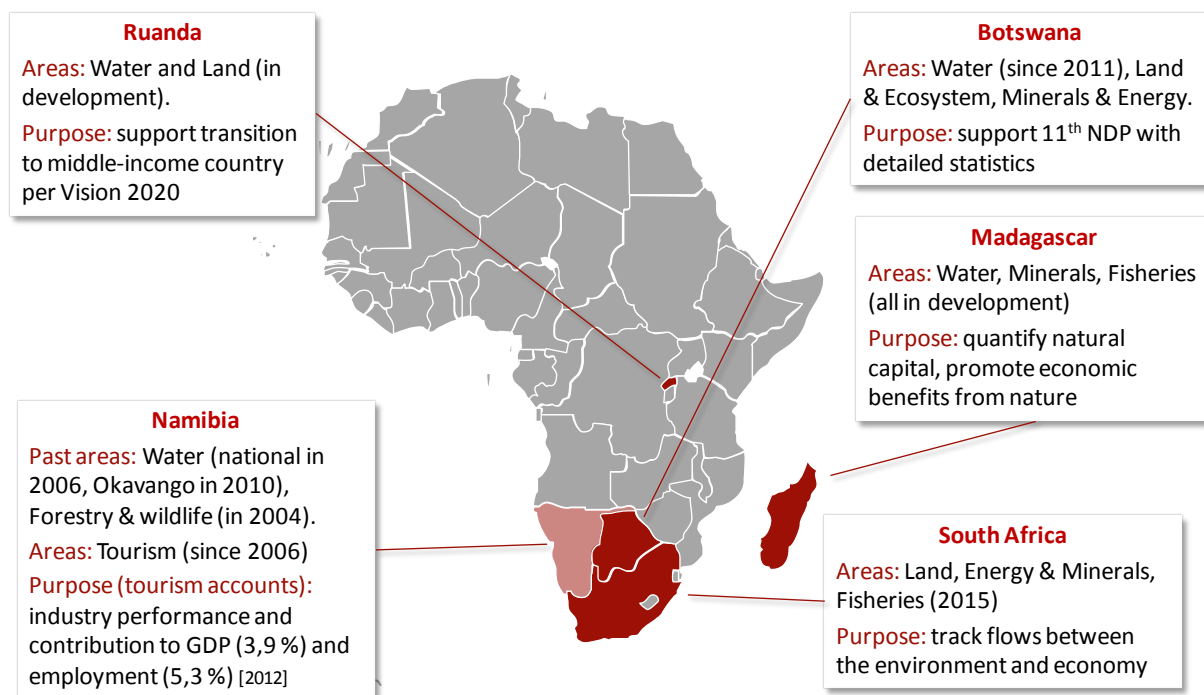
[54] Namibia Statistics Agency (2015): 2014/15 NSA Annual Report - "Statistics for development". Windhoek.

[55] When The Philippines implemented SEEA, their geo-spatial agency was integrated into the steering inter-agency committee.

[56] In this context, see also initiatives on water accounting by SADC (http://www.sadcwateraccounting.org) and UNESCO (http://www.wateraccounting.org)

Figure 5: Overview on main experiences with NCA in neighboring countries. Not shown are SADC Water Accounting pilots in Malawi, Mauritius, Mozambique, Zambia and Orange-Senqu Basin, or the accounting case studies on fuel and woodland in Zimbabwe and Swaziland.

Ruanda
Areas: Water and Land (in development).
Purpose: support transition to middle-income country per Vision 2020

Botswana
Areas: Water (since 2011), Land & Ecosystem, Minerals & Energy.
Purpose: support 11th NDP with detailed statistics

Madagascar
Areas: Water, Minerals, Fisheries (all in development)
Purpose: quantify natural capital, promote economic benefits from nature

Namibia
Past areas: Water (national in 2006, Okavango in 2010), Forestry & wildlife (in 2004).
Areas: Tourism (since 2006)
Purpose (tourism accounts): industry performance and contribution to GDP (3,9 %) and employment (5,3 %) [2012]

South Africa
Areas: Land, Energy & Minerals, Fisheries (2015)
Purpose: track flows between the environment and economy

2.3.1   Experience in Botswana

Botswana is continuously refining its National Development Plans (NDP) and is currently conceptualizing its 11th NDP. Natural Capital Accounting will be incorporated into NDP11 – which is scheduled to be commenced in April 2017[57] – as a tool to inform Botswana's strategies on climate change adaptation, poverty alleviation and post-2015 development goals.[58]

Since Botswana aims at identifying further sources of economic growth while at the same time ensuring sustainable use of its natural resources, Botswana focusses on four pillars for NCA[59] to balance impacts and opportunities: Water accounts, Land and Ecosystem Accounts, Minerals and Energy and Macroeconomic Indicators of Sustainable Development.

2.3.2   Experience in South Africa

South Africa has a long history of natural capital accounting. The first formal effort to construct water resource accounts was initiated under the Natural Resource Accounting in Southern Africa (NRASA project) in 2000, which produced comprehensive national physical and monetary water accounts for 1991/1992-1998/1999.[60] Further environmental-economic accounts have been developed in four areas of focus, namely Water (2000, 2002), Minerals (1980 –2008), Energy (2002 – 2006) and Fisheries (1990 – 2008).[61,62]

In 2012 South Africa's Department of Environmental Affairs released a Baseline Valuation Report on Biodiversity and Ecosystem Services presenting a general overview of the status of ecosystems and biodiversity as well as basic quantification of ecosystem values.[63] This general overview fed into discussions of NCA in two ways: Firstly, the 40 studies assessed ecosystem service values for or within South Africa, thereby returning proxy information of monetarization.[64] Secondly, eight of these studies focus on national scale issues, thereby providing proxy information for the national perspective of ecosystem services.

[57]   Daily News AllAfrica, 22 January 2015, http://allafrica.com/stories/201501230521.html

[58]   WAVES Partnership, https://www.wavespartnership.org/en/botswana-natural-capital-diversification-tool

[59]   Ibid.

[60]   Lange, G. and R. Hassan (1999). Natural Resource Accounting as a Tool for Sustainable Macroeconomic Policy: Applications in Southern Africa. Policy Brief of IUCN Regional Office for Southern Africa. IUCN-ROSA: Harare, Zimbabwe.

[61]   Lange, G. and Hassan, R. (2006) The Economics of Water Management in Southern Africa: An Environmental Accounting Approach. Edward Elgar: Cheltenham, UK.

[62]   Hutton, T., U.R. Sumaila (2002). Natural Resource Accounting and South African Fisheries: A Bio-Economic Assessment of the west coast deep-sea Hake Fishery with reference to the optimal utilisation and management of the resource. CEEPA Discussion Paper Series. University of Pretoria.

[63]   Department with Environmental Affairs (2012): Baseline Valuation Report on Biodiversity and Ecosystem Services, Document available from Convention on Biological Diversity (CBD) https://www.cbd.int/financial/values/SouthAfrica-ecosystemvaluation.pdf accessed 25th January 2014

[64]   Valuation in the SNA and the SEEA Central Framework is based on market transactions or, where these are unavailable, the net present value of future expected income

In terms of institutional setup, the experience from South Africa indicated the good functioning of an inter-departmental working group to address the data and quality gaps between basic statistics, environmental indicators and the accounts.

Currently South Africa updates its accounts on minerals, energy and fisheries on an annual basis.[65] Statistics South Africa puts an emphasis on mineral and energy accounts, as these were the first ones to be completed. The process of accounting is guided by the SEEA-framework.

2.3.3 Experience in other Southern African countries

In neighboring countries like Zimbabwe and Swaziland, case studies have been conducted with focus on selected accounts such as fuel-wood[66,67], forest and woodland[68], but these studies date back more than a decade. Also for the Maputo river basin which is shared among Mozambique, South Africa and Swaziland, a pilot study on water accounts was undertaken. Outcomes informed on the applicability of methodologies given the institutional arrangements and data availability situation in the river basin.[69]

In Zambia, a pilot for accounting for water was developed to measure the productivity of water in the various economic sectors and to promote water use efficiency.[70] Objectives were to develop and pilot standardized methodologies, to undertake capacity building and to develop training programs. The findings revealed that Zambia is losing US$491 million or 6.84% of GDP due to sickness, absenteeism, and low productivity associated with poor water supply and sanitation. A university dissertation from 2010 in Zambia compiled water accounts for Lusaka Water and Sewage Company.[71]

Finally, under the SADC Water Accounting project, pilots have also been conducted in Malawi, Mauritius and the Orange-Senqu Basin. None of these have yet resulted in full water accounts.

2.3.4 Success factors for NCAs in neighboring countries

Based on the experiences of accounting in neighboring countries, success factors towards NCA implementation can be identified. To this end a non-conclusive analysis was done with a focus on (legislation) arrangements, policy-making process etc., the result of which is presented in Table 6.

Table 6: Success factors for Natural Capital Accounting implementation, as derived from experiences in neighboring countries

Success factors	Remarks
1. Good functioning of an inter-departmental working group to address the data and quality gaps between basic statistics, environmental indicators and the accounts.	Source: and Example of Rwanda
2. Ministerial position (focal point) within the Finance Ministry to work with the Ministry of Environment in assessing the value of natural capital	
3. National audit offices to adopt the natural capital approach when examining the effectiveness and efficiency by which government departments use their resources and apply cost–benefit analyses.	
4. Activities around NCA to liaise with a respective National Biodiversity Strategy. In particular, the one Steering Committee of Biodiversity Strategy can play an important role in the context of a possible NCA steering group.	See also NBSAP2 of Namibia
5. To select those accounts that are achievable and realistic.	
6. For countries in data poor environment trying to move towards SEEA alignment: operationalize a short and a long term strategy	

This report will make reference to these success factors when deriving recommendations in Chapter 5.

[65] Environmental Economic Accounts Compendium / Statistics South Africa. Pretoria: Statistics South Africa, 2014, Report No. 04-05-20, p. 1, http://www.statssa.gov.za/publications/Report-04-05-20/Report-04-05-202014.pdf

[66] FAO (1998): Incorporating Fuel-wood Production and Consumption into the National Accounts. A Case Study for Zimbabwe, ftp://ftp.fao.org/docrep/fao/005/AB603E/AB603E00.pdf

[67] Vincent, J.R., and J.M. Hartwick (1997): Accounting for the Benefits of Forest Resources – Concepts and Experience. Revised draft, commissioned by the FAO forestry Department, dated 10. July 1997

[68] R. M. Hassan, P. Mbuli, C. Dlamini (2002) Natural Resource Accounts for the State and Economic Contribution of Forests and Woodland Resources in Swaziland., http://unstats.un.org/unsd/EconStatKB/Attachment50.aspx

[69] Southern African Development Community (2010): Economic Accounting of Water Use Project: Maputo River Basin Pilot Report. ACP-EU Water Facility Grant No 9 ACP RPR 39 – 90

[70] Southern African Development Community (2010): Economic Accounting of Water Use. ACP-EU Water Facility Grant No 9ACP RPR 39 – 90

[71] Makayi, Ben (2010): Water Accounting Framework – a case study of Lusaka Water and Sewage Company. University of Zambia.

[72] The GLOBE Legislators' Organisation (2013): Natural Capital Legislation Study. A Review of Efforts towards Natural Capital Legislation in Eight Countries. Authored by Sophie Allebone Webb, Rafael Jiménez Aybar, Adam Matthews and Danny Stevens.

3

Natural Capital Accounting in Namibia: Feasibility study

3 Natural Capital Accounting in Namibia: Feasibility study

A key objective for the present consultancy was to create a feasibility study of NCAs for various types of natural capitals in Namibia. This chapter presents the results of this study, starting with previous experience with NCA in Namibia (Chapter 3.1). Subsequently, the methodology including the approach and information collection are detailed (Chapter 3.2) and the results of the feasibility of NCAs for individual natural capitals is presented (Chapter 3.3). Finally, the chapter closes with a summary (Chapter 3.4).

3.1 Previous experience with NCAs in Namibia

Namibia has been compiling NCAs since the 1990s for various natural capitals. These include predominantly NCA for water, forest, wildlife, fishery and land.[73]

3.1.1 Water accounts

We briefly summarize experience with water accounts in this chapter and provide a more detailed discussion in Chapter 4.

Extensive water accounts have been compiled in Namibia by the Department of Water Affairs since the late 1990s. The last published version of accounts was made public in 2006.[74] Since then, water accounts have not been published.[75] However, the worsening conditions of the current drought has acted as impetus to stimulate a new discussion on the benefits of water accounts for Namibia. [76]

Previous water accounts were an enabler for effective water management. An important outcome was a better understanding of the distribution of water use in Namibia by industry and the water intensity (respectively water productivity) of each industry. The compilation also analyzed bulk water supply of nearly 200 water schemes and their unit supply costs. Findings revealed a range from a low of N$0.27 per cubic meter to more than N$500.00 per cubic meter, which helped contextualize water usage and provide a measure of effective water management. The Water Accounting Framework also resulted in a shift in water policy towards greater cost recovery. Nevertheless, a centralized and comprehensive annual water accounting on a yearly basis at national level is still missing up to date.

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[73] Lange, G.M. (2012) Natural Capital, Total Wealth, and Sustainable Development In Namibia. In: Implementing environmental accounts: case studies from eastern and southern Africa (Eds. Hassan, R., and E.D. Mungatana). ISBN: 978-9400753228

[74] Technical Report on Water Accounts. Ministry of Agriculture, Water and Forestry, Department of Water Affairs, Jan 2006.

[75] See also: Glenn-Marie Lange, "Water accounts in Namibia", in Glenn-Marie Lange and Rashid M. Hassan, The Economics of Water Management in Southern Africa: An Environmental Accounting Approach (Cheltenham, Edward Edgar Publishing, 2006)

[76] For the official term of a water crisis refer to http://allafrica.com/stories/201512031200.html

3.1.2   Forest accounts

Initial efforts to compile these accounts were made between the years of 1995-99. These efforts benefitted greatly from the national forest inventory which was completed in 2004 and which enabled the development of preliminary forest resource accounts for Namibia.

In these accounts, the total woody resources volume was estimated at 257 million m3. Forest products such as fuel, poles, timber were included in the accounts and valued. This revealed that forest use directly accounted for N$1 billion (3% of GDP) – which increased to N$1.8 billion if indirect use was also considered. The standing forest assets had an estimated capital value of N$19 billion, comparable with the values for fish, minerals and wildlife. The forestry accounts are presently in the process of being updated.[77,78,79]

3.1.3   Wildlife and fishery accounts

Similar to forest accounts, the wildlife accounts were last compiled in 2004 by MET (and published in 2009). The accounts revealed that the wildlife-use sector contributed approximately 2.1% of national GNP and that standing wildlife assets had a value of N$10.5 billion. The wildlife accounts are in the process of being updated and were recently analyzed with respect on how to continue and update them.[80]

Moreover, an accounting of marine fishery resources has been undertaken, because its importance to national wealth is recognized. Previous studies on physical and monetary asset accounts revealed that the valued of fish was N$3.1 billion in 2000.[81,82,83] In recent years, research was being conducted on how to apply hybrid social accounting matrix (following the SEEA concept) to fisheries in order to better understand and manage marine resources.[84]

3.1.4   Land accounts

Namibia has compiled extensive environmental-economic statistics which may eventually be used for land accounting. Early activities range as far as the 1990s. In 2008 information on land characteristics, particularly environmental information became available through the Environmental Information Service (EIS).[85] The EIS currently contains information on 11,283 data sets covering 40 top-level themes. Top-level themes include e.g. agriculture, air, animal husbandry, economics, energy, fishery, forestry, materials, natural areas, landscape, ecosystems, natural dynamics, pollution, soil, tourism, trade, waste and water. Extensive information and statistics are this available, but NCAs themselves have not yet been compiled.

3.1.5   Tourism accounts

Early work on the link between natural resources and local tourism benefit was published in 2008.[86] Namibia's tourism satellite accounts are separate from NCA but are developed using an SNA-based framework (i.e. the national accounting framework). Today, tourism (satellite) accounts are scheduled to be produced on a bi-annual basis, compiled by the Namibia Tourism Board and MET. The latest report is the 4th edition, published in 2013[87] while the next edition will be published in 2016. Extensive data collection are presently being conducted in order to expand that edition on previous editions. This collection consists of a large-scale and comprehensive survey by among owners of tourist destinations (e.g. restaurants and lodges) by means of a questionnaire and personal interviews.

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[77] Barnes, J.I., Nhuleipo, O., Muteyauli, P.I., and MacGregor, J. (2005) Preliminary economic asset and flow accounts for forest resources in Namibia. Ministry of Environment and Tourism: Windhoek, Namibia.

[78] MacGregor, J., C. Palmer and J.I. Barnes. (2007). Forest resources and rural livelihoods in the north-central regions of Namibia. Environmental Economics Programme Discussion Paper 07-01. International Institute for Environment and Development, London.

[79] Barnes et al. (2010): The value of Namibia's forest resources: Preminary economic asset and flow accounts. Development Southern Africa, Volume 27, Issue 2, DOI:10.1080/03768351003740373

[80] Barnes, J.I., Nhuleipo, O., Baker, A.C., Muteyauli, P.I., and Shigwedha, V. (2012): Wildlife Accounts: A Multi-sectoral Analysis of Namibia. In: Implementing environmental accounts: case studies from eastern and southern Africa (Eds. Hassan, R., and Mungatana, E.D.). ISBN-13: 978-9400753228

[81] Lange, G-M. (2004). The Economic value of fish stocks and the national wealth of Namibia. In: Sumaila, U.R., D. Boyer, M. Skogen und S.I. Steinshamn (Hrsg.) (2004).

[82] Lange, G-M., and Motinga, D.J. (1997): The contribution of resource rents from minerals and fisheries to sustainable economic development in Namibia. Ministry of Environment and Tourism: Windhoek, Namibia.

[83] Lange, G-M. (2003) The value of Namibia's commercial fisheries. Ministry of Environment and Tourism: Windhoek, Namibia.

[84] Winter, E. (2011): The use of natural capital for economic development in Namibia - a bioeconomic equilibrium analysis using the example of fisheries. Dissertation. University of Bonn, Germany. http://hss.ulb.uni-bonn.de/2011/2660/2660-engl.htm

[85] www.the-eis.com

[86] Libanda, B., and J.N. Blignaut (2008). Tourism's Local Benefit for Namibia's Community Based Natural Ressource Management Areas. In: International Journal of Ecological Economics & Statistics 10(8):40-52.

[87] Namibia Tourism Satellite Accounts, 4th Edition, Namibia Tourism Board, May 2013.

3.1.6   Energy and mineral accounts

Hecht (2000) gives reference to an early energy resource accounting project in Namibia[88], but no comprehensive accounting framework has come to the awareness of the authors of this report. Nonetheless – albeit not yet being used in an accounting framework – various governmental bodies, especially the Electricity Control Board (ECB; the electricity regulator in Namibia), provide annual energy statistics such as produced and consumed energy.[89]

Mineral accounts have been developed in for Namibia in 2003, based on data from 1980 to 2001.[90] In addition, the Ministry of Mines and Energy (MME) has in the past (as well as presently) been extensively collecting both geological data and resource extraction data, which would allow the compilation of full NCA.

3.1.7   Review of natural capital accounting activities in Namibia

Further to the previous chapter, we briefly summarize in Table 7 below the extent of previous experience with NCA in Namibia. This summary is focused on activities between 1995 and 2013 and provide an overview on the state of NCA in Namibia.

Table 7: Initial and non-conclusive summary of previous experience with NCA in Namibia. Asterisks denote the extent of past experience: - no previous accounting, + limited experience, ++ moderate experience, +++ comprehensive experience.

NCA type	Achieved	Extent of past experience	Remarks
Water	☑	+++	Early compilation by one ministerial department who had ownership. Demonstrated value-added through meaningful outcomes (e.g. water valuation).
Forest	☑	++	Early compilation by one ministerial department. Build-up of good people capacity. Good understanding of financial outcomes. Not further pursued since 2004, awaiting update. To reanimate the accounting, it is recommended to engage with MAWF.
Wildlife	☑	+	Comprehensively compiled in 2009 (2004 data) by MET. Build-up of good people capacity. Good understanding of financial outcomes. Not further pursued since 2009. Wildlife accounting is being taken up again by MET.
Fisheries	☑	+	Physical and monetary assets accounts were published in 2003 but not since. To reanimate the accounting, it is recommended to engage with MFMR.
Land	☒	-	No country wide land accounting to date. Accounting will need to be developed for land.
Tourism	☑	+++	Accounts are compiled on a bi-annual base, by the Namibia Tourism Board and MET. Demonstrated value through meaningful outcomes (e.g. value of tourism industry). Existing processes serve as a basis for further action.
Energy	☒	-	No comprehensive accounting framework to date. To develop the accounting, it is recommended to engage with ECB and MEM.
Minerals	☒	+	Physical and monetary assets accounts were published in 2003 but not since. Data for all resources is available from either the Chamber of Mines or individual companies. Data on mining geology is available from MME. NCAs for mining are thus feasible, but not yet pursued. To develop the accounting, it is recommended to engage with MEM.

Based on the tables' results covering past experience with NCA in Namibia, it is concluded that accounting activities on water, forest, tourism and wildlife serve as viable entries for renewed activities.

3.2   Methodology

3.2.1   Analytical framework

In order to assess the feasibility and potential of NCAs in Namibia, we utilized a three-stage analytical framework (see Figure 6).

[88] Hecht, Joy (2000): Lessons Learned from Environmental Accounting: Findings from Nine Case Studies. IUCN-World Conservation Union. Washington, DC.
[89] Electricity Control Board (2013). Statistical bulletin 2013.
[90] Lange, Glenn-Marie (2003). The contribution of minerals to sustainable economic development: Mineral resource accounts in Namibia. DEA Research Discussion Paper Nr. 54, February 2003.

Figure 6: Analytical approach for assessing feasibility and added benefit of NCAs in Namibia, and (sub) account classification used in this report.
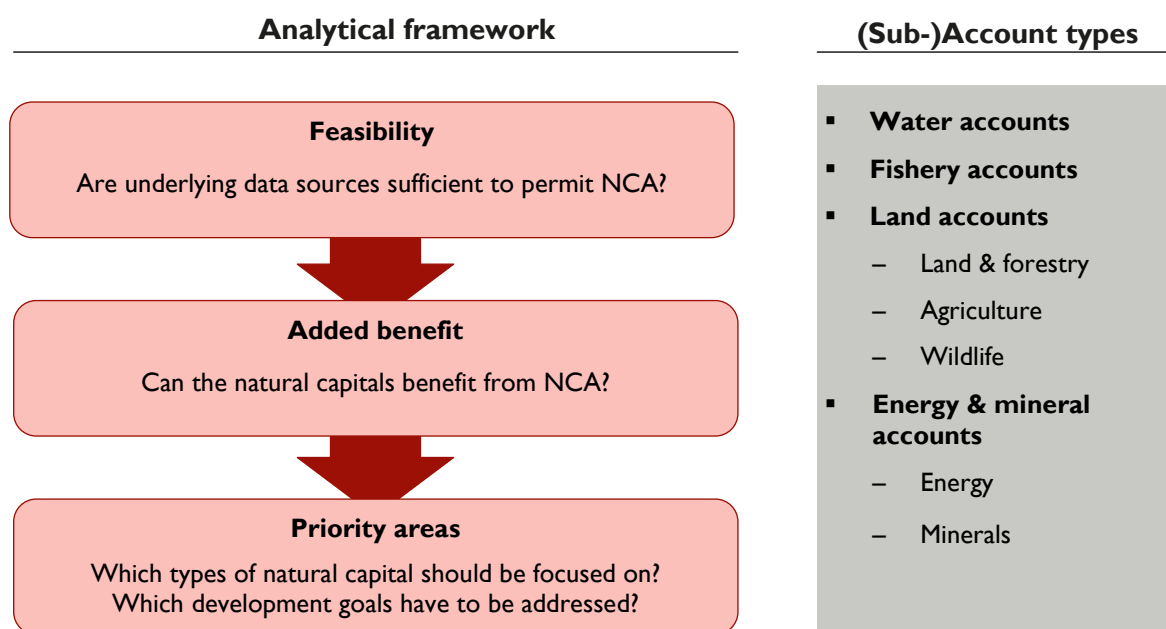
Accordingly, in a first step ("Feasibility"), we examine data sources and their quality for each of the natural capitals presently covered by SEEA.[91] Where deemed useful and appropriate, NCAs were extended by sub-accounts: land accounts were set up with three sub-accounts (land & forestry, agriculture, wildlife) and energy & minerals were set up with two sub-accounts (energy and minerals).

NCAs place strong requirements on data that is used for their compilation. Requirements state that data has to be:

· **Collected comprehensively** in order to allow the thorough creation of NCA tables. For most data sources, "Comprehensive" hereby denotes the geographic resolution of available data is high or a sufficient geographic resolution may be interpolated from adequately chosen study areas.

   For some data sources, the meaning of "comprehensive" has a slightly different meaning, in order to reflect the nature of the data source. For example, for the data source Annual sales of farmland (L.07) (see Table 18, p. 89) "comprehensive" denotes that all instances of farm sales in a year are recorded.

· **Collected regularly (preferably annually)** to permit a regular compilation of NCAs over time, and

· **available quickly** after collection (e.g. 2 years) to allow for reporting on the recent state and development of the natural capital.

To map out these requirements, we started by creating an inventory of existing data sources. Each data source was evaluated against the above mentioned dimensions of comprehensiveness, annual collection and recent availability of data (see Table 18, p. 89). Finally, an overall assessment of the quality of data source ("low", "moderate", "high") was made, based on the performance of the source in the three dimensions. In order to be considered of "moderate" or "high" quality, data source had to be collected comprehensively.

In the **second step ("Added benefit")** we assessed how and if overall management of individual natural capital would benefit from NCA. This assessment was based on two aspects:

· **Existing data framework:** The foremost question in this regard is whether existing frameworks for collecting and aggregating data are already sufficient to address information needs for the natural capital in question. If such frameworks do not yet exist, then the added benefit provided by NCA predominantly lies in aggregating environmental data from existing sources in a unified framework – and in consistently linking these data to economic data, in order to improve management approaches and policy development.

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[91] We note here that the UN SEEA assigns separate sub-accounts to land, i.e. the SEEA EEA ("Experimental Ecosystem Accounts"), and to agriculture & forestry, i.e. the SEEA AFF ("Agriculture, Forestry and Fisheries" – also and obviously including fisheries). However, land issues in Namibia, especially degradation and desertification, are closely and inseparable linked to agricultural and forestry issues. We thus draw different dividing lines in this inception report: we group agriculture, forestry and land (and wildlife) accounts while considering fishery accounts separately.

- **Decision making process:** The decision making process regarding the management of a given natural capital (e.g. setting quotas in fisheries) may already be well working based on the existing data frameworks. In such a case, NCA will add little to the natural capital in questions. Conversely, the present decision making process may not be ideal, and NCA may aid the process by providing information in a structured manner.

Finally, in the **third step ("Priority areas"),** we assessed which NCAs can serve as a meaningful and powerful priority in Namibia. Priority areas are, in this context, defined as areas which either face pressing environmental issues such as degradation, or which are important focus areas for current development goals. Our initial assessment on priority areas was double-checked and narrowed down with stakeholder during a stakeholder dialogue on 10 November 2015.

## 3.2.2. Collection of information and interviews

We pursued our analytical approach (see previous Chapter) by interviewing stakeholders and decision makers to provide us with three items of information:

- an assessment on feasibility, added benefit and priority area for each natural capital,

- relevant data sources of compiling NCA for the different types of capitals,

- documents containing more in-depth information on the natural capital in question.

Our analysis of Namibian policies and institutions discussed in Chapters 2.2.3 and 2.2.4 provided us with the basis to select those interview partners which were relevant in the context of this feasibility study. Consequently, our interview partners (and the documents they provided) derived from a wide range of institutions such as governmental bodies, non-governmental organizations, international organizations, business and industry, and academia. Moreover, consideration was given that the mix of interview partners could adequately represent all four types of natural capitals (water, fisheries, land, and energy & minerals).

In total, 63 stakeholders and decision makers were interviewed (three were interviewed twice), with whom we spoke to collect the information required by our analytical approach. Interviews were conducted in three interview phases in 2015: 14 to 22 September, 28 September to 02 October and 09 to13 November. Figure 7 depicts the distribution of interview partners by type of organization; a list of all interviewed persons is presented in Table 17 (p. 68) in Appendix A and attached as an Excel file.

Figure 7: Distribution of interview partners in total numbers by type of organization.
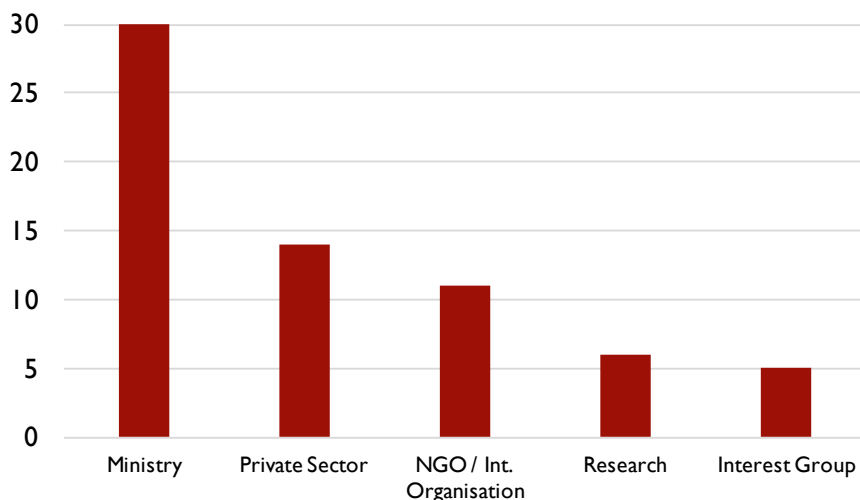
3.3. Results

The following details our results regarding the feasibility of NCAs in Namibia. These results can serve as an initial orientation for Namibian policy makers and governmental experts and their further decision making on which NCA to implement.

3.3.1.   Overview of data sources

Altogether, we identified at least 59 existing data sources that are useful for compiling NCAs for the four types of natural capital considered in this report (i.e. water, fisheries, land and energy & minerals). A list of data sources is shown in Table 18 (p. 71) in Appendix B.

Due to differences in complexity between accounts, the number and extent of data sources vary considerably across accounts. This reflects in part that some NCAs such as for water are more complex than others (e.g. those for minerals). Mainly, however, this reflects that existing data availability is simply better for certain types of NCAs. With regards to data quality we find that the majority of these sources are available in sufficient quality while quality is limited for the sub-accounts of land & forestry, wildlife and inland fisheries.

Altogether, the list of data sources is thus not exhaustive in the sense that it covers all data sources that are useful for compiling NCAs. Many data sources that would be beneficial for NCAs in Namibia do not exist (e.g. comprehensive data on biodiversity), and to collect these data would be very expensive. In our assessment, however, compiling NCA based on the existing data sources we listed would already result in functional NCA that may greatly inform and improve decision making.

Figure 8: Total number of data sources (y-axis) by NCA sub-type (e-axis).
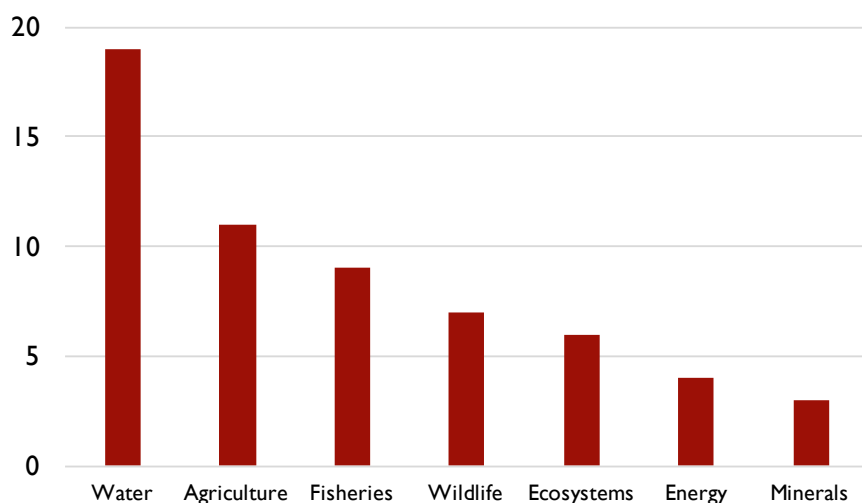
3.3.2.   Water accounts

The potential of water as a suitable candidate for NCAs was a foregone conclusion to this consultancy in that one of the consultancy's aims was to develop these accounts as a showcase. Our interviews with decision makers and experts thus focused primarily in identifying and assessing local data sources and also in actually acquiring all critical data sources. As water accounts are covered in more detail in Chapter 4 we here only briefly mention that we acquired the necessary data in order to be able to compile the fast-track water accounts.

3.3.3.   Fishery accounts

The main features as well as results on the feasibility and added benefit for a NCA for fisheries are displayed as an overview in Figure 9. Fisheries are of importance to the Namibian economy, as exemplified by a direct (and primary) contribution of 2,7% to GDP in 2014.[92]

Physical and monetary use data for marine fisheries is already collected systematically and in high quality for the seven major commercial species including hake, tuna, mackerel, and sword fish.[93] These data include annual data on landings (~475,000 t in 2012), generated revenues (N$133 million in state revenues in 2012/13), overall contribution to GDP (N$3.8 billion in 2014)[94] and total allowable catches (350,000 t for horse mackerel in 2012). In addition stock data – which is notoriously difficult to calculate for marine fish stock – is also estimated for the above mentioned

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[92] Namibia Statistics Agency (2015). Annual National Accounts 2014.

[93] See the most recent report of MFMR – Ministry of Fisheries and Marine Resource (2014): Annual report 2012/13.

[94] In contrast to the other figure, this figure is from: Namibia Statistics Agency (2015). Annual National Accounts 2014.

commercial species. Altogether, compilation of NCAs for marine fisheries is thus in principle feasible. However, the presently collected data is already consistently used to inform decision makers on sustainable strategies with respect to the fishing sector (such as the setting of total allowable catches). We thus conclude that the added benefit of a NCA for marine fisheries is presently[95] low.

By contrast, data for inland fisheries is not comprehensive, nor collected annually or available quickly after collection. NCAs are thus not feasible for this subsector. Given that the economic estimate for this sub-sector (e.g. N$41 million for the Zambezi in 2012)[96] is rather low, we neglected it in our overall assessment of the feasibility and added benefit for NCAs for fisheries.[97]

Figure 9: Overview on main features of fishery sector as well as feasibility and added benefit of a NCA for fisheries.
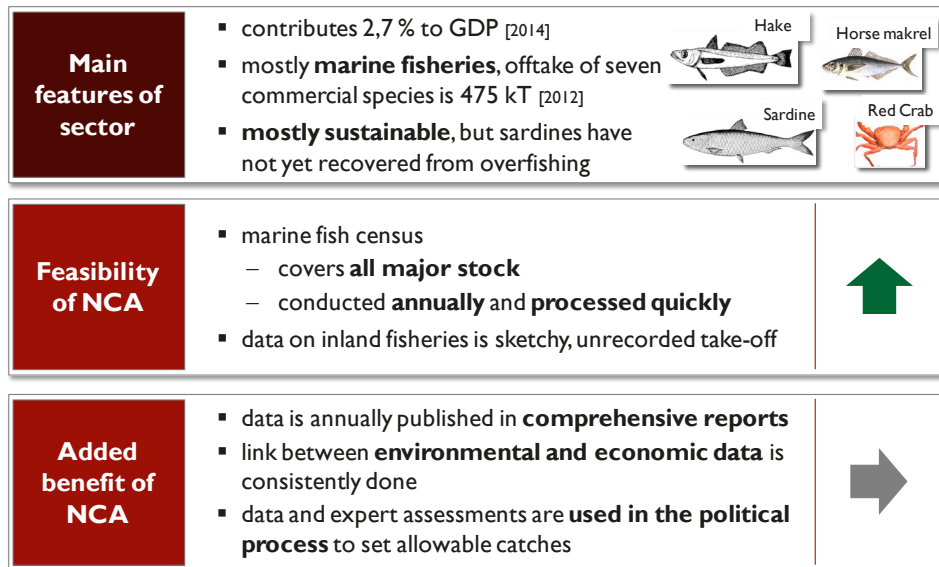
3.3.4.   Land accounts

As mentioned above, we differentiate land accounts into the sub-accounts land and forestry (in the narrow sense), agriculture and wildlife.

Land and forestry sub-accounts:

We here summarize three aspects in land and forestry sub-accounts, i.e. land area as a resource for farming, national parks and urban areas; bush encroachment; and forestry. Only data on land area is available in high quality, being comprehensively surveyed and updated by the Deed's Office (Figure 10).

By contrast, data on bush encroachment is sketchy at best: The most recent efforts at any comprehensive spatial assessment of bush cover is dating back to the late 1990s and early 2000s. Since then, bush cover has only been assessed for a limited number of study sites.[98] However, given the large number of present initiatives on bush encroachment in Namibia (e.g. the GIZ De-bushing project), comprehensive bush coverage data may very well be available in the near future.

Likewise, data on forestry is also sketchy. Since the last compilation of forest accounts in 2004 (see Chapter 3.1.2), both MET and the Department of Forestry at MAWF experienced an extensive drain in skilled experts. Presently, data on forest cover, use of forest for pole production, timber and fuel is not collected systematically and regularly.

Altogether, we thus deem land sub-accounts infeasible without an extensive improvement of data availability and quality. Nonetheless, land management could benefit greatly by the NCA framework, since it would allow to capture the underlying dynamics of the ecosystem – which are at the heart of the agricultural sector – and link them directly to land use.

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[95] This statement is conditional on MFMR continuing the annual publication of reports that contain stock figure, landing figures and such. As previously mentioned, the last available report is from 2014 for the year 2012/13.

[96] Ministry of Fisheries and Marine Resource (2014). Annual report 2012/13, p. 35.

[97] Ibid. We add here that aquaculture exists in Namibia, but that its contribution is with ~124,000 N$ even more negligible.

[98] Rothauge, A., 2014. Baseline assessment for the De-Bushing Programme in Namibia. Agriconsult Namibia.

Figure 10: Overview on main features of land as well as feasibility and added benefit of a NCA for land.

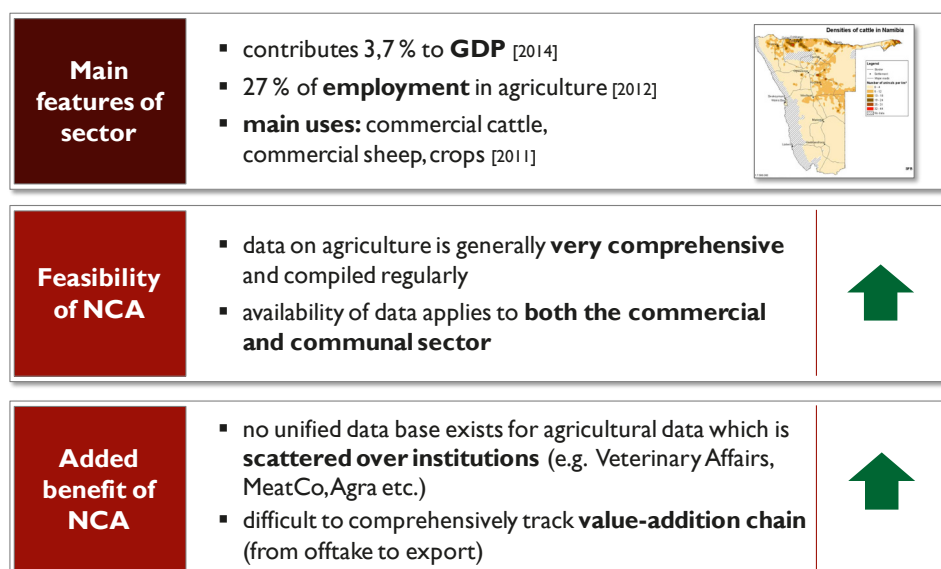| Main features of sector	▪ land use is heavily impacted on by **bush encroachment** ▪ forest and their use are relevant mainly in northeastern Namibia	Forest stock and utilization
Feasibility of NCA	▪ **data on land** (farm land, national parks, urban areas) is comprehensively available ▪ **data on bush encroachment** is dated or sketchy ▪ **forestry data** is likewise collected neither comprehensively nor regularly	➡
Added benefit of NCA	If data sources allow the compilation of accounts, NCAs could provide extensive benefits by **linking underlying ecosystem dynamics to land use** and management.	⬆

Agriculture sub-accounts:

The agricultural sector is one of the key sectors in Namibia, contributing 3.7% to GDP directly[99] and ~27% to employment (Figure 11). The main uses are commercial cattle, commercial sheep and crops.[100]

Data on agriculture is available plentiful and is collected regularly, and as such, agricultural NCAs are feasible. Agricultural data is, however, distributed across many institutions, including MLR, Agra, MeatCo, Meat Board, Agronomic board and several smaller auction companies and slaughterhouses. Herein rooted is one the main benefits of NCA: it may aggregate the disparate data into one unifying framework and permit easy and consistent statements with regards to the whole sector. In addition, an agricultural NCA would permit a tracking of the value addition chain from offtake to export which – given the importance of the agricultural sector – would provide an important information basis for policy making (e.g. with regards to actual and potential results from agricultural regulation such as the "Buy Namibian" program).

Figure 11: Overview on main features of agriculture sub-sector as well as feasibility and added benefit of a NCA for agriculture.

Main features of sector	▪ contributes 3,7 % to **GDP** [2014] ▪ 27 % of **employment** in agriculture [2012] ▪ **main uses:** commercial cattle, commercial sheep, crops [2011]	Densities of cattle in Namibia
Feasibility of NCA	▪ data on agriculture is generally **very comprehensive** and compiled regularly ▪ availability of data applies to **both the commercial and communal sector**	⬆
Added benefit of NCA	▪ no unified data base exists for agricultural data which is **scattered over institutions** (e.g. Veterinary Affairs, MeatCo, Agra etc.) ▪ difficult to comprehensively track **value-addition chain** (from offtake to export)	⬆

Wildlife sub-accounts:

The wildlife sector is an important sub-sector of the Namibian economy, both due to direct use of wildlife for hunting or game meat and due to its indirect use for non-hunting tourist visits (Figure 12). For example, hunting permits alone amounted to N$1.8 million in Q3 2015.[101]

[99] Namibia Statistics Agency (2015). Annual National Accounts 2014.

[100] MAWF, 2011. Agricultural statistics bulletin (2000-2009).

[101] Interview with Kenneth Uiseb at MET, 09 November 2015.

All main uses of wildlife require permits, including offtake of game for meat and live sales. These were up until recently recorded only on paper, but are presently converted into an electronic system. In contrast, data on game stocks in the form of census data is available only for limited areas (conservancies, national parks, ~250 freehold farms[102]) and appears to be in part of only of low quality. Similarly, data for game meat prices may, in principle be available at local butchers, but are not systematically available in a single data base.

Overall, NCA are thus partly feasible for wildlife, with both stock accounts that are based on census data and hybrid accounts that depend on systematic price data requiring improved data sources. Like the other land & ecosystem sub-accounts, NCA would provide added benefit to the wildlife sector as it would permit unified data bases and improved linkages to economic data (esp. GDP and employment). We note here for completeness sake that the existing tourism account that we discussed in Chapter 3.1.5 already expertly covers many economic perspectives relating to wildlife – an integration with wildlife accounts would generate extensive synergies.

Figure 12: Overview on main features of wildlife sub-sector as well as feasibility and added benefit of a NCA for wildlife.
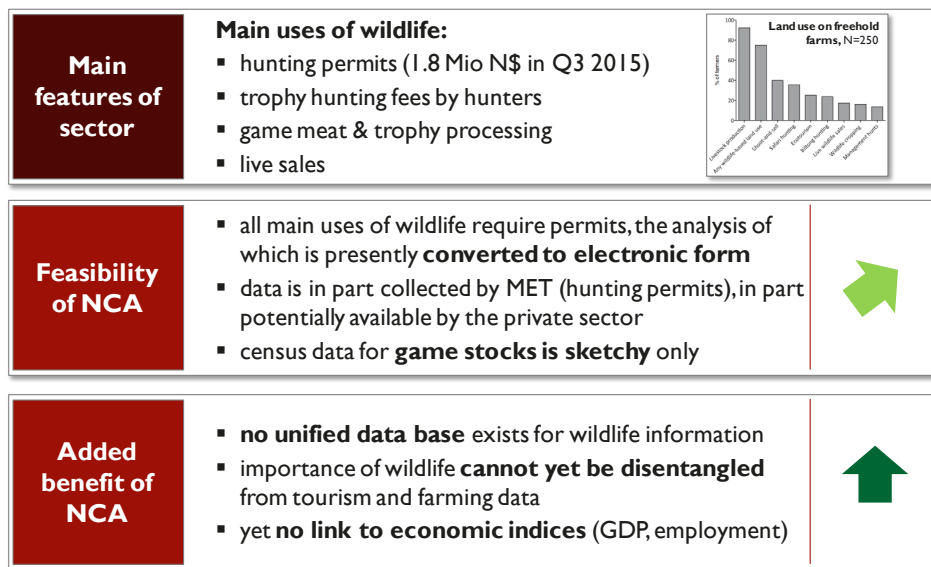
3.3.5.   Energy and mineral accounts

Energy accounts:[103]

Electricity security in Namibia is presently uncertain, as supply will not meet demand in the near future (Figure 13), predominantly because electricity procurement of electricity from neighboring countries is uncertain (treaty have not yet been negotiated) and there is insufficient installed generation capacities in Namibia[104]

Relevant data on electricity – including generation, consumption and prices data – is available in good quality for both the conventional and renewable sector. An exception are rooftop solar panels which are not monitored, but their installed capacity is presently negligible. As with other natural capitals, data for electricity is also dispersed among different institutions, including NamPower, ECB, Regional Electricity Distributers and different municipalities.
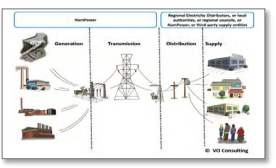
Altogether, NCAs for energy are thus feasible. They would, furthermore, provide added benefit by unifying the dispersed data in one framework and thus allowing for better forecasts and strategic decisions, such as supply-demand projections and procurement forecasts.

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[102] Lindsey, Peter (2011). An Analysis of Game Meat Production and Wildlife-based Land Uses on Freehold Land in Namibia: Links with Food Security. TRAFFIC East/Southern Africa, Harare, Zimbabwe

[103] We here discuss electricity only. Issues regarding other energy sources such as gas, coal and petroleum are presently not as critical as electricity.

[104] See for example: Namibia's energy future: a case for renewables by Detlof von Oertzen (2012) and Energy Demand and Forecasting in Namibia: Energy for economic Development by the National Planning Commission (2013).

Figure 13: Overview on main features of energy sub-sector as well as feasibility and added benefit of a NCA for energy.
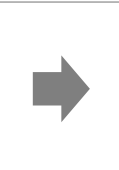
Main features of sector	▪ short-tem termination of **foreign contracts** of ~150 MW next year ▪ mid-term **gap** between supply & demand ▪ long-term **strategic decision** for or against centralization (Kudu gas field)
Feasibility of NCA	▪ production (conventional an renewable) and consumption **data is available** from NamPower, REDs, municipalities and ECB ▪ data on **rooftop PV is not covered**, but does (not yet) play a big role
Added benefit of NCA	▪ **data is scattered** among many institutions ▪ aggregating and linking data with socio-economic statistics (pop. growth) and technical data (grid loss) will allow better **forecasts** and support strategic **decisions** ▪ strong **link to other natural capitals** necessary

Mineral accounts:

The mineral sector is, in terms of GDP, the most important sector in Namibia, contributing directly 11.6% to GDP in 2014 (Figure 14). As already mentioned Chapter 2.2 the main resources are diamonds, metal ores and uranium.

Data for all resources including aggregated price data is readily available from either the Chamber of Mines or individual companies. Data on mining geology is available from MME. NCAs for mining are thus feasible. However, mining data is already thoroughly considered in the political process (i.e. what resource field to open for exploration) and NCA would only provide limited added value for minerals.[105]

Figure 14: Overview on main features of mineral sub-sector as well as feasibility and added benefit of a NCA for minerals. Source of employment figures is presentation by Grant Marais „Mining and its contribution to society", 29th Oct 2014.

Main features of sector	▪ contribute 11.6 % to **GDP** [2014] ▪ **direct employment** only 2.3 % of jobs, indirect much higher (16.8 %) * ▪ **main resources:** diamonds, metal ores, uranium
Feasibility of NCA	▪ data for **all resource is available** either from the Chamber of Mines or individual companies ▪ **data on geology** is available from the Ministry of Mines and Energy
Added benefit of NCA	▪ Decision makers have already **access to all relevant mining data** to make informed decisions, the added benefit of a NCA is thus low.

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[105] We note here that mineral exploitation appear to be not sustainable in the sense that revenues are not re-invested in the economy. However, we presently cannot see how the use of mineral NCA might alleviate this issue.

3.4. Summary of results

In the previous sub-chapter, we detailed results for the individual natural capital accounts (see overview in Figure 15).

We briefly summarize results here:

· NCAs are both (mostly) feasible and would provide added-benefit for water, wildlife, agriculture and energy.

· NCAs would provide substantial added benefits to the land accounts but are presently not being feasible due to sketchy data sources. However, as detailed above, these data shortages may well be improved in the near future.

· NCAs are feasible for fisheries and minerals, but do not provide much added benefit as political processes are in place that already adequately consider relevant information on these capitals.

We therefore conclude, based on added-benefit and (expected) feasibility that land accounts and energy accounts are prime candidates for any further development of NCAs in Namibia.

Figure 15: Summary of assessment of feasibility and added benefit of NCAs for the individual natural capitals.

	Water	Fishery	Land & Ecosystems			Energy & Minerals	
			Wildlife	Agri-culture	Eco-systems	Energy	Minerals
Feasibility	⬆	⬆	⬈	⬆	➡	⬆	⬆
Added benefit	⬆	➡	⬆	⬆	⬆	⬆	➡
Priority areas	tbd by decision makers, input by stakeholders and experts						

Finally we also note that we have above only considered NCAs individually for the separate natural capitals, and that we have not considered any cross-account synergies that may arise by implementing several or all NCAs. Such synergies are in the line of what we discussed for individual NCAs – that implementing NCAs for different natural capitals allows for a unifying framework that permits analyses and policy recommendations for overarching environmental issues.

4

Fast-track compilation of water accounts

4 Fast-track compilation of water accounts

The following provides a fast-track compilation of water accounts for Namibia. The approach is based on the SEEA-Water approach (Figure 16). This statistical environmental-economic accounting system for water offers a standardization of water accounting methods and is therefore especially suited for transboundary basins as it offers common ground when data is compiled and processed by different statistical agencies.

The approach we pursue for fast track compilation of water accounts is based on monitoring data. The data include rainfall, meteorological (temperature, humidity, sunshine, wind run) data for the climatic water balance, as well as hydrological data (runoff, water levels) for the assessment of surface and groundwater resources.

One main achievement of this report is that we derive a first estimation of total water assets for Namibia. Although this estimation is a fast track estimate, it highlights the potential for future resources development in Namibia. The subsequent chapters will detail the conceptual foundation (Chapter 4.1), past information and benchmarks in Namibia (Chapter 4.2), our methodology for compiling the fast-track water accounts (Chapter 4.3) and the fast-track accounts themselves (Chapter 4.4).

Figure 16: SEEA-Water framework and accounting for economic and environmental balances.
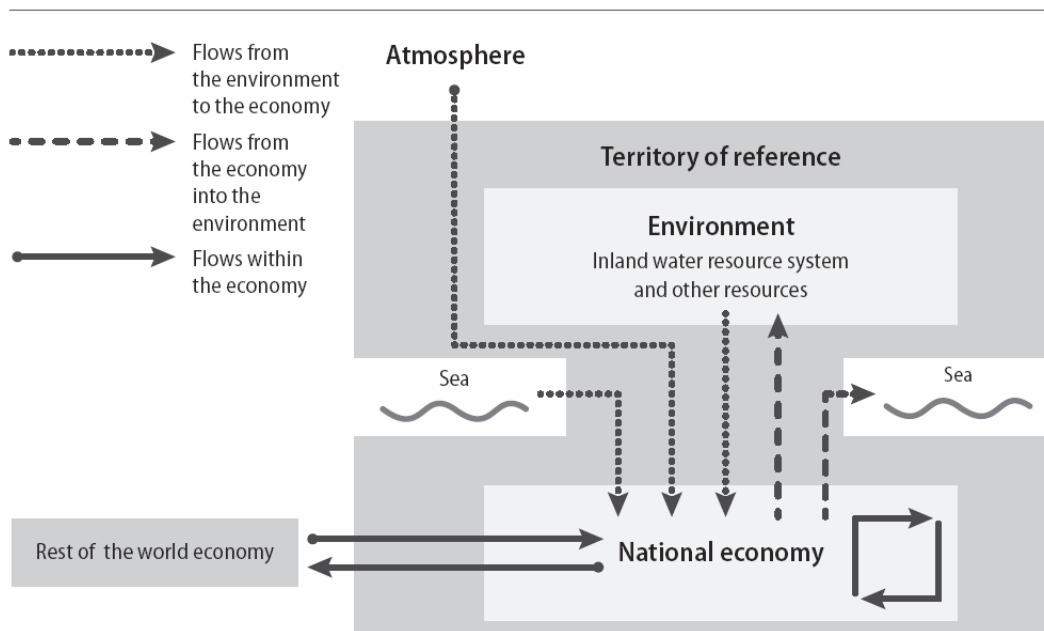
4.1. Conceptual foundation

4.1.1. SEEA-Water and adjustments to Namibia

The methodology for SEEA-Water is based on five major methodological components:

* **Asset accounts** that define the total amount of resources in stock at the beginning of an accounting period.

* **Physical flow and the matrix of flows** that depicts physical water flows such as atmospheric flows to hydrological basins, surface flows to groundwater, flows from basins or the surface to the sea or flows between resource of different countries.

* **Activities and products** which allow the mapping of water on economic entities and which are classified and defined according to the International Standard Industrial Classification and Central Production Classification (ISIC).

* **Physical supply and use tables** that present flows from the environment to the economy and from the economy to the environment according to the above classification of products and activities. Water supply tables and water use tables represent accounts from suppliers' and users' perspective. These tables are complemented by a balance of flows within the economy.

* **Environmental-economic indicators** that are based on physical flows, physical supply and use and the economic value generated.

These components of SEEA Water, and the standards on how to compile them, are in line with the main SEEA framework which we already discussed in Chapter 2.

This international SEEA standard does not consider the specific conditions of Namibia. In her landmark report on water accounting in Southern Africa, Lange et al. (2006)[106] termed some of the structures and layouts of tables for resources accounts and physical flows as 'awkward' and proposed a slightly different structure corresponding to conditions in Namibia. Specially, Lange et al. (2006) prepared tables for three major components:

* Physical system of flows for rainfall, surface water and groundwater.

* Water supply structure and distribution, comprising the classification of activities and products as well as physical supply and use tables.

* Economic use and value of water.

These allow for a more straightforward approach to compiling accounts in Namibia.

4.1.2. Classification of water resources

Namibia is an arid to semi-arid country with sporadic rainfall and high evaporation where ephemeral rivers convey and transfer water to groundwater stores. Therefore, as proposed in previous studies[107], natural water resources have been classified as:

* Ephemeral surface water[108],

* Perennial surface water,

* Groundwater,

* Recycled water,

* Unconventional water (desalination).

Groundwater is the most important source, accounting for more than 38 per cent of annual freshwater use in 2001/02 and in 2006 (Lange et al., 2006). The remaining water use is evenly split between ephemeral and perennial surface water sources. Recycled water still accounts for only a small percentage of Namibia's annual water use at the national

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[106] Glenn-Marie Lange, "Water accounts in Namibia", in Glenn-Marie Lange and Rashid M. Hassan, The Economics of Water Management in Southern Africa: An Environmental Accounting Approach (Cheltenham, Edward Edgar Publishing, 2006)

[107] Ibid.

[108] The distinction between ephemeral surface water and perennial surface water is relevant as both resources are used and managed differently. Perennial rivers (Kunene, Kavango, Zambesi and Oranje) all run on international borders and require a common transnational agreement. Ephemeral rivers flow towards the sea or towards neighboring countries, running only a few days per year, but are nonetheless a major source for groundwater recharge and surface water storage.

level, but is a locally important source of water in urban areas. For example, it forms a significant share of Windhoek's water supply since 2001/2002. Water from unconventional sources is limited to desalination, which could provide a major component of the water supply along Namibia's coast in the future.

4.1.3.   Institutional structure of water-related agencies

Another important aspect of water supply and use in Namibia relates to the institutional structure of water-related agencies.

- NamWater is the parastatal institution for bulk water supply and abstracts water from primary sources. It supplies water to some end-users directly, but the main share of bulk water supply is delivered to secondary suppliers (municipalities, rural communities and rural water suppliers) which in turn provide local distribution systems for delivery to end users.

- Local authorities and municipalities (City, Town) buy water from NamWater and redistribute it to end users. In some cases, municipalities also operate their own facilities to abstract water from primary sources such as local boreholes.

- Rural Water Supply (RWS) develops water supply systems from primary sources to rural communities. RWS purchases some water from NamWater. It is government policy that local communities should eventually take over the management of most rural supply of water from RWS.

- Self-providers are private companies, livestock farmers, tourism sites and mines that have their own water supply based on a water permit system.

This complex institutional structure of abstraction, distribution and redistribution and the importance of self-provision in rural areas and of major water users (mines) is a major obstacle to the compilation of water accounts. Ultimately, this requires the collection and compilation of data at various institutional levels, and water supply and use cannot always be resolved analytically but must be estimated.

In previous work on water accounts by Lange (1997), there were 20 categories of end users of which 17 were industries, two were different categories of households and the remaining end-user was government. In more recent accounts prepared by the Department of Water Affairs (DWA) in 2006, these account categories have been expanded to a total of 47, covering nine primary industries, 15 secondary industries, 15 service industries, five providers of government services and three household categories.[109] These categories are in line with ISIC and are therefore compatible with the economic sector classifications that are typically used in national accounts.

4.2. Past experience and benchmarks for water accounting in Namibia

This section provides a brief overview on past experience and available benchmarks for water use, supply and productivity at the national level for Namibia.

As already outlined in Chapter 3.1.1, the most recent water accounts were published in 2006, based on information dating back to 2001/2002. Subsequently, the procedure for water accounting has been revised and updated in a pilot project in 2011, but has not been published at a national scale. Therefore, the only applicable national reference and benchmark for water accounting for this report is the information from 2001/2002.

The water accounts provide a framework for measuring the contribution of water resources to the different sectors of the national economy and the impacts of changes in the economy on water resources. Overall use of freshwater (including recycled water) increased from 234 million m^3 per annum to 282 million m^3 per anno during the period 1997/98 – 2001/02, an increase of 20%. Around 14% of water abstracted nation-wide was lost or is unaccounted for during the water supply process from abstraction to use. Freshwater use increased somewhat faster than the national population, so that per capita water use increased by 8%. The productivity of water (i.e. its direct contribution to national income, in terms of value added per unit amount of water used) was shown to vary greatly between sectors,

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[109] DWA (2006). Technical Summary of Water Accounts. Department of Water Affairs. Internal Report.

with agricultural production making much less of an economic contribution per m³ of water-used than non-agricultural economic activity. The total stock of water was estimated to reach about 100 million m³ in the Kuiseb delta only (Benito et al., 2011).

There are a number of other attempts to compile at least part of the information required for water accounting for basins or regions. Benito et al. (2011)[110] published resource data for the Kuiseb region, specifying stocks and flows and including an institutional and use analysis. That publication revealed, for example, that the Kuiseb region provides an estimated 5.6 to 8 million m³ as indirect recharge and renewable water resources. This study did not include an economic analysis.

Table 8: Benchmark for water accounting in Namibia, based on 2001/2002, in million m³.

		Available resources with installed capacity in 2001/02	Potential amount per year
Primary sources			
	Dams in ephemeral rivers	100.0	200.0 (a)
	Perennial rivers	170.0	1,105.0 (a)
Groundwater	Artificial recharge	150.0	300.0
	Natural recharge		
Secondary source			
Recycling			
	Reclaimed Water	7.5	10.0
New Sources			
	Desalinization		
Total		**427.5**	**1,615.0**

Work began in 1995 under the Namibian Natural Resource Accounting Programme, initiated by the Ministry of Environment and Tourism in cooperation with DWA. Data was collected from NamWater, Local Authorities and self-suppliers (Imines and irrigation farmers). (a) Assumes better efficiency by managed transfers

A similar study has been carried out within the Strategic Environmental Assessment of the Erongo region (2011). In this study, renewable resources for the Erongo region comprising mainly the Swakop river basin amounted to a total of 15 million m³. These fell short of the estimated need of 40 million m³ for the then growing mining sector. An updated estimation of renewable water resources for Namibia and for all basins has not been made so far.

According to the last available benchmark, Namibia had a total installed capacity of 427.5 million m³ in 2001/2002, out of which 100 million m³ were abstracted from ephemeral alluvial rivers and 170 million m³ from perennial rivers (see Table 8). In 2001/2002, only natural groundwater recharge was considered (not artificial recharge), and this recharge was at 150 million m³. It is important to note that only aquifers under abstraction were considered and only as far as the capacity of installed boreholes was affected. The total amount of natural recharge for the entire country is potentially higher but water resources cannot be used or abstracted as necessary water schemes are not available.

Data on calculated and projected use and demand are available from DWA and NamWater. These data are compiled based on available abstraction data and projected demand. Table 9 presents the intermediate figures for water accounting.

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[110] Benito, G., Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., et al. (2010). Management of alluvial aquifers in two southern African ephemeral rivers: implications for IWRM. Water Resources Management, 24(4), 641–667

Table 9: Intermediate figures for water accounting in Namibia since 1997 until 2008, in million m³. * Data for 2008 are projections by DWA.

Supply, use & loss	1997	2001	2008*
Dams+Ephemeral rivers (installed capacity)	(100.0)	(100.0)	(100.0)
Supply	83.8	96.6	97.0
Use	71.0	82.9	87.0
Loss	12.8	13.7	10.0
Groundwater (developed capacity)	(150.0)	(150.0)	(150.0)
Supply	112.5	121.8	125.0
Use	96.3	104.7	106.0
Loss	16.2	17.1	15.0
Perennial rivers (abstraction capacity)	(170.0)	(170.0)	(170.0)
Supply	77.0	98.4	105.0
Use	66.2	85.9	84.0
Loss	10.8	12.6	12.5
Reclaimed (recylced capacity)	(7.5)	(7.5)	(7.5)
Supply	2.8	1.3	1.3
Use	2.3	1.2	1.0
Loss	0.5	0.1	0.1
Desalinization			
Total supply	276.1	318.1	327.9
Total use	235.8	274.7	278.2
Total loss	40.3	43.5	37.6
Demand	**334.0**	**334.0**	**369.0**

The demand side is further detailed in Table 10. Irrigation was the most important use with a demand of 155 million m³ in 2008. The water use in urban areas exceeds water use in rural areas by far, and the gap between both is widening. The Strategic Environmental Assessment by the Geological Survey Department and Department of Water Affairs (DWA), however, has limited the increase in water supply to 20 million m³ instead of the initially expected 42 million m³.

Table 10: Demand for water in Namibia since 1997 until 2008, in million m³. * Data for 2008 are projections by DWA.

| Year	1997	2001	2008*
Urban	65	65	75
Rural	10	10	12
Livestock	87	87	87
Irrigation	135	135	155
Mining	16	16	20
Tourism	19	19	20
Total	**334**	**334**	**369**

4.3. Methodology for fast-track water accounts

The development of water accounts followed the general outline and structure given in Chapter 4.1 considering previous experience in Namibia as described in Chapter 4.2. Data sources used for the compilation of accounts are noted in Appendix C and are attached to this report.

4.3.1. Asset accounts for surface and groundwater

As previously discussed, one main component of water accounts are asset accounts that comprise surface and groundwater storage. The estimation of surface storage assets is hereby straightforward as it uses the monthly dam bulletin published by NamWater (see Figure 17).[111] The dam bulletin contains information on the actual storage of all dams. In addition to artificial surface water storage, we compiled a list of natural lakes based on various publications. These lakes include the Cuvelai basin as a lake-like water body with a very variable volume of water.

Figure 17: Map of surface dams for which data is provided in monthly dam bulletins by NamWater. Blue background colors denote catchment areas.
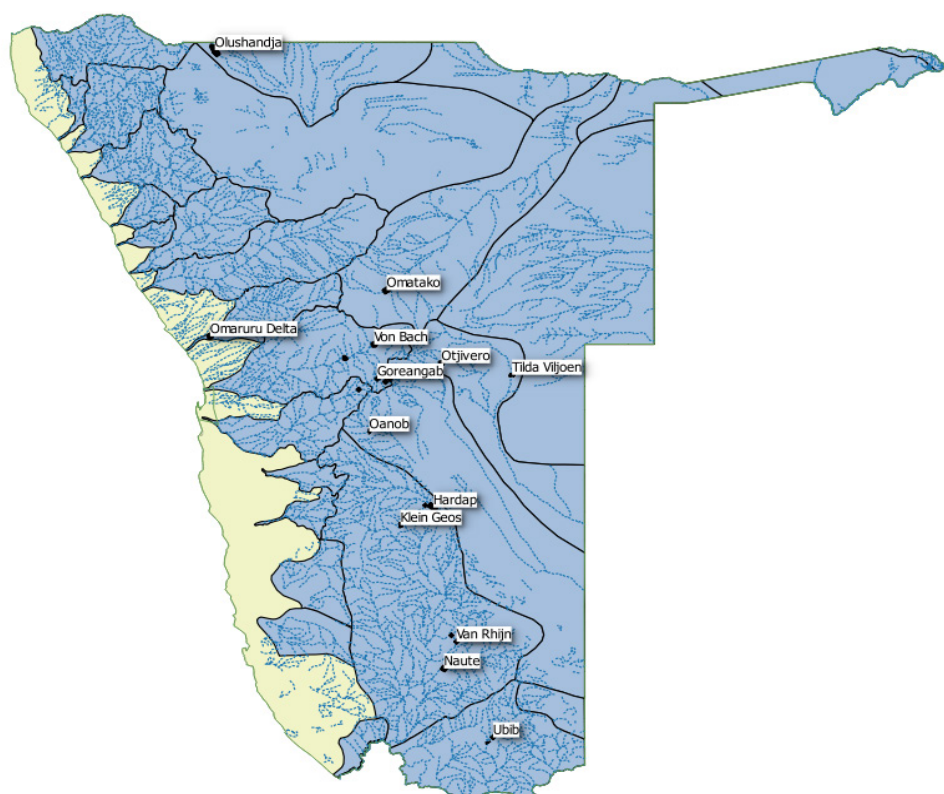
In contrast to surface storage assets, groundwater assets are presently difficult to estimate. We propose an estimation method that utilizes geological data provided by Geological Survey Department and by previous investigations by the Federal Institute for Geosciences and Natural Resources of Germany (Figure 18).

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[111] See http://www.namwater.com.na/

Figure 18: Map of geological formation. Source: Geological Survey Department Namibia.
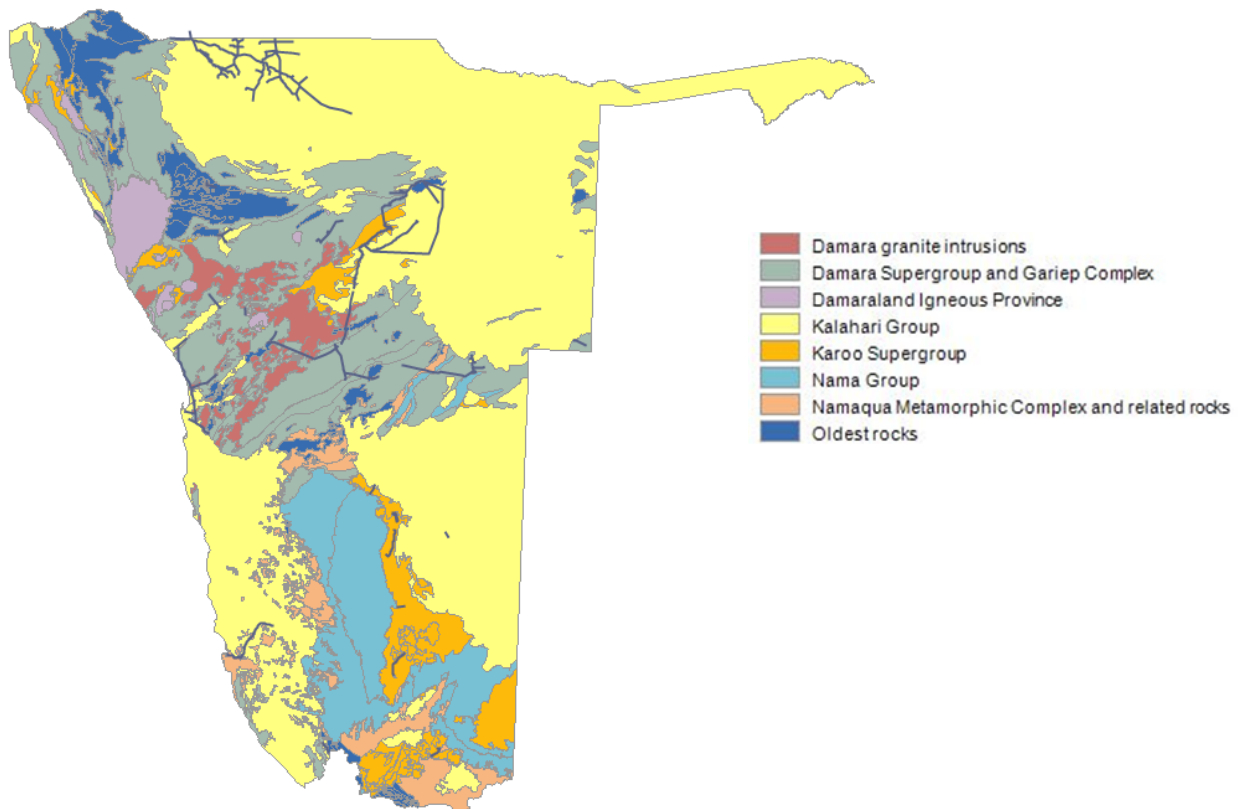
This estimation of assets is based on the depth function of effective porosity of different geological formations and on the depth to groundwater. Previous investigations (Mainardy, 1999)[112] have shown that the effective porosity of hard-rock aquifers (Damara granite intrusions, group and complex, Damara Igneous Province, Nama metamorphic complex) is relatively small and ranges from 0.5 to < 5%. Due to weathering, tectonics and decompression, only the upper part of the crust and hard-rock aquifers have a significant permeability. Some karst aquifers (Otavi Mountains), may form a significant exception with effective porosities of 5 to 15%, and sedimentary aquifers such as the Kalahari and quaternry deposits may have an effective porosity of 25 to 35%. Notwithstanding these exception, we generally assumed that groundwater occurrence decreases exponentially with depth and prepared a first estimation of groundwater assets by integrating the saturated volume over depth. The estimate has been validated with previous studies on groundwater storage.[113]

4.3.2. Physical flow and matrix of flows

For the physical flows and the matrix of flows we estimated rainfall from the environment to the land surface and evaporation as a flow from the land surface back to the environment. Daily data of rainfall, temperature and relative humidity were provided by the Namibia Meteorological Service (NMS) for a set of seven stations for the period October 2005 until September 2015. Figure 19 depicts rainfall patterns in 2015.

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[112] Holger Mainardy,(1999). Grundwasserneubildung in der Übergangszone zwischen Festgesteinsrücken und Kalahari-Lockersedimentüberdeckung (Namibia). University of Würzburg, Dissertation.

[113] Richey A. S., Thomas B. F., Lo M.□H., Famiglietti J. S., Swenson S., and Rodell M. (2015). Uncertainty in global groundwater storage estimates in a Total Groundwater Stress framework, Water Resour. Res., 51, 5198–5216

Figure 19: Map of meteorological stations provided by NMS and average annual rainfall, scaled with NMS data from 2015 (in mm per m²). For each station, daily data of rainfall, temperature and relative humidity were provided.
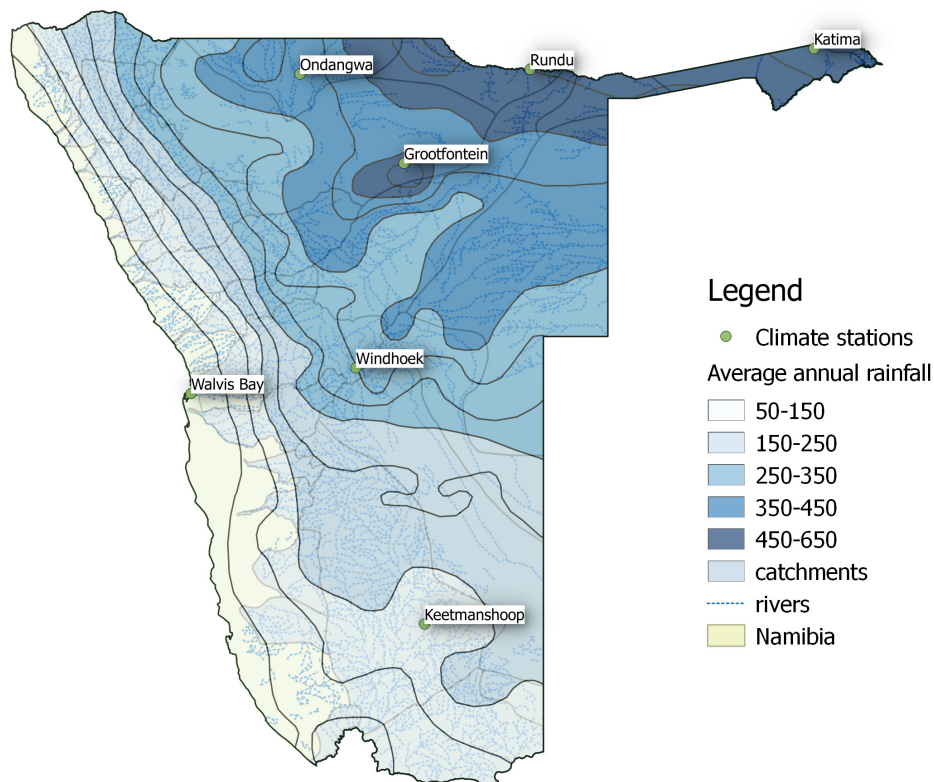
For the estimation of evaporation, it is necessary to first estimate the saturated vapor content of air.[114] Potential evaporation can then be estimated by calculating the moisture deficit (difference between saturated and actual humidity) with the Penman or Penman-Monteith method or by using the more straightforward Priestley-Taylor or Hargreaves approach.[115] For our compilation of accounts we employed the approach by Priestley-Taylor, a physically-based estimation for evaporation (Külls, 2001 and Maidment, 1994).

A precise estimation of runoff has been calculated by analyzing master stations with daily runoff data by DWA for 2014/2015. Data for such analyses has already been provided by DWA for the period 2006 until 2015 (see Figure 20 for a map of master stations). Results have been validated by using a common rule of thumb, i.e. assuming that 4% of mean annual rainfall became runoff.[116]

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[114] Maidment (1994) Handbook of Hydrology. 1024 p.

[115] Ward and Robinson, Principles of Hydrology, 1999

[116] Overall, it is estimated that on average only about 4% of the rainfall become surface run-off and as little as 1% of the rainfall effectively recharges groundwater resources.

Figure 20: Map of hydrological stations with runoff data provided by Department of Water Affairs in 2015.
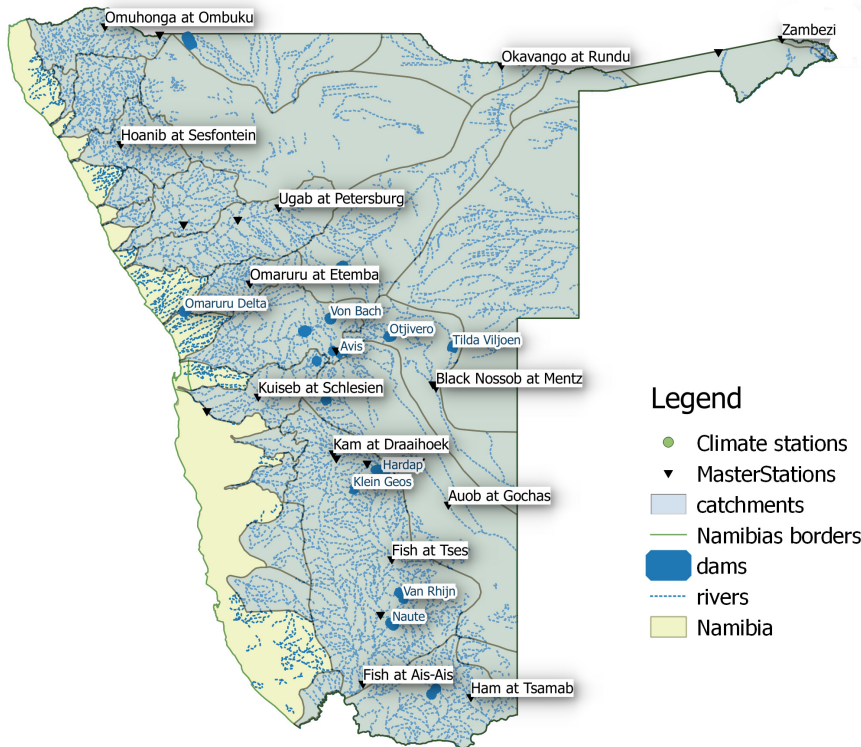
An alternative method for estimating surface runoff rapidly is to use the unit runoff map proposed by DWA (1992) (Figure 21).[117] The advantage of this method is that it also provides data for ungauged basins. The unit runoff map specifies the runoff per unit area (m^2) for average rainfall. The unit runoff value needs to be multiplied with a factor (f = [actual annual rainfall] / [mean annual rainfall]) to provide a value for a specific year. Runoff can also be estimated using rainfall-runoff models that have been developed for Namibian conditions such as the Namrom model operated by NamWater.

Figure 21: Map of unit runoff (Department of Water Affairs, 1992).

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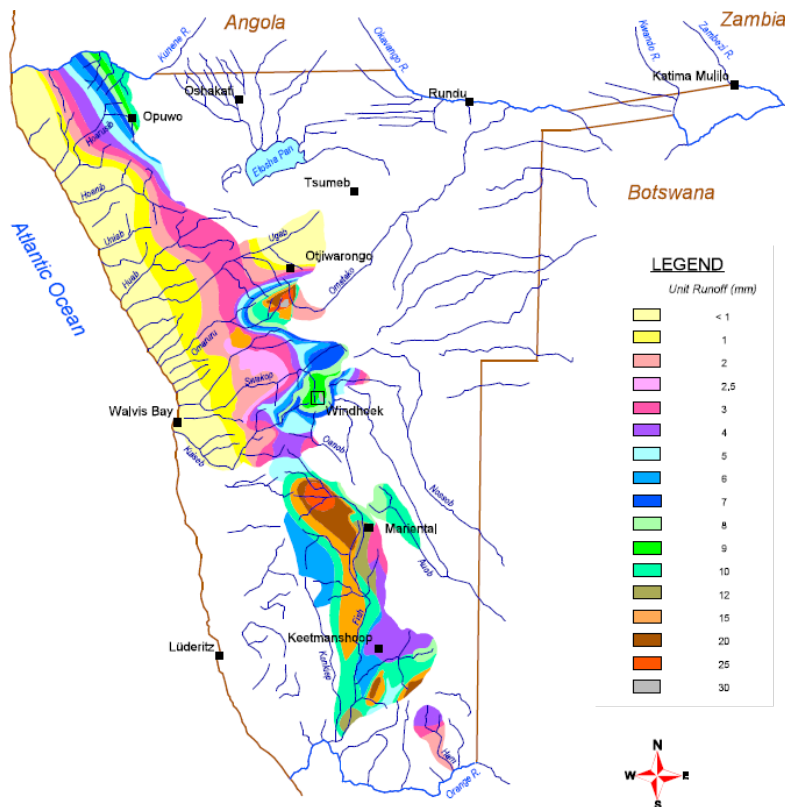
[117] DWA (1992). Runoff map, produce by University of Namibia.

Finally, the groundwater recharge as the physical flow of seepage from rainfall or floods to the groundwater store is very difficult to estimate, in spite of many studies on direct infiltration to aquifers from rain and on indirect recharge from floods.[118,119] At a national level, 1% of mean annual rainfall constitutes a conservative estimate of annual recharge, and we used this value as an estimate for groundwater recharge.

4.3.3.   Activities and products

We classified activities and products according to the classification employed by DWA (2006)[120]. Table 11 (see next page) lists these classifications, with some categories not being relevant for Namibia or data not being available.

For fast compilation of water accounts, we recommend to simplify these categories to the level used by Lange et al. (2006). In general, we further recommended to develop a structure of activities and products ranging from detailed classification to a more general level of classification in order to allow for the aggregation and disaggregation of accounts according to analytical needs.

Table 11: Classification of activities and products according to ISIC (examples).

Economic Sector	ISIS classification
Primary Industries	
Communal Livestock	not available
Commercial Livestock	012
Communal Irrigation	not available
Commercial Irrigation	011
Fishing	05
Secondary Industries	
Meat Processing	1511
Fish Processing	1512
Electricity supply	40
Tertiary Industries	
Hotels	551
Post and telecommunication	65
Public Sector	
Education	80
Civil Service	75

4.3.4.   Physical supply and use tables

The collection of data for physical supply and use tables is difficult due to the complex institutional structure. A graph of the distribution system linking these institutions has been proposed by DWA (2006) and is also given by Lange et al. (2006), and is reprinted in Figure 22. Matters are further complicated by fragmented of insufficient pricing information on water.

A starting point for compiling physical supply and use tables is the redistribution of bulk water supplied by NamWater to municipalities. Physical quantities may, in principle, be derived from the NamWater database. Corresponding costs for supplying water to municipalities and directly to end users have been published by NamWater in annual reports until 2008, but for recent years such reports are no longer publicly available.

Local authorities and municipalities distribute water to end-users, and corresponding data has to be requested in individual municipalities. Water costs for end-users principally consists of two components: 1) the NamWater costs of abstraction and transfer to local authorities or distributors, and 2) the cost of supply and distribution of water to the end user. However, local authorities and municipalities do not always aim for full-cost recovery, especially not in small villages.[121]

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[118] e.g. Külls (2000) Groundwater Recharge of the North-Western Kalahari. 174 p

[119] Dahan, O., Tatarsky, B., Enzel, Y., Külls, C., Seely, M., & Benito, G. (2008). Dynamics of flood water infiltration and ground water recharge in hyperarid desert. J. Hydrol., 46(3), 450–461.

[120] DWA (2006) Technical Summary of Water Accounts. Department of Water Affairs. Internal Report.

[121] As of 2011, Ae Gams Data should assists local authorities to operate costing systems, to collect data on municipal water supply and distribution as well as costs recovered from end users. For this report, we could not acquire information from Ae Gams Data.

Figure 22: The distribution (above) and redistribution (below) of water in Namibia as a conceptual foundation for compiling physical water supply and use. Source: DWA (2006).
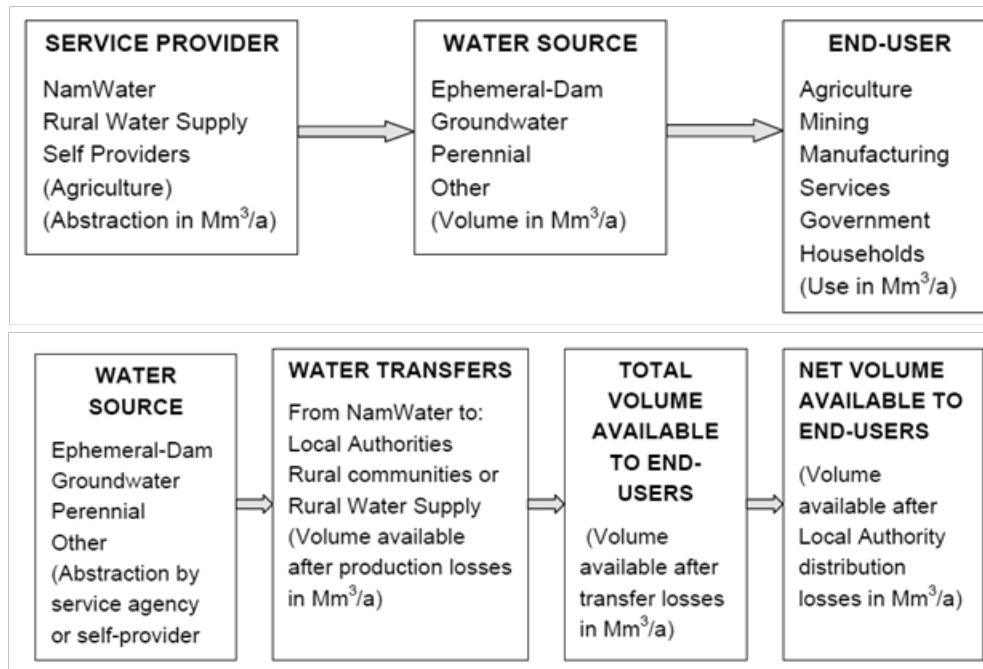
Rural water supply is managed by the DWA's Directorate of Rural Water Supply, in order to ensure a sustainable supply of safe water to people and livestock in rural areas (Figure 23). This is achieved in community based management through Water Point Committees. Data on physical quantities and pricing may thus be provided by the Directorate of Rural Water Supply.

Finally, for self-providers there is only limited information as most of the water is directly abstracted from groundwater and not recorded. Corresponding cost are simply "production costs" for abstracting groundwater, and may only be estimated. Water use can only be estimated based on available water permits and indirect reference from production data.

Altogether, for our fast-track water accounts, we could only obtain information on physical supplies for at the national level, but could not obtain pricing information at the necessary level.

Figure 23: Water supply schemes in Namibia with pipeline and dam system.
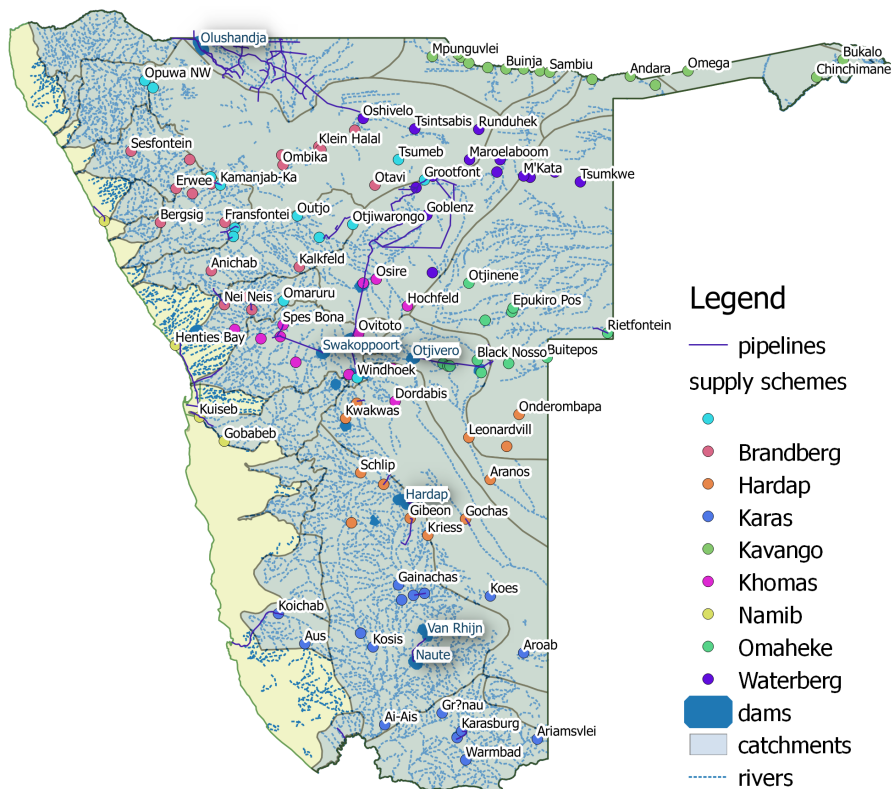
4.3.5. Environmental-economic indicators

Various environmental-economic indicators may be compiled by combining water accounts and economic statistics. One such indicator is the economic benefit of water use by sector which allows, for example, the identification of water-efficient sectors. Typically, this indicator is calculated as the ratio of value addition and water use:

$$B_i = VA_i / W_i$$

where

B	economic benefit of water use in sector i
VA	value added generated by sector i
W	m³ of water used in sector i

Similar indicators can be calculated with respect to output or employment by substituting VA for the respective output/employment variable.

4.4. Fast track water accounts

The fast-track water accounts that we compiled are envisioned to highlight how water accounting can be applied. During this process certain elements could not be elaborated such as water quality accounts, emission accounts and waste accounts – however, these can be added to fast track water accounts at a later stage, provided that relevant data is available.

4.4.1. Asset accounts

In the compilation of water accounts, we firstly estimated the stocks of water available in Namibia (Table 12) per annum. This is, in fact, the first asset account estimation done for Namibia including natural and artificial surface water and ground water.

The maximum stock of surface water resources corresponds to the dam capacity that amounts to a potential 708 million m³, provided dams are filled. A total of only 227 million m³ of water stock was found to be in the dams as of late 2014 (Namwater, 2014). This corresponds to 32% of the total volume. The list of dams also provides further detail on the main water use and supply: irrigation, water supply, flood control or hydro-electricity.

Ephemeral lakes account for about 4,800 million m³ of water in Namibia. Although this seems an enormous resource compared to the volume of abstracted groundwater, most of this water is saline or cannot be used for agriculture or water supply or is not available on a permanent basis. This asset, however, is of major importance for maintaining ecosystem functions in the Cuvalai basin and Etosha pan.

Table 12: Stocks of water in Namibia as of 1st October 2014, in million m³.

Name of dam	River	Major basin	Sub-basin	Since	Reservoir capacity	Irrigation	Water supply	Flood control	Hydroelectric
Omatjenne	Ugab	South Atlantic Coast	Ugab	1933	5.1				
Avis	Klein Windhoek	South Atlantic Coast	Swakop	1933	2.4		x		
Daan Viljoen	Black Nossob	Orange Basin	Nosob	1957	0.4				
Goreangab	Gammams	Orange Basin	Auob	1958	3.6		x		
Bondels	Satco	Orange Basin	Orange	1959	1.1				
Ruacana									x
Omarur Delta (Omdel)		South Atlantic Coast	Omaru		41.3				
Bondelswarts									
Otjitazu									
Hardap	Vis	Orange Basin	Fish	1962	294.6	x	x	x	
Tilda Viljoen	Black Nossob	Orange Basin	Nosob	1964	1.2				
Olushandja	Etaka Oshona	South Interior	Omuramba Ovambo	1971	42.3				
Friedenau	Kuiseb	South Atlantic Coast	Namibia south west coast	1971	6.7		x		
S. Von Bach	Swakop	South Atlantic Coast	Swakop	1971	48.6		x		
Naute	Lowen	Orange Basin	Fish	1971	83.6	x	x	x	
Nawaspoort	Usib	Orange Basin	Fish	1975	3.0		x		
Swakoppoort	Swakop	South Atlantic Coast	Swakop	1977	63.5		x		
Dreihuk	Hoem	Orange Basin	Orange	1978	15.5		x		
Omatako	Amatako	South Interior	Omuramba Omatako	1981	43.5		x		
Otjivero Main	White Nossob	Orange Basin	Nosob	1984	9.8				
Oanob	Oanob	Orange Basin	Auob	1990	34.5		x		
Otjivero Silt	White Nossob	Orange Basin	Nosob	1990	7.8				
Baynes				Incomplete					x
Popa Falls				Incomplete					x
Total					**708.5**				

The estimation of the total stock of groundwater proved to be a very difficult task for which no available information could be found. In fact, a previous project on the estimation of total groundwater stocks had failed to provide results (personal communication, DWA). Based on detailed information of the Geological Survey Department of aquifer boundaries and aquifer properties, the total stock of groundwater reserves was estimated to amount to ~1,630,000 million m³. This estimate was confirmed by recent estimates of the world groundwater resources published in Nature confirming our estimate based on GRACE gravimetry measurements.[122] Part of this asset is saline and cannot be used for human consumption. Furthermore, part of the asset is located in remote areas and cannot be developed easily. The estimated potential of groundwater resources to be developed amounts to 300 million m³, the actual amount of groundwater reserves per year is 200 million m³.

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[122] Richard G. Taylor, Bridget Scanlon, Petra Döll et al. (2015) Groundwater and Climate Change. Nature Climate Change, 3, 322–329.

Table 13: Estimation of surface and subsurface water, in km³. 1 km³ equals 1,000 million m³. Values in table rounded.

		Surface Water			Subsurface Water		
		Artificial Reservoirs [in km³]	Lakes [in km³]	Rivers [in km³]	Groundwater [in km³]	Soil water [km³]	Total [km³]
Opening Stocks		0.23	4.80	0.10	1,630.00	41.20	1,676.30
Increase in Stocks							
	Precipitation	0.30	1.40	11.70	0.00	219.00	232.50
Inflows							
	From Upstream territories		12.00	31.70	2.10	0.00	33.80
	From other resources				2.30	8.70	11.00
Decrease in stocks							
	Abstraction	0.10	0.00	0.17	0.17		0.44
	Evaporation	0.15	9.80	3.70	0.00	230.00	228.70
Closing stocks		**0.28**	**8.40**	**39.63**	**1,634.24**	**38.90**	**1,724.47**

The total amount of rainfall per year was 232,500 million m³ in 2014/2015[123]. Most of this resource has been stored in soils and subsequently used by plants or lost by non-productive evaporation. A total of 11,700 million m³ of flow has been produced, including a flow of 1,400 million m³ to the Etosha pan and to other pans (Kalahari). Only 300 million m³ have been stored in dams. Taking into account evaporation losses total inflow is reduced to the figures reported by NamWater in the dam bulletin for 2014/2015. Perennial flows form more than 30,000 million m³.

Decreases in stocks are caused by abstraction from different natural sources: Abstraction from dams amounted to 100 million m³ (Table 14). Although the total volume of dam storage amounts to more than 708 million m³, the total storage in the first week of April of the last 10 years varied between 125 and 592 million m³ with an average of 435 million m³. In principle, dams are designed to accommodate about 3 times the annual runoff of about 150 million m³. The 95% safe yield of all dams in Namibia is 92.7 million m³ only.[124]

Namibia has received a major amount of inflow from transboundary inflows (33,800 million m³) along its northern and southern borders. The use of water from these transboundary water resources is bound and limited by international agreements. Although the total amounts of water available from perennial rivers is 1,030 million m³, only 170 million m³ can be used so far, given available infrastructure (canals). The abstraction of surface water from the Oranja, Kwanda, Kunene, Zambezi and Okavango can still be increased in the future. Groundwater abstraction totalled 130 million m³ of an installed capacity of 165 million m³ in 2015. The potential resource is estimated as being 300 million m³ per annum. Groundwater abstraction requires high investments into surveys and development, and this resource use is therefore expected to show only a limited increase.

Table 14: Abstraction of water from primary sources in 2014/2015 and potential amount, in million m³.

		Abstraction in 2014/15	Potential amount per year
Primary sources			
	Dams in ephemeral rivers	100.0	200.0 (a)
	Perennial rivers	210.0	1,105.0 (a)
Groundwater	Artificial recharge		
	Natural recharge	130.0	300.0
Secondary source			
Recycling			
	Reclaimed Water	12.5	10.0
New Sources			
	Desalinization	26.0	
Total		**478.5**	**1,615.0**

(a) assumes better efficiency by managed transfers

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[123] FAO, Factsheets
[124] The 95% safe yield corresponds to the amount available during 95% of the time.

4.4.2. Physical supply and use accounts

Data on water supply and use were obtained from NamWater and DWA, and are based on correlations of population data, livestock and production data for mines, farms and industries (Table 15). While the supply and use from ephemeral rivers have increased, losses in distribution systems could be reduced since 2001. Losses occur in pipe systems and at distribution points and depend on the quality of the pipe network. The increase of groundwater use has been moderate due to the high cost for development. The use of water from perennial rivers mainly for irrigation has increased significantly.

Since 2001 the amount of desalinized water has increased due to the construction of desalinization plants for mine water supply. At the same time the amount of reclaimed water has increased in the city of Windhoek. 30% of the 21 million m³ used per year are reclaimed. Still, the supply of water has increased from about 276 million m³ in 1990/1991 to more than 435 million m³ in 2015. The projected demand exceeds this figure.

Table 15: Abstraction of water from primary sources from 1997 until 2015, in million m³. The projected data for 2008 (see Table 9) is not displayed.

Supply, use & loss	1997	2001	2015
Dams+Ephemeral rivers (installed capacity)	(100.0)	(100.0)	(100.0)
Supply	83.8	96.6	103.0
Use	71.0	82.9	95.0
Loss	12.8	13.7	7.5
Groundwater (developed capacity)	(150.0)	(150.0)	(165.0)
Supply	112.5	121.8	130.0
Use	96.3	104.7	111.0
Loss	16.2	17.1	15.0
Perennial rivers (abstraction capacity)	(170.0)	(170.0)	(210.0)
Supply	77.0	98.4	170.0
Use	66.2	85.9	89.0
Loss	10.8	12.6	12.5
Reclaimed (recycled capacity)	(7.5)	(7.5)	(12.5)
Supply	2.8	1.3	6.3
Use	2.3	1.2	6.2
Loss	0.5	0.1	0.1
Desalinization			26.0
Total supply	276.1	318.1	435.3
Total use	235.8	274.7	301.2
Total loss	39.8	43.4	35.1
Total	**334.0**	**334.0**	**513.5**

Water demand for urban water use has increased from 65 million m³ in 1997 to 80 million m³ in 2015 due to the ongoing urbanization in Namibia (Table 16), mainly in Windhoek. Rural water demand from self-supplied sources or water schemes operated by RWS is stable at 10-11 million m³. Water use for livestock is likewise stable at 87-89 million m³.[125] At the same time, water use by the biggest consumer, irrigation agriculture, has further increased to 204 million m³ in 2015. Water supply for irrigation used to be mainly from perennial rivers, but the development of irrigation projects in the Fish River Canyon has increased the supply from ephemeral rivers. The increase of water demand by the mining industry could be compensated by the development of desalinization plants.[126] Water use by tourism has increased to 27 million m³ in 2015 and is expected to increase further.

[125] Water for livestock needs to be estimated based on life-stock numbers and figures which may fluctuate wildly.

[126] The Strategic Environmental Assessment for the Erongo Region has clearly pointed to the limited availability of surface and groundwater and resulted in developing an alternative water supply.

Table 16: Use of water in different sectors of the economy since 1997 to 2015, in million m³. The projected data for 2008 (see Table 10) is not displayed.

Year	1997	2001	2015
Urban	65	65	80
Rural	10	10	11
Livestock	87	87	89
Irrigation	135	135	204
Mining	16	16	32
Tourism	19	19	27
Total	**334**	**334**	**443**

# 4.4.3. Institutional framework for water accounting

The implementation of operational water accounting in Namibia requires an institutional setup of ministries, ministerial departments and stakeholders. We will conduct our own institutional analysis to propose a suitable framework below, but we will start by briefly discussing previous work on the institutional framework conducted by Benito et al. (2010). [127]

Previous work:

Benito et al. (2010) describe the institutional arrangement for integrated water resources management in an institutional setup that includes the stakeholders required to prepare available stocks, physical use and flows of water. The setup is organized in three levels: the national level, the basin level and the community level (Figure 24). At the national level, water resources are regulated by MAWF. DWA holds, manages and processes hydrological data (e.g. river flow, groundwater levels) and also keeps records of water rights assigned. The Meteorological Office holds climate data (e.g. rainfall, temperature). NamWater holds information regarding the reservoirs, abstraction and pumping rates, and dams.

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[127] Benito, G., Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., et al. (2010). Management of alluvial aquifers in two southern African ephemeral rivers: implications for IWRM. Water Resources Management, 24(4), 641–667.

Figure 24: Institutional framework for basin water management, reproduced from Benito et al. (2010).
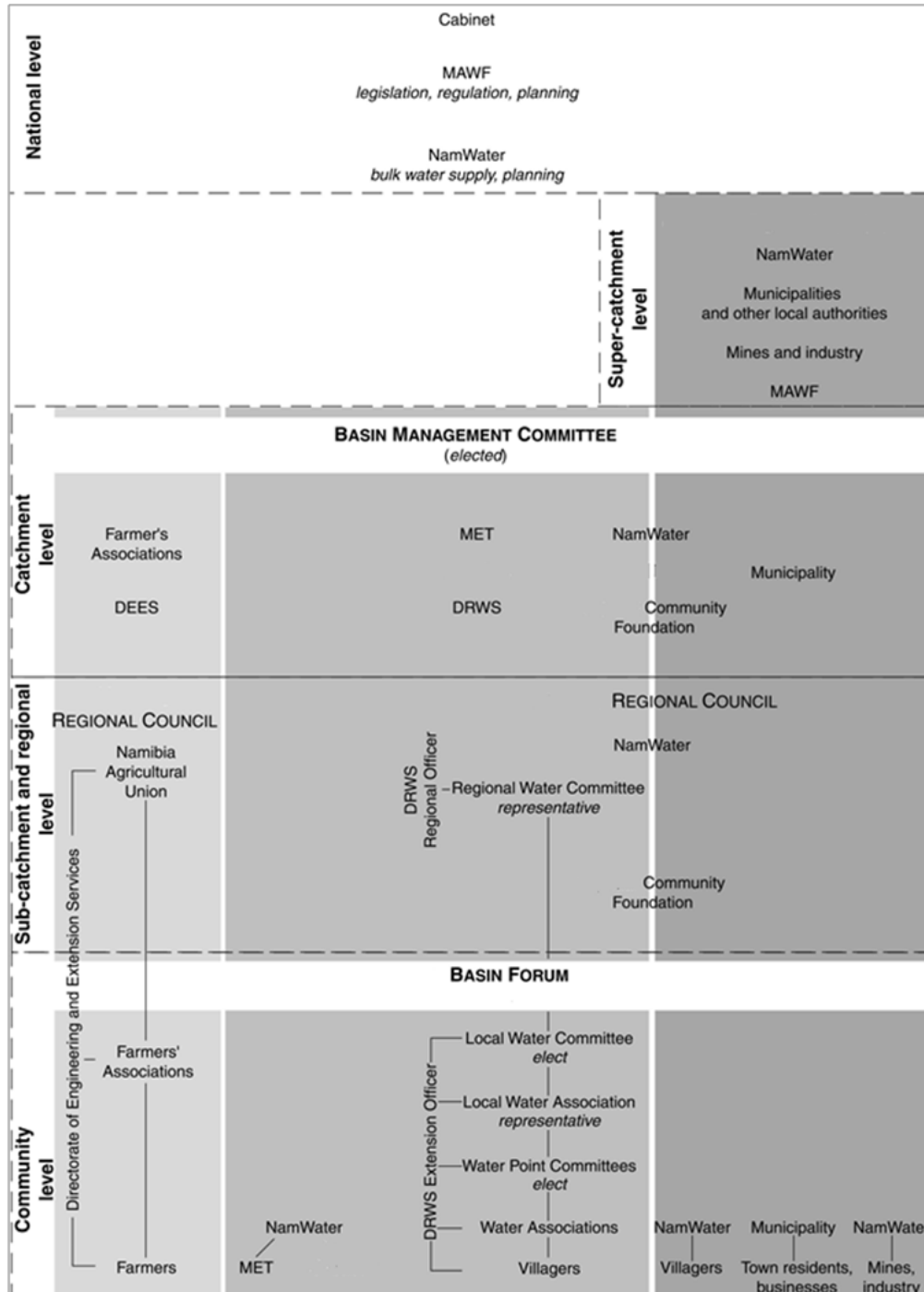
The situation becomes much more complex when the basin and community level are considered: Besides governmental institutions, regional and local councils, interest groups and associations take part in the decision making process concerning the abstraction and use of water. Most importantly in the context of water accounting is that information and data are only insufficiently shared between the three hierarchical levels. For example, NamWater sells water to municipalities but receives no information on the distribution of water to end-users by the municipalities (where record-keeping itself is, in part, sketchy). Drawing on data from the institutions at the national level will thus only allow for general statements on water management and not present a comprehensive and detailed picture.

Finally, the previous institutional framework for integrated water resources management did not consider institutions responsible for economic and statistical aspects. These institutions were not immediately relevant for the issues addressed by Benito et al. (2010).

Expansion of the previous framework:

In order to expand on the above described framework and specifically address data flows and processing, as well as the inclusion of economic and statistical institutions, we conducted an institutional analysis together with experts and stakeholders at a stakeholder participation workshop in 2015 in Windhoek. Figure 25 depicts the proposed institutional framework based on this analysis.

Figure 25: Proposed institutional framework for water accounting developed during the stakeholder involvement workshop in November 2015, Windhoek. Light red rectangles depict institutions, green rectangles depict data sources.
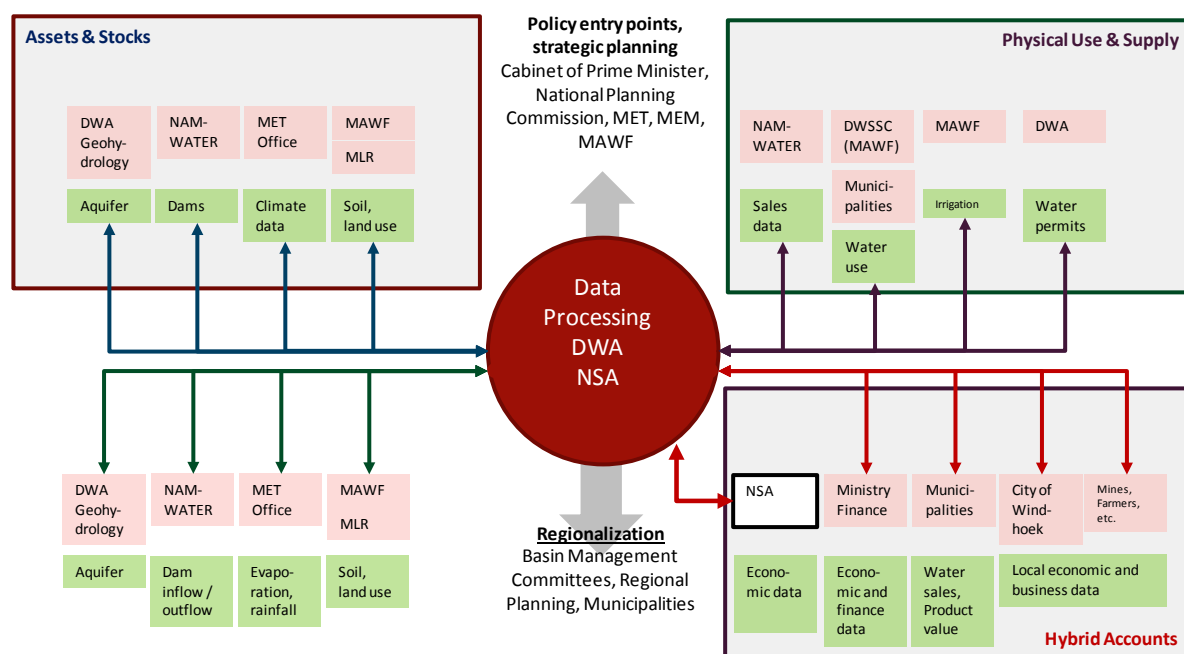
This framework includes the institutions to be involved when preparing water accounts from a physical and economic perspective, and indicates data sources, transfers and processing:

1. Institutions and data are grouped by the four thematic fields corresponding to the main components of water accounts, i.e. i) assets and stocks, ii) flows, iii) physical use and supplies, and iv) hybrid accounts. Double listing is possible, for example if an institution is relevant for providing data to both asset & stock accounts and flow accounts (such as MAWF).

2. Institutions that process data, produce integrated information and coordinate the data and information flow are depicted in the center of the institutional framework. Stakeholders agreed that DWA and Namibia Statistics Agency (NSA) should play a key role in assembling and processing information.

3. All institutions involved need to carry out quality control and pre-processing of their own data as far as possible. Therefore, communication between the data integrating and coordinating institutions (see 2.) and the data contributing institutions (see 1.) is crucial, as indicated by arrows on both ends of the data flows. The coordinating institutions need to specify the format and level of aggregation of data needed for assembling water accounts.

4. Water accounting produces indicators and indices for many institutions. These indicators can be used for strategic planning, reassessment of policies (upward arrow, policy entry points). It is important to note that water accounts can also provide indicators at the basin and sub-basin level for regional planning, better governance for municipalities and even local stakeholders and users (downward arrow, regionalization).

The above proposed framework will be able provide the necessary structures to maintain operational water accounts and expand on the preliminary work on fast-track accounts that was conducted in this report.

4.4.4. Policy entry points

Natural capital accounting in general, and water accounting in specific, may contribute to the successful implementation of various international and Namibian policies. In the following, we list several policy entry points where water accounting may greatly aid implementation:

• The Vision 2030 aims at providing access to safe drinking water to its citizens. Water accounting provides an instrument to reduce pressure on water resources that result from inefficient water allocation. Water accounting also includes a component for waste water flows and returns from the economy. Hidden environmental impacts associated with economic activities (e.g. for mining) can thus be quantified.

• The Vision 2030 is implemented through successive five-year National Development Plans (NDPs). The latest of these is the 4th NDP for the period of 2013 – 2017 which aims at ensuring water security for human consumption and industrial development, through recharging strategic aquifers, recycling and reusing water. It also addresses the management of water demand through water-saving technologies. Water accounting provides a suitable framework for assessing the impact of new technologies on flows from the environment and to the economy.

• Similarly, the Namibian Climate Change Policy stresses the need to develop new technologies. New technologies need to be developed also for the water sector to address climate change issues related to water shortages for agricultural production. Water accounting provides efficient tools to evaluate and assess the impact of introducing new technologies especially in the field of agriculture.

• Namibia's 'Intended Nationally Determined Contributions' (INDC) to address climate change emphasize that climate change adaptation is of prime importance to the country. INDC for Namibia address long lasting floods and droughts that will have impacts on human well-being and developmental growth, which in turn could result in decreases to the country's Gross Domestic Profit (GDP) (GRN, 2015). Water accounting provides efficient indicators for increasing resilience with respect to these natural and economic risks.

• Finally, with respect to the SDGs, water accounting also directly addresses SDG 6.4, i.e. substantially increasing water-use efficiency across all sectors and ensuring sustainable withdrawals and supply of freshwater to address water scarcity. It indirectly supports the goal of implementing integrated water resources management at all levels, including through transboundary cooperation (SDG 6.5). Finally, water accounting offers an instrument and operational method to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes (SDG 6.6).

5

Recommendations and roadmap for implementing NCAs

5 Recommendations and roadmap for implementing NCAs

In this Chapter we derive twelve recommendations (RE) from our feasibility of NCAs and the fast-track development of water accounts. The recommendations may serve as guidelines to facilitate the thorough and sustainable implementation of NCAs in Namibia. Altogether, recommendations can be grouped into three sets:

- ## Inter-institutional cooperation (Chapter 5.1):

NCAs, as proposed here, are based on existing data sources since data collection itself is very costly. This set of recommendations address ownership of respective NCAs, coordinating institutions and inter-institutional agreements.

- ## Development of water accounts and other NCAs (Chapter 5.2):

Beyond the feasibility study and fast-track water accounts in the report, further actions are necessary to develop full NCAs in Namibia. Foreseen activities include transformation of the fast-track water accounts into full accounts as well as development of other NCAs such as land or wildlife. Our recommendations towards these objectives are covered under the second set of recommendations.

- ## Expert positions, capacity building and financing (Chapter 5.3):

Essential for the successful implementation and long-term continuation of NCAs will be the availability of financial and personal resources. Adequate staffing with highly skilled accounting experts will be a major success factor. Important will also be the build-up and training of local capacity and its financing. Our recommendations towards these objectives are covered under the third set of recommendations

The three sets and the altogether twelve individual recommendations are presented for overview in Figure 26a. Furthermore, for an exemplary roadmap for implementing these three sets of recommendations see Figure 26b.

a) List of recommendations

Establishing an inter-institutional cooperation	
RE 1	A regular inter-institutional dialogue should be initiated
RE 2	Ownership of NCAs should be agreed
RE 3	MET should coordinate efforts to implement NCAs until ownership is decided
Development of water accounts and non-water accounts	
RE 4	Fast-track water accounts should be developed to full water accounts
RE 5	Decide rapidly on which non-water accounts shall be developed
RE 6	Utilization of existing structures from the (fast-track) water accounts is key for other NCAs
RE 7	Initiate and maintain good collaboration mode with data owner
RE 8	Accounts should be continued on an easy-to-use software platform
RE 9	Collaboration with neighboring countries should be taken up to benefit from shared experiences
Expert positions, capacity building and financing	
RE 10	At least two expert positions should be cleared for any NCAs
RE 11	Present staff should be continuously trained in the application of NCAs
RE 12	Clarify short/medium/long term funding and fill positions with hired accounting experts

b) Roadmap

Figure 26: Recommendations (top) and roadmap (bottom) for implementing NCAs.
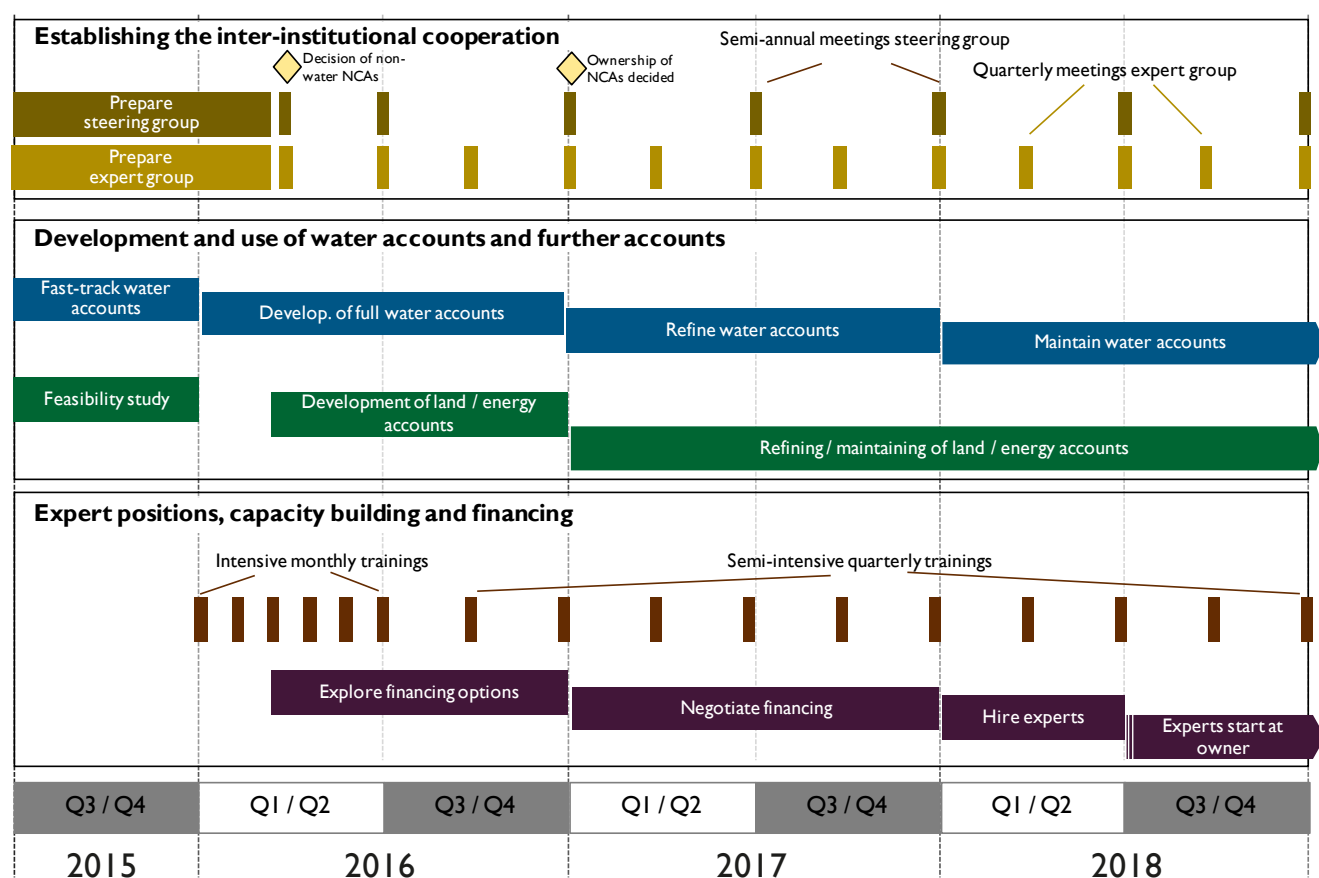
5.1. Establishing an inter-institutional cooperation

This sub-chapter details the first set of recommendations (RE)

RE 1   A regular inter-institutional dialogue should be initiated

Within the diverse landscape of ministerial and non-ministerial institutions, different mandates arise with respect to NCAs. This has been detailed previously in Chapters 3 (feasibility study) and 4 (fast-track water accounts).

No single institution has (yet) the expertise to completely and self-sufficiently develop and maintain NCAs. Therefore, institutions need to cooperate in account development and operational maintenance of it. To this end, we recommend that a regular institutional dialogue should be initiated on two levels:

- A **high-level group of decision makers** that will manage the political dimensions. This will include ownership of accounts (see RE 2), decision making of which non-water NCAs to develop (see RE 5) and agreements on how to organize data flows between institutions (see RE 7). The high-level group should meet at least semi-annually in order to address necessary decisions in due time. Key members are relevant sectoral ministries as well as ministries and institutions that have a mandate for data compilation and planning, such as Namibian Statistics Agency or the National Planning Commission.

- An **expert group** that will deliberate and solve technical issues, such as the accounting structures to be implemented (see RE 6) or the software platform to be used as an accounting tool (see RE 8). As technical issues will, especially in the beginning of account implementation, arise frequently, the expert group should meet at least quarterly – with selected issues being discussed by part of the group at even shorter periods (i.e. monthly). The high-level group of decision makers shall provide for nominations of membership.

In order to draw momentum from the present efforts to implement NCAs in Namibia, these groups should be rapidly initiated and nominations be made – ideally in 2016.

RE 2   Ownership of NCAs should be agreed

A prime question regarding the continuation of NCAs is assigning ownership: i.e. which institution will be responsible for (annually) compiling the NCA in question and overseeing their further development?

In principle, there are three potential options for setting the scope of ownership:

1.   All NCAs at one institution:

   In this option, one institution owns all NCAs that are developed (e.g. water, energy, land etc.). Such an institution should, ideally, be an institution with an overarching mandate, such as the Namibian Statistics Agency or the National Planning Commission.

2.   Each NCA at the most fitting institution:

   In this option, each NCA is owned by the institution that has the predominant expertise for the natural capital in question. For example, water accounts are owned by the Department of Water Affairs at MAWF, or energy accounts by MME.

3.   Sub-NCAs at the most fitting institution:

   Applying predominantly to land accounts, this option entails that natural capital (land) is not wholly owned by one institution, but that subclasses of this capital are owned by different institutions. For example, sub-land accounts such as wildlife accounts and forestry accounts may be owned by MET and MAWF, respectively.

All these three options have their benefits and trade-offs for those institutions that have a stake in NCAs. It is recommendable that ownership is granted to those organizations that can show existing resources and a plan of how these would relate to short/medium/long term co-funding arrangements (see RE 12).

RE 3   MET should coordinate efforts to implement NCAs until ownership is decided

The renewed effort to implement NCAs that is the basis for this report, has been initiated and supported by MET. As such, MET has built up substantial in-house expertise and experiences of coordinating on environmental issues with various other departments or government bodies. Therefore, MET is in the position to (at least temporarily) promote further NCA implementation in Namibia.

To that end, MET should coordinate the set-up of the inter-institutional dialogue described in RE 1 and take on an initial coordinating role if NCAs are owned by different institutions (options 2 and 3 in RE 2). These coordinating role should in due time be handed over to an institutions with a more encompassing mandate for statistics, planning or policy implementation (e.g. NSA or NPC). Furthermore, MET should jump start the development of non-water NCAs where deemed necessary and appropriate. As with hand-over of the coordinating role, once ownership for the jump-started accounts has been decided (see RE 2), these accounts should likewise be handed-over to the respective institutions.

5.2. Development of water accounts and non-water accounts

This sub-chapter details the second set of recommendations:

RE 4   Fast-track water accounts should be developed to full water accounts

The scope of this consultancy with respect to water accounting was the development of fast-track water accounts for ready and easy use. They already contain major components such as physical supply and use tables. However, full-fledged water accounts have a much broader scope. They also include the following components:

- **Water quality accounts**: The quality of water flows from the environment and back to the environment can be evaluated with SEEA-Water and NCAs. Water quality constitutes an important aspect of environmental management in Namibia due to salinization and pollution, especially for agriculture (salinization) and the mining sector but also some for municipalities and some manufacturing branches.

- **Waste water accounts**: Waste water management can be managed based on accounts for waste produced and flows or streams of waste generated by different economic activities. This is very important in relation to municipal waste water and to tailings or other potentially toxic pollutants generated by the mining sector (e.g. in the copper and uranium industries).

Fully-fledged water accounts are much more adequate for presenting a complete picture of water stocks, their use and regeneration in Namibia. Thus, given the motivation for this report (i.e. the present and future water pressure), fully-fledged accounts should be developed.

RE 5   Decide rapidly on which non-water accounts shall be developed

It has been shown that non-water NCAs accounts are both feasible and useful in Namibia (see feasibility study, Chapter 3). Prime candidates for NCAs – based on data availability and usefulness, as detailed in Chapter 3.4 – are land accounts and energy accounts, but development of other NCAs would also provide added-value and may be deemed more appropriate by decision makers.

Precisely this decision – i.e. on what non-water NCAs to pursue – has to be made by decision makers. This decision should be made swiftly because extensive synergies with national planning processes structures and development of water accounting may be realized, including:

- **Development of accounting frameworks**: As mentioned below (see RE 6), different NCAs benefit greatly from developing a unifying framework tailored to the needs of Namibia.

- **Momentum for using accounts**: The aim of NCAs is to provide information for planning processes and decision making. We believe that visibility and contribution of NCAs can be greatly enhanced, if multiple accounts (such as water, energy, etc.) are all generated at the same time using a consistent accounting system.

- **Capacity building**: An introductory training on water accounts has already been provided by us on 11 / 12 November 2015, and a more formal training needs to be provided in the course of further development of these accounts (see RE 11). If non-water NCAs are also developed, trainings for both accounts types may easily be integrated.

As already mentioned above, the institution to make the decision will be the high-level group (RE 1).

RE 6   Utilization of existing structures from the (fast-track) water accounts is key for other NCAs

The fast-track water accounts can form a useful basis for other accounts, because the conceptual framework may readily be applied to natural capitals other than water. For the possibility that other NCAs may be developed in the near future

(see RE 5), any further development of water accounts (or other NCAs for that matter) should explicitly consider the development of a unifying framework with generic components and processes.

As such, NCAs should contain as many generic components and processes as possible. This specifically includes the following:

- NCAs should be developed on a routine and operational basis and not on a project basis. NCAs should be developed from available data sources and monitoring structures by streamlining data flows and data processing of available data.

- Data pre-processing should be done by the agencies that collects the data. For example, hydrological data should be processed by the Department of Water Affairs.

- Collection of economic and hydrological data should consider the data needs of NCAs. Existing data processing programs should be modified in such a way as to generate data for NCAs on a routine basis.

RE 7   Initiate and maintain good collaboration mode with data owner

The proposed framework for NCAs is based on the notion that these accounts can be constructed on the basis of existing data sources.[128] Our results reveal that suitable data exist for most natural capitals, but that data is typically distributed across different institutions or project bodies (see Table 18, p. 89) – with respect to water, for example, at NamWater, MAWF, Meteorological Service and municipalities. It will be essential that any institutions that owns a given NCA collaborate closely with these data providing institutions.

These data providing institutions fall into four categories:

- Institutions that provide **physical information** on stocks, supply and use of the natural capital in question. In the case of water accounts this includes NamWater that may supply bulk water information and the Meteorological Service that may provide rainfall information.

- nstitutions that provide **economic information** related to the natural capital in question. Economic information includes price data of the natural capital in question – for example, tariffs in the case of water which may be supplied by NamWater and municipalities.

- NSA that provides a **mapping of individual businesses to ISIC codes** in order to allow the disaggregation of accounting information by industries. [129]

- Project based data that are generated by multi-year research or implementation projects in Namibia. These are often funded by bilateral donor organizations, research funds, development bank and others. Such projects often generate extensive and long data series which may have applications for NCAs.

The above mentioned Table 18 can serve as a guideline on which institutions may provide what data. However, a more- in-depths analysis on data requirements and sources is necessary in order to identify the necessary collaboration agreements. For water accounting we provided such an analysis with the work flow diagram which was developed by experts in the course of our training on 11/12 November 2015. Similar work flow diagrams should be developed for each individual NCA in question.

Finally, we emphasize that the responsibility for post-processing and data quality activities should lie in the responsibility with of the data owner. This will considerably reduce processing mistakes arising from experts at the account owning institution who are less familiar with the underlying data sources as compared to experts at the data providing institution. As such, data should be provided to the account owner in a ready-to-use form.

RE 8   Accounts should be continued on an easy-to-use software platform

The present consultancy implemented the fast-track water accounts in Excel. For the limited scope of these fast-track accounts – e.g. no pollution of trans-national accounting tables – Excel is a suitable software platform. However, once accounts become more complex and require increasing cross-referencing between different account tables and increasing data imports, Excel is no longer suitable. Thus, in order to use complex accounts, alternative software platforms should be implemented.

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[128] We note here, that the data collection and processing itself is prohibitively expensive. As such, a new collection process in the context of account development should only be initiated if absolutely necessary.

[129] Similarly, NSA coordinates the Namibia National Spatial Data Infrastructure which may provide further added-benefit for provision of data.

We recommend the investigation of the following options:

- Microsoft Access.

- Weap – Water Evaluation and Planning System.

- Geographic Information System based on the agreements of the Namibia National Spatial Data Infrastructure.

- Data-processing based on existing database platforms in the different institutions e.g. DWA.

Features of these software platforms that have to be considered relate to integration, data formats, price and complexity. Alongside the training and capacity building requirements, preferable platforms should require only limited training (several days) in order to use all functions necessary to manage accounts.

RE 9   Collaboration with neighboring countries should be taken up to benefit from shared experiences

As Chapter 2.3 shows, several other countries in Southern Africa are actively implementing NCAs and are, in part, already operating accounts for a variety of natural capitals. Namibia may benefit greatly from transfer of knowledge and best practice information. Thus, collaborations with the relevant institutions of neighboring countries should be initiated and a community of practice be established.

More specifically, collaborations provide knowledge and best practice information with respect to:

- Tailoring accounts to specific local conditions in Southern Africa such as land issues (bush encroachment) and climate issues (semi-aridity).

- Aligning goals of NCAs with regional visions and strategies such as the Gaborone Declaration.

- Integrating accounts into planning processes by also taking on the learning of neighboring countries. For example, in Botswana, Natural Capital Accounting will be incorporated into NDP11 – which is scheduled to be commenced in April 2017 – as a tool to inform Botswana's strategies on climate change adaptation, poverty alleviation and post-2015 development goals.

Such collaboration may be initiated by directly approaching relevant institutions in neighboring countries. Alternatively, the WAVES program – which initiated NCA activities in several of the mentioned countries – may act as a bridge builder to establish contacts, and may provide additional expertise from non-African member countries.

5.3. Expert positions, capacity building and financing

This sub-chapter details the third set of recommendations:

RE 10   At least two expert positions should be cleared for any NCAs

Maintaining NCA on a year-to-year basis is a responsible job requiring skilled personnel that is motivated to build-up accounts and indicators that are highly relevant for the future planning processes of Namibia. We recommend that two expert positions, if not already existing, should be created for each NCA.[130]

The operational tasks of these experts will include:

- Relationship management, liaison and interface management with data owners regarding data provision, data quality and data transfer.

- Data import, processing and data quality assurance.

- Compiling account tables.

- Analyzing and interpreting account tables.

- Compiling (annual) reports and – if requested – ad hoc information from accounts.

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[130] The natural capitals – water, fisheries, land & ecosystems and energy & minerals – we cover in this report are quite different in scope and thus also require a different amount of experts to maintain them.

- Continuously developing accounts to uptake methodological and scientific advances of the underlying SEEA framework.

- Relationship management and interface with end users to satisfy their expectations and deliver adequate results.

These operational tasks will require a subject matter understanding of the NCA in question. Matching natural resources background on wildlife or water or energy together with general accounting is highly desired. Once candidates are identified and assigned to the posts, it is vital to continuously train and further develop their capacity.

RE 11 Present staff should be continuously trained in the application of NCAs

During the course of our consultancy, we provided an introductory training to present staff of various ministries – including the MET and the Department of Water Affairs of MAWF – on water accounting on 11 / 12 November 2015. This training covered the structure of the account and utilization of its basic tables (i.e. stock, flow and hybrid tables). However, in order to ensure that staff operating the accounts will have sufficient expertise, more in-depth training should be provided that covers the complete scope of NCAs in question as well as practical guidelines for account operation.

Such a training should include all staff assigned to operate water accounts and non-water NCAs. To ensure a continuous learning process and incorporate current developments in accounting – for example, best practice experience from neighboring countries or improvements in the underlying SEEA framework by the UN – it should be held at least quarterly until accounts are firmly embedded into the respective institutions in 2018. In addition, intensive training "bursts" should be held monthly at the beginning of account implementation in 2016.

With regards to training institutions, several alternatives exist:

- UNESCO training program in Namibia.

- World Bank regional training program.

- Joint training program by Namibian practitioners and higher education facilities.

The above mentioned training programs are non-exclusive and different (parts of) trainings may be combined to achieve optimal training effects.

Finally, if hiring of new staff in significant number is an issue (see RE 10), one may also consider to formally integrate training into higher education curricular in Namibia as one or two course components. This will provide a cost-effective alternative to hiring (costly) experienced accounting experts.

RE 12 Clarify short/medium/long term funding and fill positions with hired accounting experts

As recommended above, new accounting experts may need to be hired (see RE 10). In most cases, funds for such hires are not planned into ministerial budgets for the upcoming budgeting period. In order to jump-start the NCA implementation, temporary external financing should be secured.

Financing should cover the initial period of account operation from 2017 onwards for a period of roughly two to three years. This will provide ample time for the owning institution to secure budgets for the expert positions in questions. After the temporary financing period, expert positions should then continuously be financed by the owning institution. Financing may come from a variety of sources, including Namibian institutions or international organizations like the World Bank or the European Union.[131]

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[131] We recommend to take on the learnings from previous forest inventories with regard to skill retention and continuity as a success factor. Under the forest inventory there had been substantial capacity building and successful recruiting of highly skilled and talented professionals. However, when funding for the forest accounts dried up and without a long-term and attractive perspective available, key staff could not be retained.

6

Conclusion

6 Conclusion and next steps

In this report, we analyzed the feasibility of natural capital accounting (NCA) in Namibia, developed fast-track water accounts and presented an overview on the training to build capacity around natural capital accounting. We identified 12 recommendations to further facilitate NCA implementation which can be grouped into three sets:

- inter-institutional cooperation,
- (further) development of water accounts and other NCAs, and
- expert positions, capacity building and financing.

Based on these recommendations we propose the following next steps for further activities:

- Initiate the inter-institution dialogue.

- Successful national capital accounting in Namibia requires good collaboration of a number of different institutions. We conclude that this dialogue should be initiated swiftly in order to make necessary political decisions and to define the (data) work flow between institutions. We are confident that this will rapidly enable operational development and maintenance of accounts. We see the involvement of key institutions for planning and statistics – especially the NPC and NSA – being equally vital in order to generate sufficient momentum and coverage for accounts.

- Clarify ownership of water accounts.

- To date, fast-track water accounts have become operational and available through this consultancy. It is now imperative to decide on the ownership of these accounts. This will greatly aid the upcoming development of these accounts, information flows between involved institutions and training of staff.

- Clarify whether and what non-water NCAs should be pursued.

  Simultaneous development of different NCAs can generate extensive synergies, e.g. by creating common frameworks or by jointly achieving capacity building over different NCAs. We recommend to swiftly clarify amongst involved stakeholders whether further NCAs should be developed, and if yes, which of them should be developed.

Following these steps will set the NCA implementation process in motion and will, in concert with the roadmap (see Figure 26), contribute to a successful and long-term utilization of NCAs in Namibia.

Appendix A: List of interview partners

Table 17: List of interview partners. Three interview partners were interviewed twice.

Nr	Organisation	Organizsation type	Contact person	Position	Positon type	Account type
1	Ministry of Lands Reform	Ministry	I. Mwanyekange	Chief Land Use Planner	Management	Land
2	Ministry of Agriculture, Water and Fisheries; Department of Water Affairs	Ministry	Christoph Munikasu	Chief Development Planner	Data specialist	Water
3	Namwater	Private Sector	Andre Mostert	Hydrology Manager	Management	Water
4	Namwater	Private Sector	Ndapewa Hatutale	GIS Specialist - Planning and Investigation	Data specialist	Water
5	Namwater	Private Sector	Godfrey Pazvakawambwa	Chief Development Planner	Data specialist	Water
6	MET	Ministry	Konrad Übelhör, Nadine Faschina	Programm Leader, Project Leader	Management	various
7	Namibia Nature Foundation	NGO / Intern. Organisation	Angus Middleton	Executive Director	Management	various
8	Ministry of Lands Reform	Ministry	Martina Römer, Ullrich Scheffler	Programme Coordinator, CIM-Expert	Management	Land
9	Ministry of Lands Reform	Ministry	Rachel Munyakati	Data specialist	Data specialist	Land
10	Ministry of Finance	Ministry	Amy Tjiho	Economist: Directorate of Economic Policy Advisory Services	Management	various
11	Namibia Statistics Agency	Ministry	C Kondiri	GIS Analyst	Data specialist	various
12	Namibia Statistics Agency	Ministry	Mr. Ngahahe	GIS Analyst	Data specialist	various
13	Namibia Statistics Agency	Ministry	Titus Kamatuka	Senior Statistician: National Accounts	Data specialist	various
14	SAIEA	Private Sector	Peter Tarr, John Pallett	Executive Director, Manager	Management	various
15	MET, Directorate of Tourism and Gaming	Ministry	Abner Nambahu	Data specialist	Data specialist	Land (Tourism)
16	Namibia Tourism Board	Private Sector	Benedict Dundee	Manager Research and Intelligence	Management	Land (Tourism)
17	Namibia Agricultural Union	Interest Group	Harald Marggraff	Manager: Commodities	Management	Land
18	MAWF - De-Bushing Vorhaben	NGO / Intern. Organisation	Frank Gschwender	Project leader	Management	Land
19	Namibia Agricultural Union	Interest Group	Roelie Venter	CEO, Manager: Commodities	Management	Land
20	Bundesantstalt für Geowissenschaften, Department of Water Affairs and Forestry	Research	Martin Quinger, Christoph Lohe	Project Manager, DWAF-BGR project "Groundwater Management in the CEB"	Data specialist	Water
21	Department of Water Affairs	Ministry	Maria Amakali	Director	Management	Water
22	Department of Water Affairs	Ministry	Geraldine Diergardt	Data manager	Data specialist	Water
23	Desert Research Foundation	NGO / Intern. Organisation	Martin Schneider	Director, Researcher Water Desk	Management	various
24	Desert Research Foundation	NGO / Intern. Organisation	Olla Aldrich	Expert on Water	Data specialist	various

Nr	Organisation	Organizsation type	Contact person	Position	Positon type	Account type
25	Ministry of Fisheries and Marine Resources	Ministry	Johannes Holtzhausen	Researcher	Management	Fisheries
26	Hydro-Met	Ministry	Jennifer Moetie	Control Meterological Technician	Data specialist	Water
27	MAWF, Veterinary Services	Ministry	Alec Bishi	Senior Officer	Data specialist	Land
28	MET, DEA		Lawrie Harper-Simmonds	External Expert	Data specialist	Land
29	Namwater	Private Sector	Cornwell Chadya	General Manager: Finance & Asset Management	Management	Water
30	SASSCAL	NGO / Intern. Organisation	Henry Mwima	Executive Director	Management	various
31	SASSCAL	NGO / Intern. Organisation	Peter Erb	National Director	Management	various
32	SASSCAL	NGO / Intern. Organisation	Christoph Schumann	Director of Fundraising	Management	various
33	World Wide Fund for Nature	NGO / Intern. Organisation	Chris Weaver	Managing Director, Namibia Program	Management	various
34	World Wide Fund for Nature	NGO / Intern. Organisation	Greg Stewart-Hill		Data specialist	Land / various
35	PwC	Private Sector	Talita Horn	Director	Management	various
36	Polytechnic of Namibia	Research	Samuel John	Dean	Management	various
37	National Planning Commission	Ministry	Sylvester Kamwi	Chief National Development Advisor	Management	various
38	National Planning Commission	Ministry	Manongwa T Sikanda	Assistant Deputy Chief: National Development Advisor (Office of the President)	Management	various
39	National Botanical Research Institute of Namibia	Research	Esmerialda Strauss	Head of the NBRI	Management	various
40	MET	Ministry	Kauna Schroder	MET DEA Commissioner	Management	various
41	Ministry of Urban and Rural Development	Ministry	Sunny Shuuya	Chief Land Use Planner	Management	Water / various
42	Ministry of Finance	Ministry	Albertina-Taina Nankela	Director Budget Management and Control State Accounts	Management	various

Nr	Organisation	Organizsation type	Contact person	Position	Positon type	Account type
43	NamWater / University of Cologne	Research	Sebastian Tonke	PhD student	Data specialist	Water
44	Ministry of Energy and Mines	Ministry	Norwel Mwananawa		Management	Minerals / Water
45	Ministry of Energy and Mines, Geological Survey Department	Ministry	Kombada Mhopjeni	Chief Geologist	Data specialist	Minerals / Water
46	Meat Board of Namibia	Private Sector	Mr. Goliath Tujendapi	Manager: Trade & Strategic Marketing	Management	Land
47	Namibia Chamber of Mines	Private Sector	Lauren Davidson	Economist	Management	Minerals / Water
48	Namibia Chamber of Mines	Private Sector	Veston Malango	CEO	Management	Minerals / Water
49	Polytechnic of Namibia, Department of Land Management	Research	Marina Coetzee	Senior Lecturer	Data specialist	Land
50	Agra Co-operative Ltd.	Private Sector	Pauline Lindeque	Manager: Consultancy, Research & Technology	Data specialist	Land
51	World Bank / WAVES partnership	NGO / Intern. Organisation	Glenn-Marie Lange	Sr. Environmental Economist	Management	various
52	Agronomic Board	Interest Group	Christof Brock	CEO	Data specialist	Land
53	Private Consultant	Research	Roel Slootweg	Consultant	Management	various
54	Ministry of Energy and Mines	Ministry	Nico Snyders	Chief Energy Researcher	Data specialist	Energy
55	Namibia Agricultural Union	Interest Group	Harald Marggraff	Manager: Commodities	Management	Land
56	MET, Department of Scientific Affairs	Ministry	Kenneth Uiseb	Deputy Director: Monitoring Research and Planning	Management	Land (Wildlife)
57	MET, Department of Scientific Affairs	Ministry	Helmut Tjikurunda	Researcher	Data specialist	Land (Wildlife)
58	NamPower	Private Sector	Reiner Jagau	CEO: Power System Development	Management	Energy
59	NamPower	Private Sector	Margaret Mutschler	Head of Renewables	Management	Energy
60	MET, Directorate Forstry	Ministry	Joseph Hailwa	Director of Forestry	Management	Land (Forestry)
61	MET, Directorate Forstry	Ministry	Vincent Louw	Deputy Director of Forestry Research	Data specialist	Land (Forestry)
62	Desert Research Foundation	NGO / Intern. Organisation	Martin Schneider	Director, Researcher Water Desk	Management	various
63	Electricity Control Board	Ministry	Charity Nsofu	Senior Engineer: Quality of Supply	Management	Energy
64	Agricultural Trade Forum	Interest Group	Jürgen Hoffmann	Special advisor / Trade Advisor	Management	various
65	Agra Co-operative Ltd.	Private Sector	Pauline Lindeque	Manager: Consultancy, Research & Technology	Data specialist	Land
66	Ministry of Energy and Mines, Geological Survey Department	Ministry	Gabi Schneider	Director	Management	Minerals / Water

Appendix B: List of data sources

Table 18: List of data sources available in Namibia for compilation of NCA and their quality. Data quality with regard to whether 1) data is comprehensive, 2) data is collected annually, and 3) data is available quickly after collection (with two years). Based on the performance of data sources in these three dimensions, an overall data quality is assessed. Abbrevations: E & M – energy and mines

Nr.	Main account	Sub account	Data category	Short description	Custodian of data	(Spatially) comprehensive	Collected annually	Available quickly	Assessment of data
F.01	Fisheries		Weather / climate data	Martitime weather and climate data (e.g. sea surface termperature) along the coast	MFMR	selected areas	yes	yes	high
F.02	Fisheries		Physical data	Maritime physical data (e.g. oxygen concentration, upwelling) in Walvis Bay and Lüderitz	MFMR	selected areas	yes	yes	high
F.03	Fisheries		Primary production	Concentration of phytoplankton along the coast (proxy: chlorophyll-a concentration)	MFMR	yes	yes	yes	high
F.04	Fisheries		Secondary production	Concentration of copepods at Walvis Bay and Dune Point	MFMR	selected areas	yes	yes	high
F.05	Fisheries		Stock census	Census of main commercial stocks	MFMR	yes	yes	yes	high
F.06	Fisheries		Landings of fish / seafood	Landings for main commercial species (e.g. horse mackerel, hake, pilchard)	MFMR	yes	yes	yes	high
F.07	Fisheries		Catch values	Landed, processed and exported value	MFMR, NSA	yes	yes	yes	high
F.08	Fisheries		Revenues from fees	Revenues from quota, licenses and by-catch fees; levy from the Marine Resource Fund	MFMR	yes	yes	yes	high
F.09	Fisheries		Inland fisheries	Census, landing and values data for inland fish	MFMR	no	no	no	low
L.01	Land	Land & forestry	Land area	Area of land used for farm land, national parks, urban area, infrastructure etc.	MLR (Deeds Office)	yes	N / A	N / A	high
L.02	Land	Land & forestry	Bush cover	Area of land covered by bush	MET	no	no	yes	low
L.03	Land	Land & forestry	Area of forest	Area covered by forest	MAWF (Directorate of Forestry)	yes	no	no	moderate
L.04	Land	Land & forestry	Forest off-take for fuel	Annual use of forest for fuel, by region	MAWF (Directorate of Forestry)	no	no	no	low
L.05	Land	Land & forestry	Forest off-take for poles	Annual use of forest for poles, by region	MAWF (Directorate of Forestry)	no	no	no	low

Nr.	Account Main account	Account Sub account	Data category	Short description	Custodian of data	Data is... (Spatially) comprehensive	Data is... Collected annually	Data is... Available quickly	Assessment of data
L.06	Land	Land & forestry	Forest off-take for saw timber	Annual use of forest for saw timber, by region	MAWF (Directorate of Forestry)	no	no	no	low
L.07	Land	Agriculture	Price of land	Annual sales of farm land	MLR (Deeds' Office)	yes	yes	yes	high
L.08	Land	Agriculture	Livestock area	Area used for livestock farming	Agra / University of Lüneburg	yes	N / A	N / A	high
L.09	Land	Agriculture	Livestock numbers	Annual livestock census for large and small stock, collected for a sample of farms	MAWF (Veterinary Services)	yes	yes	yes	high
L.10	Land	Agriculture	Livestock off-take for live sales	Annual livestock off-take for live sales or meat production	Agra / other auction companies	yes	yes	yes	high
L.11	Land	Agriculture	Prices of live livestock	Daily quantity and prices of live sales of cattle / sheep sold at auctions	Agra / other auction companies	yes	yes	yes	high
L.12	Land	Agriculture	Livestock off-take for meat	Annual livestock delivered to slaughterhouses	MeatCo / other slaughterhouses	yes	yes	yes	high
L.13	Land	Agriculture	Price of livestock meat	Annual quantity and prices of livestock meat	MeatBoard	yes	yes	yes	high
L.14	Land	Agriculture	Export of livestock meat	Monthly quantity and prices of livestock sold abroad	MeatBoard	yes	yes	yes	high
L.15	Land	Agriculture	Crop area	Area used for crop farming	Agronomic Board	yes	yes	yes	high
L.16	Land	Agriculture	Crop off-take	Annual crop production in terms of off-take	Agronomic Board	yes	yes	yes	high
L.17	Land	Agriculture	Price for corps	Annual quantity and prices for crop sales	Agronomic board	yes	yes	yes	high
L.18	Land	Wildlife	Game numbers	Annual census data for game	MET (Scientific Services)	no	no	yes	low
L.19	Land	Wildlife	Game offtake for meat	Number of game shot from hunting licences	MET (Scientific Services)	yes	yes	yes	high
L.20	Land	Wildlife	Price of game meat	Quantity and prices of game meat from hunting	MET (Scientific Services)	no	no	no	low
L.21	Land	Wildlife	Game offtake for live sales	Daily quantity and prices of live sales of game sold at auctions	Agra / other auction companies	yes	yes	yes	high
L.22	Land	Wildlife	Price of live game	Daily quantity and prices of live sales of game sold at auctions	Agra / other auction companies	yes	yes	yes	high
L.23	Land	Wildlife	Number of tourists	Bi-annual visitors to Namibia	Namibia Tourism Board	yes	no - biannually	yes	high

| Nr. | Account | | Data category | Short description | Custodian of data | Data is ... | | | Assessment of data |
	Main account	Sub account				(Spatially) comprehensive	Collected annually	Available quickly	
L.24	Land	Wildlife	Tourism revenues	Bi-annual tourism spendings on hunting, guest farms and national park visits	Namibia Tourism Board	yes	no - biannually	yes	high
W.01	Water		Map and volume of groundwater	Digital map of groundwater acquifers, volume of the acquifers	MAWF (Dept. of Water Affairs), MME	interpolation	no	no	high
W.02	Water		Map of rivers	Digital river map, shape-files	MAWF (Dept. of Water Affairs)	yes	yes	yes	high
W.03	Water		Map of basins	Digital basin map of Namibia with national basins according to Namibian Water law	MAWF (Dept. of Water Affairs)	yes	yes	yes	high
W.04	Water		Map of dams	Digital map of dams in Namibia, shape files	NamWater	yes	yes	yes	high
W.05	Water		Map on rural water supply abstraction points and community wells	Digital Map on rural water supply abstraction points and community wells, shape-file	MURD	no	yes/RWS	no	low
W.06	Water		Map of access to drinking water	Digital map of access to drinking water, shape-file	MURD	no	no	no	low
W.07	Water		Volume of dams	Monthly data on volume and stage volume relationship for dams	NamWater	yes	monthly	yes	high
W.08	Water		Rainfall	Daily rainfall data for all available station in Namibia, 2005-present	Hydro-MET	interpolation	monthly	in general	high
W.09	Water		Evaporation	Monthly data on temperature, wind humidity, solar radiation, global radiation; for all stations, 2005-present	Hydro-MET	interpolation	monthly	in general	high
W.10	Water		Discharge and run-off	Monthly discharge series, including station map of hydrological monitoring data	MAWF (Dept. of Water Affairs)	no	yes	no	low
W.11	Water		Run-off coefficient map	Digital runoff coefficient map of Namibia	MAWF (Dept. of Water Affairs)	yes	no	no	low
W.12	Water		Borehole Data	Borehole data of a National Groundwater Monitoring Network giving some key information on major aquifers	MME (Geological Survey Department)	no	yes	no	low
W.13	Water		Active mines	Active Mine licences and type of their production (metal and process e.g. heap leaching)	MME (Geological Survey Department)	yes	yes	yes	low

| Nr. | Account | | Data category | Short description | Custodian of data | Data is … | | | Assessment of data |
	Main account	Sub account				(Spatially) comprehensive	Collected annually	Available quickly	
W.14	Water		Water abstraction by mining industry	Monthly water abstracted by mining industry for mining	Chamber of Mines	no	yes	no	high
W.15	Water		Inter-basin bulk water supply	Monthly data on bulk supply between basins	NamWater	no	no	no	low
W.16	Water		Bulk water supply	Monthly bulk water supply to municipalities and to individual customers outside municipalities	NamWater	no	yes	no	low
W.17	Water		Water supply to industries / household in Windhoek	Monthly water supply to industries / household by municipalities	Municipalities	no	yes	no	low
W.18	Water		Tariffs for bulk water supply	Monthly tariffs for bulk water supply for all municipalities and rural customers	NamWater	yes	yes	yes	high
W.19	Water		Water pollution	Water pollution in major basins and rivers	MAWF (Dept. of Water Affairs)	no	no	no	low
E.01	E & M	Energy	Electricity generation from conventional sources	Generation capacity and annual generation from conventional sources (incl. hydropower)	NamPower	yes	yes	yes	high
E.02	E & M	Energy	Electricity generation from renewable sources	Generation capacity and annual generation from renewable sources (solar, wind)	NamPower	yes	yes	yes	high
E.03	E & M	Energy	Electricity consumption	Annual consumption of electricity (domestic, commercial, industrial)	ECB, REDs, municipalities	yes	yes	yes	high
E.04	E & M	Energy	Electricity prices	Annual prices / tariffs of electricity	ECB, REDs, municipalities	yes	yes	yes	high
E.05	E & M	Minerals	Output / prices of diamonds	Output of diamonds and their (aggregated) value	Chamber of Mines	yes	yes	yes	high
E.06	E & M	Minerals	Output / prices of uranium	Output of diamonds and their (aggregated) value	Chamber of Mines	yes	yes	yes	high
E.07	E & M	Minerals	Output / prices of metal ore	Output of diamonds and their (aggregated) value	Chamber of Mines	yes	yes	yes	high

Appendix C: List of data files attached to this report

The following files accompany this inception report and serve as appendices:

1. List of decision makers and experts who were interviewed, in Excel

2. List of data sources relevant for constructing NCAs, in Excel

3. Fast track water accounts and respective data, various data formats

    Account tables in Excel

    Climate and physical data from the Atlas of Namibia

    Ground and surface water data from the Department of Water Affairs

    Geological data from the Geological Survey Department

    Hydrological data from Namibia Meteorological Service

    Various Maps

4. Information of the stakeholder workshop (program, presentation, summary, stakeholder assessment of priority areas), various data formats

5. Background literature, various data formats