climate change counts

STRENGTHENING UNIVERSITY CONTRIBUTIONS TO CLIMATE COMPATIBLE DEVELOPMENT IN SOUTHERN AFRICA

Namibia Country Report

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SARUA CLIMATE CHANGE COUNTS MAPPING STUDY

VOLUME 2 COUNTRY REPORT 6 2014

STRENGTHENING UNIVERSITY CONTRIBUTIONS TO CLIMATE COMPATIBLE DEVELOPMENT IN SOUTHERN AFRICA

Namibia Country Report

Series Editor: Piyushi Kotecha

Authors: Heila Lotz-Sisitka and Penny Urquhart

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Note

This is the Namibia Country Report of the Southern African Regional Universities Association (SARUA) ***Climate Change Counts*** *mapping study. It brings together background documentation on climate change in Namibia, insights into knowledge and research needs and capacity gaps (individual and institutional), a mapping of existing university roles and contributions to climate compatible development (CCD); as well as a discussion on possibilities for CCD learning pathways and future collaborative knowledge co-production and use in Namibia.*

This report is one of a set of 12 Country Reports in Volume 2, which inform Volume 1: the integrated regional Knowledge Co-production Framework of the ***Climate Change Counts*** *mapping study, and which includes comparative regional analysis using the outputs of the other SADC countries, as well as the proposed regional framework for collaborative research on climate compatible development.*

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SARUA is a not-for-profit leadership association of the heads of the public universities in the 15 countries of the SADC region. Its mission is to promote, strengthen and increase higher education, research and innovation through expanded inter-institutional collaboration and capacity-building initiatives throughout the region. It promotes universities as major contributors towards building knowledge economies, national and regional socio-economic and cultural development, and for the eradication of poverty.

The authors are responsible for the choice and the presentation of the facts contained in this document and for the opinions expressed therein, which are not necessarily those of SARUA and do not make any commitment for the Association.

*The **Climate Change Counts** mapping study is the inception phase of the SARUA Programme for Climate Change Capacity Development. The mapping study was made possible through the professional, financial and in-kind support of multiple partners. The principal study sponsor was the Climate and Development Knowledge Network (CDKN).*

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Acronyms

AAP NAM	African Adaptation Project Namibia
AMESD	Africa Monitoring of the Environment for Sustainable Development
BID	Background Information Document
CBO	Community Based Organisation
CCAM	Conformal-Cubic Atmospheric Model
CCD	Climate compatible development
CCS&AP	Climate Change Strategy and Action Plan
CCU	Climate Change Unit
CDKN	Climate and Development Knowledge Network
CDM	Clean Development Mechanisms
CETN	Conservation and Environment Trust of Namibia
CGCMs	Coupled Global Climate Models
CSA	Consulting Services Africa
CSIR	Council for Scientific and Industrial Research
DfID	UK Department for International Development
DRFN	Desert Research Foundation of Namibia
EMS	Environmental Management Systems
EWS	Early Warning System
FANR	Faculty of Agriculture and Natural Resources
FFEWS	Famine and Flood Early Warning System
GCF	Green Climate Fund
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GIS	Geographical Information Systems
GRN	Government of the Republic of Namibia
HEI	Higher Education Institution
HEMA	Higher Education Management Africa consortium
I&FF	Investment and Financial Flows
IDRC	International Development Research Centre
IECN	Integrated Environmental Consultants Namibia
ITEM	Innovative Technology for Enhancement of Production Systems and Management of the Environment
LTER	Long Term Ecological Research Network
MEAs	Multilateral Environmental Agreements
MET	Ministry of Environment and Tourism
MME	Ministry of Mining and Energy
MRC	Multidisciplinary Research Centre
NACSO	Namibian Association of CBNRM Support Organisations
NaEON	Namibian Environmental Observation Network
NAMREP	Namibian Renewable Energy Programme
NAPAs	National Adaptation Strategies

NCCC	National Climate Change Committee
NCCP	National Climate Change Policy
NCHE	National Council for Higher Education
NDP4	Namibia's Fourth National Development Plan
NEEN	Namibian Environmental Education Network
NEEP	Namibia Energy Efficiency Programme
NGO	Non-Governmental Organisation
NIEs	National Implementing Entities
NNF	Namibia Nature Foundation
NQA	Namibian Quality Authority
NTFPs	Non Timber Forest Products
RAEIN-Africa	Regional Agricultural and Environmental Initiatives Network – Africa
RETs	Renewable Energy Technologies
RIBBB-SA	Regulatory Innovation: breaking biosafety boundaries in southern Africa
RS&T	Research, Science and Technology
SADC	Southern African Development Community
SADC REEP	Southern African Development Community Regional Environmental Education Programme
SARUA	Southern African Regional Universities Association
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Use
SNC	Second National Communication
UNAM	University of Namibia
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change

1 INTRODUCTION

1.1 Regional climate risks and university leadership for climate compatible development in southern Africa

Globally, southern Africa is one of the regions most vulnerable to the impacts of climate change. Current climate variability and vulnerability to extreme events such as floods and droughts is high, and a range of existing stressors, including water availability, land degradation, desertification and loss of biodiversity constrain food security and development. Reduction of the region's structural poverty is further challenged by health threats such as malaria and HIV/AIDS, as well as institutional and governance aspects. Climate change will compound many of these interlinked problems for regional livelihoods, which are often based on subsistence agriculture, and for regional economies, which are often dependent on natural resources. The region's high vulnerability to climate change is a function of the severity of the projected physical climate impacts and this multi-stressor context, which heightens both exposure and sensitivity to the impacts.

In addition to its role as a risk multiplier, climate change introduces new climate risks. Already the observed temperature changes for southern Africa are higher than the increases reported for other parts of the world (IPCC 2007); projections indicate a 3.4°C increase in annual temperature (up to 3.7°C in spring), when comparing the period 1980–1999 with the period 2080–2099. Mean warming over land surfaces in Southern Africa is likely to exceed the average global land surface temperature increases in all seasons.[1] Further projections are for overall drying for southern Africa, with increased rainfall variability; a delay in onset of the rainy season with an early cessation in many parts; and an increase in rainfall intensity in some parts. [See Figure 1.][2] Additional climate-driven risks, in addition to the direct effects of increased temperature and increased incidence and/or severity of extreme events like floods and droughts, include more wind storms, hot spells and wild fires. Both the heightened and the new risks will act at the local level to compound other stressors and development pressures faced by people, and at the national level on the region's natural resource-dependent economies. The all-encompassing nature of the impacts highlights the fact that climate change is not a narrow environmental problem, but a fundamental development challenge that requires new and broad-based responses.

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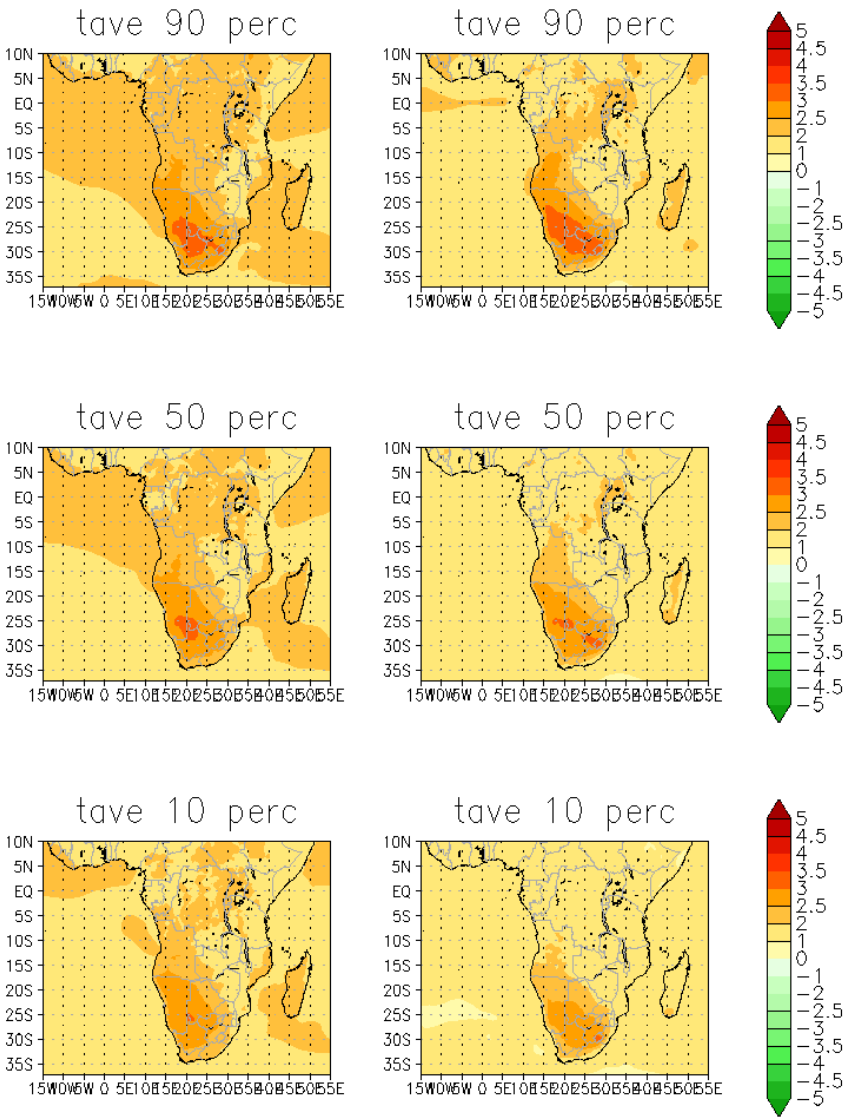
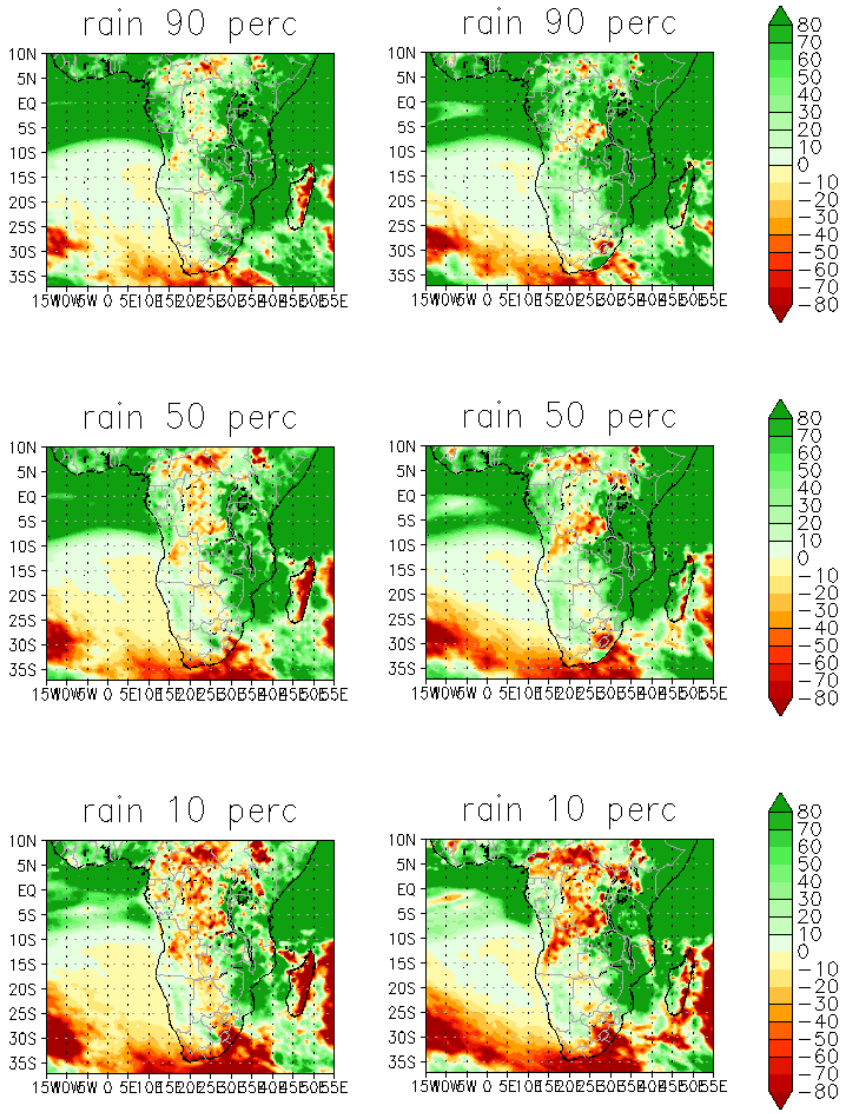
[1] IPCC. 2013. *Impacts, Vulnerability and Adaptation: Africa*. IPCC Fifth Assessment Report, draft for Final Government Review, Chapter 22.

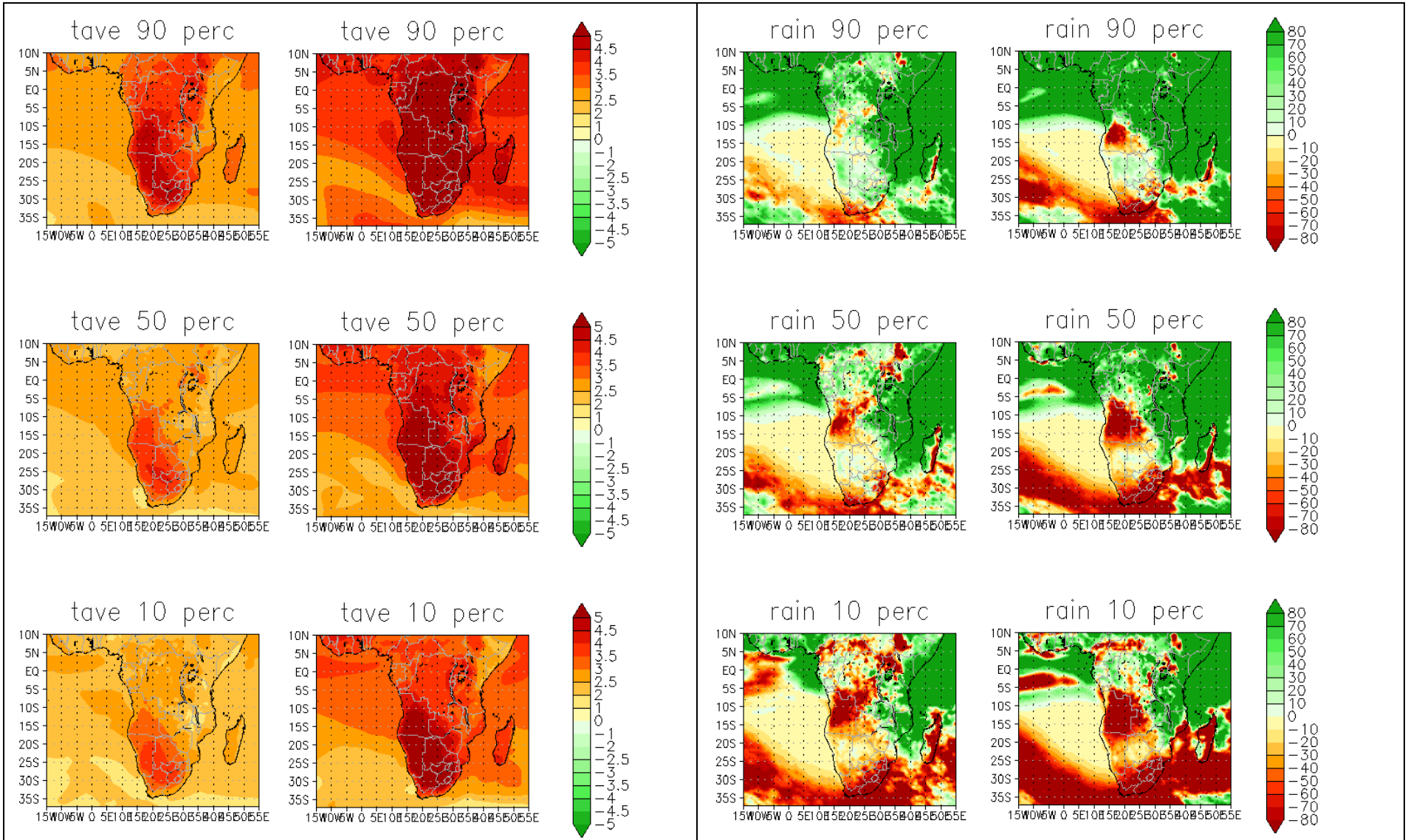
[2] The projections of future climate change displayed in Figures 1 and 2 were provided by the Council for Scientific and Industrial Research (CSIR), and have been obtained through downscaling the output of a number of coupled global models (CGCMs) to high-resolution over Africa, using a regional climate model. All the CGCMs downscaled contributed to the Coupled Model Intercomparison Project Phase 5 (CMIP5) and Assessment Report 5 (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Details on these simulations are provided in the LTAS Phase 1 Technical Report no. 1. The regional model used is the conformal-cubic atmospheric model (CCAM), developed by the CSIRO in Australia. For various applications of CCAM over southern Africa, see Engelbrecht, F.A., W.A. Landman, C.J. Engelbrecht, S. Landman, B. Roux, M.M. Bopape, J.L. McGregor and M. Thatcher. 2011. "Multi-scale climate modelling over southern Africa using a variable-resolution global model," *Water SA* 37: 647-658.





Note: The 90th percentile (upper panel), median (middle panel) and 10th percentile (lower panel) are shown for an ensemble of downscalings of three CGCM projections, for each of the time-slabs. The downscalings were performed using the regional model CCAM. All the CGCM projections are contributing to CMIP5 and AR5 of the IPCC, and are for RCP4.5.

Figure 1: Projected change in the annual average temperature (°C) and annual average rainfall (mm) over the SADC region, for the time-slab 2040–2060 and 2080–2099, relative to 1970–2005



Note: The 90th percentile (upper panel), median (middle panel) and 10th percentile (lower panel) are shown for an ensemble of downscalings of three CGCM projections, for each of the time-slabs. The downscalings were performed using the regional model CCAM. All the CGCM projections are contributing to CMIP5 and AR5 of the IPCC, and are for RCP8.5.

Figure 2: Projected change in the annual average temperature (°C) and annual average rainfall (mm) over the SADC region, for the time-slab 2040–2060 and 2080–2099, relative to 1970–2005

Figures 1 and 2[3] showed the projected change in the annual average temperature (°C) and annual average rainfall (mm) over the SADC region, for the time-slabs 2040–2060 and 2080–2099, relative to 1970–2005. The Figure 1 CGCM projections are for RCP4.5 and Figure 2 for RCP8.5.

Further projections are for overall drying for southern Africa, with increased rainfall variability; a delay in onset of the rainy season with an early cessation in many parts; and an increase in rainfall intensity in some parts. Additional climate-driven risks, in addition to the direct effects of increased temperature and increased incidence and/or severity of extreme events like floods and droughts, include more wind storms, hot spells and wild fires. Both the heightened and the new risks will act at the local level to compound other stressors and development pressures faced by people, and at the national level on the region's natural resource-dependent economies. The all-encompassing nature of the impacts highlights the fact that climate change is not a narrow environmental problem, but a fundamental development challenge that requires new and broad-based responses.

The National Policy on Climate Change for Namibia recognises the fundamental link between climate change and development and states:

> *"Namibia is recognised as one of the countries most vulnerable to the impacts of climate change. The predicted increases in temperature and evaporation as well as increased variability of rainfall will exacerbate the existing challenges that Namibia is facing as the driest country south of the Sahara. Given the reliance of the majority of our population on climate-sensitive sectors such as agriculture, livestock management and fishing, the potential impacts of these changes could be catastrophic for our people. In addition climate change will bring a host of new challenges and opportunities for which we need to be thoroughly prepared … In spite of all of these challenges and threats, there are also opportunities for Namibia to benefit from climate change."*
>
> (Government of Namibia 2011, ii)

Shifting perspective from 'development' to 'climate compatible development' requires significant scientific and social innovation. New forms of learning, leadership, planning, policymaking and knowledge production are needed. New collaboration platforms will be needed within and between countries and their universities. Universities have a key role to play in supporting societal innovation and change for CCD. Not only do they develop the knowledge and competence of future leaders in government, business and civil society, but they also provide immediate societal responses given their pivotal role as centres of research, teaching, knowledge sharing and social empowerment. Given the risk multiplier effect of climate change, coupled with the multiple stressor context, it is clear that the impacts of climate change will be far-ranging, acting upon diverse sectors such as transportation, agriculture, health, industry and tourism. This necessitates a wide-ranging and cross-sector response, which will call upon non-climate-related knowledge fields.

[3] Engelbrecht et al. 2014. "Multi-scale climate modelling". Climate trends and scenarios for South Africa. Long-term Adaptation Scenarios Flagship Research Programme (LTAS). Phase 1, Technical Report no. 1.

"Universities need to develop a strong understanding of the knowledge, teaching, research and outreach implications of the external climate change development context in which they operate. This calls for:

- New scientific directions and practices;
- New teaching and learning content and approaches;
- Stronger forms of community outreach and policy outreach activities; and
- Enhanced collaboration between universities and other knowledge producers and users in society.

In recognition of the above issues and their longer term implications for society and universities, the Southern African Regional Universities Association hosted a Leadership Dialogue in 2011 which resulted in a vision for a collaborative programme on climate change capacity development, with a defined set of outcomes.

1.2 The SARUA Climate Change Capacity Building Programme: History and Objectives

The Southern African Regional Universities Association (SARUA) has established a five-year programme for Climate Change Capacity Development, to deliver on its mandate of promoting, strengthening and increasing higher education research and innovation, through expanded inter-institutional collaboration and capacity building initiatives throughout the region. The five-year programme is endorsed by a majority of Vice Chancellors within SARUA's 60 public university members.[4] The programme aims to build capacity for *climate compatible development (CCD)*, which is emerging as a platform for significant collaboration across the academic sector. The objectives identified are as follows:

- **Collaborative network development** (establishment of six collaborative networks);
- Policy and community outreach;
- **Research** (140 PhD students (average 10 per country) in at least two themed research programmes);
- **Teaching and learning** (integration of CCD into undergraduate and Masters degree programmes);
- **Knowledge management** (regional database and knowledge management systems); and
- **Institutional learning and support** (ongoing reflexive development of programme).[5]

The programme started with an extensive **mapping study** of current climate-related priorities and university capabilities for CCD of countries in the region, supported by funding from the UK and Dutch-funded Climate and Development Knowledge Network (CDKN). The Higher Education

[4] This was the number of SARUA member universities when this mapping study took place (2012/13).

[5] Butler-Adam, J. 2012. *The Southern African Regional Universities Association (SARUA). Seven Years of Regional Higher Education Advancement. 2006-2012*. Johannesburg: SARUA.

Management Africa consortium (HEMA) is coordinating the study on behalf of SARUA. This Namibian Country Report forms part of the mapping study.

The initiative is diagrammatically illustrated below.

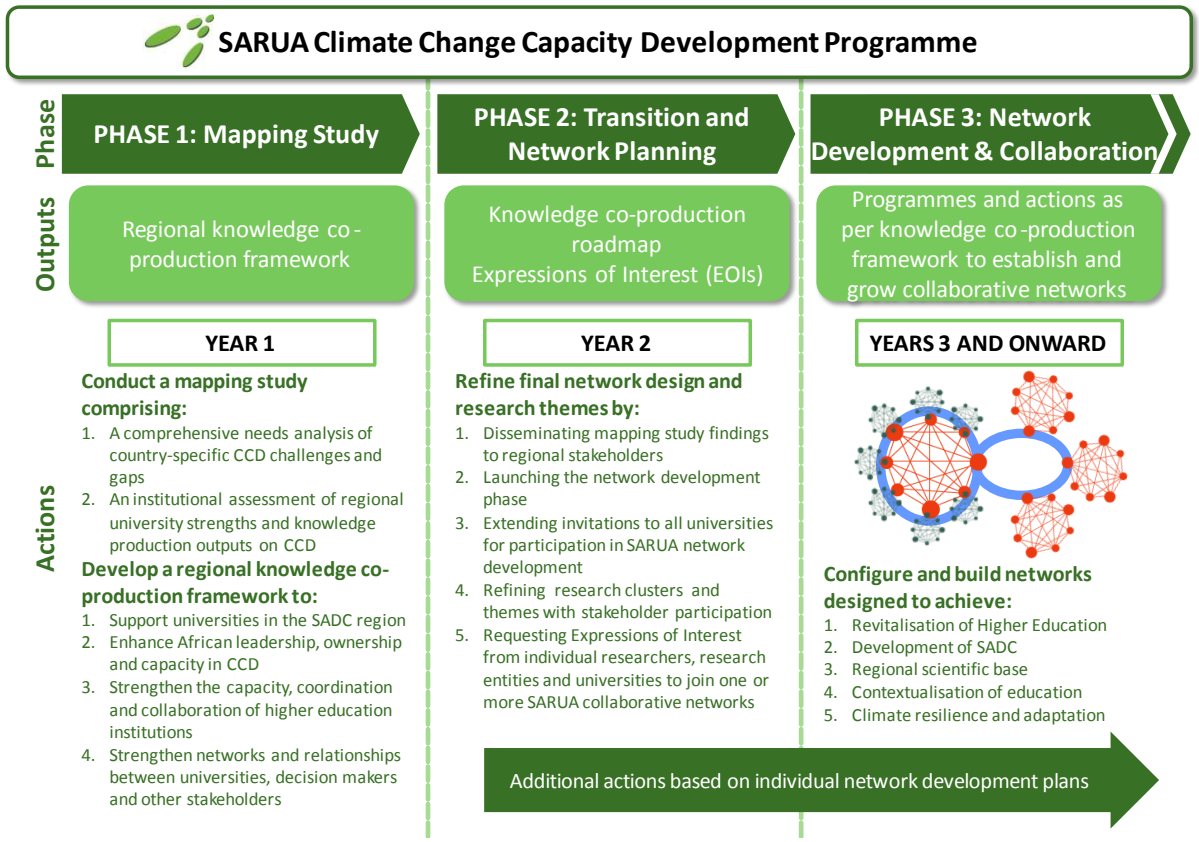


Figure 3: The SARUA Climate Change Capacity Development Programme, showing the mapping study

The intended outcome of the SARUA **mapping study** will be a collaborative research framework to enhance co-production of knowledge on CCD. It will include strategies to strengthen networks for climate compatible development research, teaching, community and policy outreach involving knowledge co-production processes between participating universities and policy and community stakeholders. This framework will form the basis for the realisation of the longer term objectives of the SARUA programme outlined above, as well as for a SADC-level research programme and various country-based partnership agreements. It will provide a 'knowledge platform' for regional and country-based fundraising for research and knowledge co-production. As such the framework seeks to benefit universities themselves, while also strengthening regional interaction and co-operation.

The Regional Knowledge co-production Framework for Climate Compatible Development can be obtained from the SARUA website (www.sarua.org).

1.3 The SARUA CCD mapping study: Mapping existing capacity and future possible knowledge co-production possibilities

Climate compatible development is low carbon, climate resilient development. While the concept clearly requires integration of development, adaptation and mitigation (see definitions below), specific framing of the concept of CCD may vary between countries, universities and disciplines,

according to differing national, institutional and disciplinary goals, needs and values. The scope and strength of existing expertise, networks and capacity for climate compatible development research and knowledge production in SADC is largely unknown or unconsolidated. Despite the emerging knowledge infrastructure for CCD in the region, opportunities for collaboration involving higher education institutions within and between countries are yet to be fully explored.

To address these factors, the mapping study aimed to:

- Explore diverse understandings of CCD on a country-by-country basis;
- Scope CCD knowledge and capacity needs on a country-by-country basis (a 'needs analysis'); and
- Identify and map research, teaching and outreach capabilities for CCD that exist in southern African countries (an 'institutional analysis' of SARUA member universities); and
- Produce an up-to-date picture of the extent of knowledge co-production and trans-disciplinary research practices across the SARUA network and identify opportunities for future collaboration.

The country-by-country mapping study reports are supplemented by a regional perspective generated through analysis across countries, to provide a platform for regional collaboration and knowledge co-production. This document contains the country analysis from Namibia.

The mapping process was designed to be scientifically informed, participatory and multidisciplinary. Through the workshop process new collaborative possibilities will emerge, and a stronger engagement and participation in the SARUA five-year programme on Capacity Development for Climate Change will be established.

1.4 Key concepts

Climate Compatible Development

Climate compatible development (CCD) is low carbon, climate resilient development. The concept has been developed in recognition of the urgent need for adaptation, given current climate variability and the severity of projected climate impacts that will affect the region, as well as the need to reduce emissions as rapidly as possible to avoid more catastrophic climate change in the future. Thus, while CCD can be framed in different ways, given nationally and locally specific development trajectories, it does require that current and future climate risks are mainstreamed into development, and that both adaptation and mitigation are integral goals of development, as indicated by Figure 3. Thus CCD not only recognises the importance of both adaptation and mitigation in new development pathways, but, as further explained in Mitchell and Maxwell (2010), "Climate compatible development goes one step further by asking policy makers to consider 'triple win' strategies that result in low emissions, build resilience and promote development simultaneously". In the southern African context, poverty reduction, as an integral component and goal of regional and national development strategies, would be a desired co-benefit. Uncertainties in major drivers of change, including climate, socio-economic and political risks, necessitate that CCD be viewed as an iterative process, in which vulnerability identification and risk reduction responses are revised on the basis of continuing learning. Climate compatible development emphasises climate strategies that embrace development goals and development strategies that integrate the threats

and opportunities of a changing climate.[6] Thus climate compatible development opens up new opportunities for interdisciplinary and transdisciplinary research, teaching and engagement with communities, policy makers and practitioners.

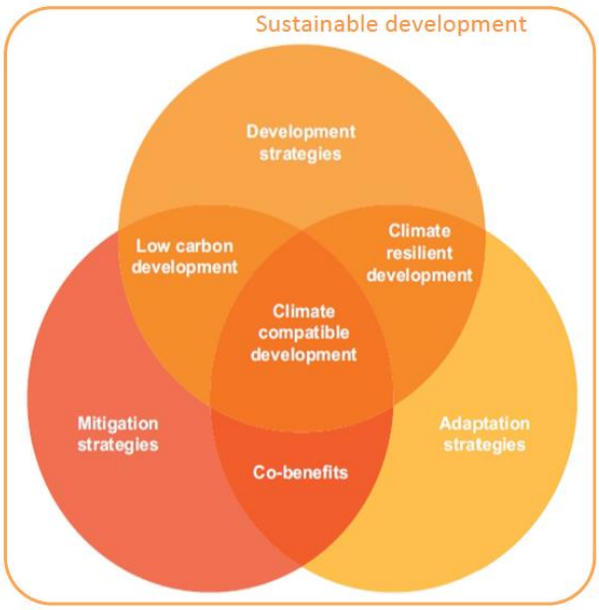


Figure 4: Conceptual framework for Climate Compatible Development (adapted from Mitchell and Maxwell, 2010)

While CCD is the central concept used in the work that is funded by CDKN, it is important that this is understood alongside the concept of climate-resilient development pathways as defined by the Intergovernmental Panel on Climate Change (IPCC) and the wider concept of sustainable development (see definitions below).

Climate-resilient pathways

The following definition of climate-resilient pathways is taken from the glossary of the Fifth Assessment Report prepared by the Intergovernmental Panel on Climate Change (IPCC)[7]:

> *"Evolutionary processes for managing change within complex systems in order to reduce disruptions and enhance opportunities. They are rooted in iterative processes of identifying vulnerabilities to climate change impacts; taking appropriate steps to reduce vulnerabilities in the context of development needs and resources and to increase the options available for vulnerability reduction and coping with unexpected threats; monitoring emerging climate parameters and their implications, along with monitoring the effectiveness of vulnerability reduction efforts; and revising risk reduction responses on the basis of continuing learning. This process may involve a combination of incremental changes and, as necessary, significant transformations."*

[6] Mitchell, T. and S. Maxwell. 2010. *Defining climate compatible development.* CDKN Policy Brief, November 2010.

[7] IPCC. 2013. *Fifth Assessment Report: Impacts, Vulnerability and Adaptation*. Currently in draft form.

The IPCC highlights the need for a focus on both adaptation and mitigation, as indicated by the following sentence:

> *"Climate-resilient pathways are development trajectories that combine adaptation and mitigation to realise the goal of sustainable development. They can be seen as iterative, continually evolving processes for managing change within complex systems."*[8]

Sustainable development

The most widely accepted definition of sustainable development, as formulated in the Bruntland Commission's 'Our Common Future' report in 1987, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition has been highly influential in shaping international environmental and development policy, since the Rio Earth Summit in 1992, where Agenda 21 was put forward as a global development plan for aligning goals of economic development with social and environmental sustainability. Early discussions on sustainable development tended to focus on the triple bottom line concepts of environment, economy and society separately. More recent discussions on sustainable development foreground the need for 'strong sustainability', in which society, economy and environment are seen as interacting in an interrelated, nested system. The concept of sustainable development as used widely today emphasises that everything in the world is connected through space, time and quality of life, and thus necessitates a systems approach to understanding and solving interlinked social, environmental and economic problems.

In 2002 South Africa hosted the World Summit on Sustainable Development, and the Johannesburg Plan of Implementation re-affirmed commitment to Agenda 21, and the Millennium Development Goals. These are currently under review and will be expanded through Sustainable Development Goals. In 2012 the Rio+20 Conference was held in Rio de Janeiro, and the outcomes of this global summit on sustainable development are captured in a document entitled 'The Future We Want'. One major shift in discourse and objectives from the early 1992 Summit and the Rio+20 Summit is a stronger concern for climate change and climate compatible development, especially the emergence of a low carbon future, accompanied and partly implemented by Green Economies. These international commitments, together with ongoing assessment of national sustainable development concerns and goals, have driven the development of sustainable development policy and practice. The concept of CCD highlights the necessity of integrating current and future climate risks into development planning and practice, in the ongoing goal of achieving sustainable development.

[8] IPCC. 2013. *Fifth Assessment Report.*

2 METHODOLOGY, DATA SOURCES AND ANALYSIS LOGIC

2.1 Research design

This country-based study has been informed by an interactive and dialogical research design that included document analysis of key national and regional documents focusing on climate change in Namibia and in the SADC region. This produced an initial analysis which was used to plan for and engage university participants and national organisations involved in the climate change and development arenas in a consultation to discuss a) the validity of the analysis, and b) expanded views and perspectives on the analysis, and to generate further insight into knowledge co-production practice and possibilities for climate compatible development.

The following methods were used to compile the mapping study Country Report for Namibia, within an overall interpretive, participatory and consultative and social realist methodology[9]:

2.1.1 Document analysis

The Country Report provides a summary of needs, priorities and capacity gaps already identified within key country documents (see below) for climate change, adaptation and mitigation, and in some cases, where this was available, climate compatible development. This was used as a source of background information for the stakeholder and institutional consultations held in each country. While the scope of CCD is necessarily wide, the document analysis did not focus on sectoral policy and institutions, but concentrated on overarching policy dealing with mainstreaming climate change into planning and development. The initial document analysis was presented to stakeholders during the workshops, and was revised based on outcomes of the consultations held in the country.

For the Namibian Country Report, the following documents were analysed through rapid desk review of the following key policy and programme documents:

- Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), July 2011 (GRN, 2011a);
- Namibia National Climate Change Policy (GRN, 2011b);
- National Climate Risk Management Capacity Development Plan2 (GRN);
- Namibia's National Capacity Self-Assessment for Global Environmental Management, (GRN, 2005);
- Namibia National Development Plan 4 (GRN, 2012a); and
- The Climate Change Strategy and Action Plan for Namibia (GRN, 2012b).

[9] A social realist methodology takes account of knowledge that has previously been established via scientific methods before engaging in consultative and participatory knowledge production processes.

2.1.2 Stakeholder and university staff consultations (national workshop)

The first round of country consultations of the SARUA mapping study Initiative *Climate Change Counts* was held in Namibia at the Thuringerhof Protea Hotel in Windhoek on 13 and 15 March 2013.[10] The consultations were structured as a two-day programme, with Day 1 focused on government stakeholders, and Day 2 focused on university stakeholders. See Appendix A for the list of participants. A summary of the content of the different sessions is provided below in Table 1. From detailed workshop proceedings captured by a team of four rapporteurs, a workshop report was produced and circulated to all participants for verification and accuracy. Data produced in the workshops was also verified and added to during plenary sessions. The workshop report forms a substantive basis of the data used for this Country Report, combined with document analysis and questionnaire data.

Table 1: Workshop programme outline

TIME	DAY 1: 13 MARCH 2013	DAY 2: 15 MARCH 2015
INTRODUCTION	SARUA initiative overview	▪ SARUA initiative overview
SESSION 1	Framing Climate Compatible Development	▪ Framing Climate Compatible Development and report-back from Day 1 on needs, priorities, and knowledge and other gaps
SESSION 2	Country priorities and needs Knowledge and institutional gaps and capacity	▪ Who is doing what, where and why in Universities in climate compatible development? (Research, Teaching, Community Engagement) ▪ How does this respond to the identified needs and priorities? ▪ What are existing university plans? ▪ What are the gaps?
SESSION 3	Information, knowledge and research needs Plenary report-backs from group work	▪ Introduction to developing and supporting knowledge co-production
SESSION 4	What is the role of the university sector? Identifying other knowledge partners	▪ Opportunities for collaboration ▪ Policy implications for government, universities and donors
SESSION 5	Way forward and collect questionnaires on sector-specific priorities, gaps and capacity	▪ Way forward and collect questionnaires

[10] The Namibia consultations were made possible through the kind contribution of the University of Namibia.

2.1.3 Questionnaires

Two different questionnaires were prepared to obtain more in-depth data on climate change and CCD knowledge co-production practice and possibilities, and to enable people who were unable to attend the country workshops to participate in the mapping study (see Appendices C and D). One was designed for university professionals and the other for national and regional stakeholders who are involved in climate change and CCD. For Namibia, a total of 30 questionnaires were answered, which included 13 stakeholders and 17 university professionals. Questions covered:

2.1.3.1 University staff questionnaire

A. **General demographic and professional information** (name, gender, highest qualification, job title, years of experience, years of experience with CC, name of university, country, faculty, department, programme, contact details)
B. **Understandings of Climate Change and Climate Compatible Development** and views on critical CCD issues and responses from universities (staff and university leaders)
C. **Capacity, knowledge and research gaps** (levels of involvement in CC and CCD research – local, national and international; levels of single, inter- and transdisciplinary involvement in CCD research; stakeholder involvement; funding and fundraising for CCD research; policy contributions; major research programmes / projects; active researchers; research knowledge networks)
D. **Curriculum, teaching and learning** (specialist courses; integration of CCD issues into courses; cross faculty teaching; inter- or transdisciplinary teaching approaches; service learning approaches; critical thinking and problem solving approaches; social or technical innovation courses; assessment and examination of CCD issues; staff willingness and staff ability; actual courses and teaching methods)
E. **Policy, community engagement and student involvement**
F. **University collaboration** (inside the university; between universities in country; with partners; regional and international involvement)
G. **University policy and campus management**

2.1.3.2 Stakeholder questionnaire

The stakeholder questionnaire covered items A-C above, with an additional:

H. **Interests, policies, networks and Centres of Excellence or Expertise**

2.2 Limitations of the mapping study

This mapping study was constrained by a) a lack of baseline data on knowledge and research gaps for climate compatible development and university-based responses in Namibia, and b) by time and resource constraints that did not allow for **in-depth field visitation, individual interviewing or observation** before, during and after the consultation process. Moreover, the information generated at the country workshop relates to the number of participants, their expertise and the number of different sectors and institutions present. Further, while every effort was made to obtain questionnaire responses from as wide a range of stakeholders as possible, and follow-ups were

made to enhance this, the range of questionnaire responses obtained does provide certain limitations to the data set. However, the **best available information was carefully consolidated, reviewed and verified** in the construction of this mapping study Country Report. Overall, the mapping study was further constrained by a budget cut imposed mid-way through the study.

While much information could be obtained on climate change- and CCD-related knowledge gaps, research needs and capacity gaps, there is obviously more to be learned about these. Similarly, as much information as possible was obtained on 'who is doing what' and on existing research, knowledge co-construction practice and possibilities, but there is clearly also more to learn about these. This mapping study Country Report is therefore a useful 'initial document' and it is hoped that Namibia, and in particular, the University of Namibia together with the Ministry of Higher Education, the Ministry of Environment and Tourism and other national stakeholders, can take this analysis forward in ongoing mapping and planning activities related to CCD research and knowledge co-production.

2.3 Expanding the mapping study

There are numerous ways to expand this study, most notably by administering the questionnaires (included in Appendices C and D) in a manner that would include *every academic at the University of Namibia and at the Polytechnic,* and in a way that would allow for aggregate data within and across Faculties and Departments (Appendix B). The scope of such a detailed analysis lay beyond the capacity of the current mapping study. Data from questionnaires is therefore indicative rather than conclusive. Similarly, the questionnaire for stakeholders can be administered with additional national and local stakeholders (Appendix D) involved in environment and development initiatives in Namibia to understand the full scope of climate change and CCD responsiveness in Namibia, and to further develop the knowledge co-production capacity for CCD in Namibia. In many ways therefore the SARUA study, as reported in the mapping study Country Report, maps out the pathway forward for more detailed and ongoing reflexive analysis of CCD knowledge co-production capacity in Namibia, and through the questionnaires and analysis provided for in this document, begins to provide for ongoing monitoring and development capability for CCD knowledge co-production in Namibia. Ministries who could take this study forward could include the Ministry of Higher Education and the Ministry of Environmental Affairs, together with other relevant partners and stakeholders.

2.4 Analysis logic

The analysis logic informing this mapping study Country Report is threefold. It firstly maps out a needs analysis which identifies country based knowledge, research and capacity gaps for key CCD priorities as articulated in documents, workshop and questionnaire responses. Secondly, it provides an institutional analysis providing insight into existing institutional capacity for CCD knowledge co-production. Thirdly, it provides a perspective not only on existing knowledge co-production practice for CCD in Namibia, but also on knowledge co-production possibilities, based on information gathered during the mapping study. It provides a knowledge base for producing knowledge co-production pathways in Namibia, which may also assist Namibia **to co-operate with other SADC countries in regional knowledge co-production processes.**

3 NEEDS ANALYSIS

3.1 Introducing the needs analysis

The needs analysis starts with a brief overview the socio-economic context and projected climate impacts and vulnerabilities in Namibia (section 3.2), as these are key drivers of the **'need' for CCD** identified by policy, in workshops and via the questionnaires (section 3.3). The needs analysis then describes **more detailed knowledge, research and capacity needs** (section 3.4) using the following differentiation of capacity gaps:

- **Knowledge gaps** (e.g. insufficient knowledge of appropriate CCD technologies);
- **Research gaps** (e.g. no research on cultural uptake of CCD technologies);
- **Individual capacity gaps** (skills needed) (e.g. for technicians / systems thinking etc.); and
- **Institutional capacity gaps** (which have inferred knowledge and research gap implications) (e.g. resources to implement large scale technology change programmes).

It is possible that this analysis can be extended in future, and readers of the mapping study are advised to use the information provided here as best available information (produced within the constraints of the mapping study outlined above) rather than as definitive information.

3.2 Socio-economic context and projected climate impacts and vulnerabilities: Drivers of CCD needs

3.2.1 Socio-economic context

Namibia is situated on the south-western coast of Africa, covering an area of 825 418 km², with a population of 2.1 million. The climate is generally hot and dry with sparse and erratic rainfall and frequent droughts. Ninety-two percent of the land area is defined as hyper-arid, arid or semi-arid. Namibia is one of the driest countries south of the Sahara, with a mean annual rainfall ranging from less than 25 mm in the southwest and west to just above 700 mm in the northeast of the country. It is also one of the few dryland countries with internationally recognised biodiversity hotspots: the Sperrgebiet, and the Namib Escarpment. Namibia's modern market sector produces most of the country's wealth, while the majority of the population depends on the traditional subsistence sector. Primary sectors, in descending order of GDP contribution, include mining, tourism, agriculture and fishing. The country has one of the highest unequal income distributions in the world with a Gini coefficient of 0.6, yet the disparity is masked by a relatively high average adjusted per capita income of N$25 675 358 (about US$3 537) in 2011/2012. Namibia has more than 200 000 skilled workers, as well as a small trained professional and managerial class; the high joblessness context includes almost 60 percent youth unemployment. HIV/AIDS continues to threaten human capacity in the country, and has resulted in a current life expectancy of 49 years, down from 62 years in 1991.

The dryland conditions, and the high dependence on traditional subsistence sector economic activities, as well as the resource-intensive nature of the primary economic sector activities, make Namibia vulnerable to climate change, and are key drivers of the need for CCD responses in Namibia.

3.2.2 Observed and projected climatic changes, impacts and vulnerabilities

3.2.2.1 Observed climatic changes

The warming trend is already well established in Namibia, with maximum temperatures increasing over the past 40 years, as observed in the frequency of days exceeding 35°C, and a reduction in days below 5°C. There is a high degree of certainty that the country will become hotter throughout the year, with a projected increase in temperature of between 1°C and 3.5°C in summer and 1°C to 4°C in winter in the period 2046–2065. While there is considerable spatial heterogeneity in rainfall trends, it appears that the northern and central regions of Namibia are experiencing a later onset and earlier cessation of rains, resulting in shorter rainy seasons in most vicinities. There has been a statistically significant decrease in the number of consecutive wet days in various locations, and observed increases in rainfall intensity.

3.2.2.2 Projected climatic changes

Concerning future projections, it is not clear whether average rainfall will be reduced, although intensity is likely to be increased. The most consistently projected changes are for an increase in late summer rainfall over major parts of the country, and a decrease in winter rainfall in the south and west. The projected temperature increases will result in increased evaporation and evapotranspiration of 5-15 percent, further reducing water resource availability and dam yields. Groundwater recharge may suffer a reduction of 30-70 percent across the country, with a potential exception in the recharge of alluvial aquifers originating in central areas. Fire danger ratings and the incidence of wild fires may increase.

3.2.2.3 Impacts and vulnerabilities

Climate change will have a considerable impact on the natural resources of Namibia, threatening the resource-based livelihoods of the majority of people who live in rural areas. Namibia's Second National Communication to the UNFCCC (GRN 2011a) summarises vulnerabilities and the need for adaptation responses in the following areas: socio-economic development; water resources; agriculture; coastal zone and fisheries; community-based natural resource management (CBNRN) and tourism; health and disaster risk preparedness. Vulnerability to climate change differs between regions in Namibia and between various socio-economic groups; in particular, the impact of poverty and HIV/AIDS may reverse relatively favourable environmental conditions in the northern regions. While all sectors and groups engaging in agriculture will be affected, this will be most severe for poor people living in marginalised areas, where the complex interaction of socio-economic stressors in subsistence farming households (poor health, inequitable access to land, gender inequality, population growth, and increasing competition for shared resources) will be exacerbated by climatic changes. Apparent dwindling capacity for social organisation and support in communities in various regions of the country will limit adaptive capacity.

All these issues are drivers of the need for CCD and for CCD knowledge, research and capacity development in Namibia. Namibia has been proactive in developing national policy and priorities to guide CCD in Namibia, as can be seen in the next section.

3.3 Identified needs: Short to medium term national priorities for CCD in Namibia

3.3.1 Identified needs: Adaptation and mitigation priorities articulated in policy and strategy

Namibia has identified key needs and priorities, related to the abovementioned observed and projected climatic changes, impacts and vulnerabilities. Namibia's Second National Communication to the UNFCCC (GRN 2011a) commits the country to focus predominantly on low carbon development and to secure appropriate long-term sustainable resources for adaptation to the effects of climate change. Associated with the vulnerabilities identified by the SNC, as summarised above, specific adaptation priorities that have been highlighted are:

- **Water:** Improve integrated water resources management, including through policy and legislative development, measures to reduce evapotranspiration and improve water resource use efficiency;
- **Agriculture**: Technological measures e.g. irrigation, water harvesting, conservation agriculture, use of adapted varieties; enhanced farm management; improved social organisation and adaptive capacity including through enhanced local community involvement in knowledge generation and adaptation decision making;
- **Sea level rise**: Responses include infrastructural e.g. sea walls and dolosse; soft or ecosystem-based e.g. retention of wetlands and cultivation of kelp beds; socio-institutional e.g. zoning and early warning systems;
- **Tourism:** Pro-poor nature conservation and community-based natural resource management (CBNRM) marketed as carbon neutral and fair trade;
- **Health:** Integrated system-wide response and capacity building on all fronts, including response measures for fast-onset change; strengthen water and sanitation systems; and
- **Disaster risk preparedness:** Strengthened to deal with droughts and floods, spatial planning to reduce exposure, pro-poor disaster insurance schemes developed.

The SNC (GRN 2011a) identifies the following **barriers to adaptation** to climate change:

- **Insufficient awareness** (information limited to specialists and access to research by stakeholders);
- **Political and institutional barriers** (implementation of policies, low public participation);
- **Socio-cultural barriers** (technology stigmatisation and techno-focus, as well as a different local priority than national ones at times); and
- **Financial barriers** (types and conditionality of funds, insufficient pricing of resources, and lack of access to private funding).

The SNC (GRN 2011a) further identifies the following **mitigation measures**:

- Assessment of the costs and benefits of fuel switching for motor vehicles in Namibia;
- Assessment of feasible and economic investment in cleaner energy in Namibia;
- Assessment of the potential for building local entrepreneurship in Namibia in response to Clean Development Mechanisms and research in most suitable solar technology options;
- Assessment of the economic costs and benefits of improving lighting and energy efficiency/demand side management in public and other buildings; and
- Review of the forestry sector activities and their impact on Namibia`s greenhouse gas balance.

In the more recent Climate Change Strategy and Action Plan (CCS&AP) for Namibia (GRN 2012b), clearly defined thematic areas for adaptation, mitigation and cross-cutting issues are identified as focus for action.

In the CCS&AP strategy, climate change **adaptation** is addressed through four themes:

- Food security and sustainable biological resource base;
- Sustainable water resources base;
- Human health and well-being (or security); and
- Infrastructure development.

Mitigation is addressed through the following themes:

- Sustainable energy and low-carbon development; and
- Transport.

Cross-cutting issues or themes on adaptation and mitigation are also identified and included in the strategy and action plan:

- Capacity building, training and institutional strengthening;
- Research and information needs, including how to use climate change information;
- Public awareness, participation and access to information;
- Disaster reduction and risk management;
- Financial, resource mobilisation and management;
- International cooperation and networking;
- Technology development and transfer; and
- Legislative development.

3.3.2 Identified CCD priorities and needs articulated in workshop interactions

It was noted in the workshop that Namibia had made good progress in articulating the projected impacts, and required actions and strategies necessary to address the challenges of climate change, and to promote climate compatible development. *It was noted, however, that knowledge of the needs associated with climate change priorities and national strategies was not widely distributed in Namibian society, and was only beginning to permeate the education system, universities, knowledge networks and wider social learning systems in the country*.

The stakeholder and universities workshop identified a number of priority CCD needs, which reflected the key interests of those attending the workshop. Examples of such the CCD needs articulated in the workshop include:

- Marine Biodiversity Management (for national environmental management pathways);
- Non-timber forest product management and development (as a livelihood strategy for rural community-based natural resource management pathways);
- Sea-level rise, coastal erosion and increased storm activity at sea (with potentially severe impacts on mining industries);
- Environmental Education and Training (mainstreamed across the education, training and capacity building system);

- Change in cultural norms (in both rural and urban contexts; linking to indigenous knowledge and engaging with approaches to social change); and
- Political leadership and will (including ethical leadership, and ongoing reflexivity in policy and strategy development).

Participants in the workshop also noted the importance of focusing on both rural *and* urban, and communal and commercial contexts of climate compatible development (it was felt that most climate change needs discussions were centred on rural issues) for example it was said that *"climate change is not just about community based conservancies and rural development; it is impacting urban areas as well".* Other discussions pointed to the deep-seated paradoxes that are situated in the social change process that is needed for climate compatible development. It was said, for example, that, "*there is a need to confront the paradoxes within trends of developed countries for consumerism and high levels of resource utilisation, and the aspirations of developing countries, which are now following this path*".

3.3.3 Identified needs for CCD articulated in questionnaire data

Questionnaire data showed that there is a relationship between institutional interest / mandate and/or disciplinary interest / mandate and the definition of priority needs (see Table 2).

Table 2: Needs identified by different stakeholders / disciplinary specialists (derived from questionnaire data)

Need identified	Institutional interest / mandate and/or disciplinary interest / mandate
Cutting emissions. Adaptation and Mitigation Strategy development and implementation.	Ministry of Environment and Tourism
Awareness and sensitivity needed for conversion to renewable resources; adaptive and diverse forms of land management for biological diversity and animals / livestock	University Central Consultancy Bureau
Water scarcity in urban areas; and livelihood pathways (enterprise development) of migrants to urban areas who cannot cope with climate changes in rural areas	National Product Manufacturing and Marketing Institution
Gender, poverty, cultural demands and impacts related to climate change need to be addressed	Sociology Department and Department of Geography, History and Environmental Studies (UNAM)
National database with sector specific data derived from on-site measurement of climate variables to generate trends and scenarios sector-by-sector	Land Management Department (Polytechnic)
Dealing with Heat Stress impacts of climate change	School of Nursing and Public Health Faculty of Science
Need for targeted training programmes on CCD for communities, schools, under- and postgraduates	Faculty of Education (UNAM)
Need for differentiating between annual climatic variation shifts and broader 'climate change' patterns	Department of Agriculture and Natural Resources (UNAM)
Need for commitment from leaders, capacity building in CCD, and co-ordination of activities	Science Faculty / Research and Publications Office in the University (UNAM)

Need identified	Institutional interest / mandate and/or disciplinary interest / mandate
Better data and data management systems and evidence for early warning systems, financial and technical capacity for policy and strategy implementation	Humanities and Social Sciences / Multidisciplinary Research Centre (UNAM)
Need for integrated approaches to climate change risk and vulnerability and to adaptation to risks	Climate Change and Disaster Risk Management/ Multidisciplinary Research Centre (UNAM)
Desertification primarily, and trends or practices that induce land degradation	Land Use Planning and Rural Development, Natural Resources and Tourism (Polytechnic)
First understand the magnitude of these climatic variations over time so as to target the areas that are most affected. Acquire good scientific and socio-economic data for the vulnerable areas, so as to have an idea of the magnitude of the required intervention	Geology (UNAM)

Table 2 above shows that different institutions / disciplines and levels of interdisciplinary management shape the perceptions of what the most important climate compatible development 'needs' are. For example, the Multidisciplinary research centre emphasised integrated responses; the School of Public Nursing and Health emphasised the need for dealing with heat stress; the Land Use Planning and Rural Development unit at the Polytechnic identified the need to address issues of desertification and how they impact on land use; and the Sociology Department identified the need to deal with gender, poverty and rural development related CCD concerns.

It is important to identify and recognise these different interests, ways of approaching the identification of CCD needs, and the associated diversity of perspectives in knowledge co-production processes and approaches. Such perspectives also show the interdisciplinary and multi-sectoral nature of climate change. *How to harness such perspectives, and the associated expertise that informs such perspectives is the ultimate challenge of a knowledge co-production framework and process.*

All these identified CCD priorities have associated knowledge and capacity needs, which will be discussed in more detail below.

3.4 Knowledge and capacity needs: CCD research, knowledge, individual and institutional capacity gaps (related to CCD priorities)

Building on the identified needs for CCD priorities in Namibia (discussed in section 3.2 above), are identified needs for **CCD research, knowledge and capacity gaps.** This section reports on these as found in key national documents, and as articulated by stakeholders and university staff attending the workshops and completing questionnaires.

3.4.1 Research needs and knowledge gaps

Namibia's Second National Communication to the UNFCCC (GRN 2011a) makes extensive reference to a comprehensive set of research needs, including the following specific research gaps:

- Strengthen systematic meteorological observation and improve climate and hydrological datasets;
- Coordinated data management;
- Disaster preparedness and vulnerability mapping;
- Agricultural technologies and production systems;
- Other monitoring-based research;
- Indigenous knowledge and coping strategies;
- Carbon sequestration by anthropogenic ecological disturbances;
- Greenhouse gas data collection and analysis;
- Fuel switching and fuel use efficiency;
- Wind and solar energy; and
- Economics of climate change impacts, adaptation and mitigation.

These are further elaborated on in the Climate Change Strategy and Action Plan for Namibia (CCS&AP, GRN 2012b) which identifies specific knowledge and research needs under ***'Cross-Cutting Issues, Theme 2: Research and information needs, including how to use climate change information'.*** Associated knowledge production networks and partners are also identified, showing a commitment to knowledge co-production involving multi-stakeholders at different levels (see Appendix E for more detail). These research priorities as stated in policy, were expanded on by workshop and questionnaire data (italics) and include:

Research on the collection and application of data in climate change models at national, regional and local levels, with specific reference to the following knowledge needs:

- Strengthening and improvement of meteorological weather data and other relevant field data in various localities to inform CC predictions and impact analysis;
- Linking up regional climate change models to generate better boundary conditions;
- Capacity to understanding of climate prediction models at local scale levels;
- Up-to-date data on sector scenarios;
- Use of space-based technology for predicting impacts of climate change;
- Developing and/or validating country and regional specific climate prediction models on a sectoral basis; and
- Developing of land evaluation models that can project commodity-based performances.

Research on monitoring of ecosystem and biodiversity changes and their impacts:

- Monitoring systems to evaluate changes in ecosystem and biodiversity, especially sensitive ecosystems;
- Participatory ecosystem monitoring systems involving multiple stakeholders (universities, schools, officials in line ministries, extension workers and communities);
- Reporting and assessing implications of changes in ecosystems and biodiversity, including for livelihoods of local people (recommend appropriate adaptation measures);
- Studying bush encroachment and understanding its impact on Namibia's greenhouse gas profile; and
- Ecosystem vulnerability analyses for ecosystem-based adaptation and mitigation.

Climate proof research, with specific reference to the following knowledge needs:

- Impacts of climate change on crops, livestock, fisheries, forests, pests and diseases;

- Evolving adverse climate tolerant genotypes and land-use systems;
- Traditional knowledge for adaptation;
- Social issues, including but not limited to: migration and changing household composition, loss of labour due to HIV/AIDS, land tenure security, access to credit and technologies and household activities including water and fuel collection and preparation;
- Environmental engineering to contribute to sustainable development and growth; and
- Environment and water resources management (also in urban areas).

Research on sea level rise, with specific reference to the following knowledge needs:

- Monitoring of sea level rise and salinity along the coast of Namibia (using hydro-meteorological data);
- Modelling of inundation and salinity impacts of sea level;
- Modelling and prediction of socio-economic, health and ecosystem impacts of sea level rise;
- Relocation planning;
- Effects of increased storm activity at sea; and
- Migration patterns linked to movement to and from the coast.

Research on, and documentation of traditional / indigenous knowledge and coping practices, with reference to the following knowledge needs:

- Best practices, traditional knowledge and alternative practices for coping with climate variability and extreme weather; and
- Dissemination and use of such knowledge in different parts of Namibia.

Research on the macro-economic and sectoral impacts of climate change, with specific reference to the following knowledge needs:

- Sectoral analyses using system dynamics models to support national development planning and analysis of medium to long term development issues at national level;
- Assessing costs of not adapting and benefits of early climate change adaptation within sectors;
- Impact of climate change on the macro-economy of Namibia including impacts on growth, employment, trade etc.;
- Life-cycle assessments of commodities in major sectors of the economy; and
- New products development – including better use of existing Namibian climate adjusted plants and NDN Timber Forest products.

Additional research needs are alluded to (not captured in the same level of detail in the table above) in the other Thematic Areas of the CCS&AP (GRN 2012b) under the thematic areas for adaptation, mitigation and cross-cutting issues.

In **Adaptation Theme 1 on Food Security and Sustainable Resource Base** the following research needs are identified and / or implied:

- Conduct field level trials of climate resilient cropping patterns and associated water management systems;
- Conduct research to develop crop varieties that are climate resistant and resilient (e.g. maize, wheat, pearl millet (Mahangu) etc.;
- Conduct research and select better adapted livestock breeds which are climate resilient;

- Develop rangeland management models that are resilient to climate change;
- Produce GIS maps that show areas vulnerable to drought and flooding in Namibia;
- Document best-practice indigenous food and drought-coping mechanisms;
- Conduct simulation exercises of contingency plans in flood and drought-prone areas;
- Monitor land cover changes in areas covered by forests;
- Monitor and research understanding of climate change impacts on fisheries and aquaculture;
- Establish and monitor the impact of sea level rise on the fishing industry, existing marine culture operations, identified marine culture development sites and infrastructure along the coast;
- Determine and test coping and adaptation mechanisms for rural communities along the perennial rivers (aquaculture may be a suitable adaptation);
- Pilot test adaptive measures for coastal zone activities (consumptive and non-consumptive use);
- Model sea level rise to predict the area size that is likely to be impacted by a higher sea level and explore, develop and pilot adaptation measures;
- Conduct ecosystem vulnerability assessments;
- Model and forecast future changes in biodiversity and ecosystems due to climate changes and develop adaptive responses;
- Document economic benefits of biodiversity and ecosystem services and how these are threatened by climate change and develop adaptive responses; and
- Identify priority species threatened by climate change and undertake focused research and conservation measures.

Adaptation Theme 2: Water security identifies the following specific research needs: Monitor changes in water quality and quantity available for drinking; and model and forecast future water changes due to climate change. **Adaptation Theme 3: Human Health and Well-Being** has the following research needs: Identify the implications of climate change on human health and well being; Review outreach programmes to include areas that are vulnerable to climate change related health risks; and Assess the impact of floods and other climate change related disasters on the provision of sanitary services. **Adaptation Theme 4: Infrastructure** also has research needs such as: Develop climate change infrastructure risk assessment methodology and conduct climate change risk assessment studies as well as define the risk for various infrastructures for each sector; and Investigate structural and non-structural causes of water logging in the context of draining capacity of urban areas in major cities and towns (such as Windhoek, Oshakati, Katima Mulilo etc.).

Mitigation themes also have identified research needs. **Mitigation Theme 1: Sustainable Energy and Low Carbon Development** identifies the following research needs: Investigate future energy needs of Namibia and choose the most cost effective energy supply; Research and invest in harnessing wind energy, particularly in coastal areas; Undertake feasibility studies for tidal and wave energy, geothermal energy, energy from biomass and solar heating technologies for domestic use**;** Collect and monitor accurate data regarding GHG emissions from the agricultural sector; Conduct an assessment of investment and financial flows to address climate change adaptation in the Land use, Land-use Change and Forestry (LULUCF) sector; and Undertake studies to quantify the amounts of methane produced at waste dump sites in Windhoek and other cities and towns (amongst others – see Appendix E).

Cross-cutting Issues also have identified research needs. For example, **Cross-cutting Issues Theme 1: Capacity building, training and institutional strengthening** suggests the need to pilot aspects of the establishment of a Climate Change Agency that will co-ordinate all aspects of climate change issues in Namibia; and the need to set up appropriate systems for dissemination and distribution of climate change information and research data to interested stakeholders. **Cross-cutting Theme 3**: **Public awareness, participation and access to information** suggests involving local farmers and other stakeholders to provide data on how they cope with the effects of climate change; while **Cross-cutting Theme 4: Action plan for disaster reduction and risk management** suggests the need to undertake vulnerability mapping (using remote sensing techniques and GIS) to delineate areas prone to disasters such as floods and enable identification of adaptation strategies, and to assess the sensitivity of developmental goals and aims of organisations or operations to climate change in order to understand the likely impacts of climate change. **Cross-cutting Theme 7 Action Plan for Technology Development and Transfer** suggests that there is a need to expand technology research, development and demonstration and promote technology innovation, and also to identify and test potential technologies that may be adopted to address adaptation or mitigation in key sectors impacted or likely to be affected by climate change. (See Appendix E for more detail.)

From this, it is clear that adaptation and mitigation practices as planned for in the CCS&AP (GRN 2012b) are highly reliant on research and knowledge (co-) production processes, and that the diversity of these knowledge needs are well articulated in the CCS&AP at a suitable level of detail (see Appendix E).

What is of interest in this analysis (as presented above), is that the national research and knowledge needs (Appendix E) are more nuanced when considered in thematic context. This is an important point to note for knowledge co-production processes, so as not to lose the specificity of the research problems and/or contexts. Of interest too, is a general ***lack of research emphasis into the processes that are to uphold the cross-cutting elements*** *e.g. public awareness is recommended, but no research is proposed to ensure efficacy or innovations associated with public awareness approaches, models etc.* And while research partners are identified, little is said about **what capacity exists for undertaking the research needed.** This mapping study Country Report attempts to shed further light on this issue.

Workshop and questionnaire data also identified research needs related to climate change data and modelling, sea level rise, and ecosystem and biodiversity changes, indigenous knowledge, and macro-economic issues. Similar knowledge needs were identified, captured in Table 3 below. This shows that detailed engagement with the national priority areas by specialists from universities and stakeholder groups provides for a more refined analysis of research needs.

Table 3: Knowledge, research and individual and institutional capacity gaps identified by workshop participants (related to the thematic areas in the CCS&AP)

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Marine biodiversity management **(mining and fishing industries)**	▪ Marine biodiversity knowledge is very limited, more needed for interpreting environmental surveys ▪ Lack of baseline information on environmental impacts ▪ Limited collaboration with other relevant stakeholders	▪ Surveys of marine biodiversity, continuously updated ▪ Processes for collaborative management of marine biodiversity ▪ Environmental assessment	▪ Marine scientists ▪ Monitoring and evaluation expertise	▪ Lack of environmental management systems ▪ Improved institutional arrangements for transboundary marine environmental plans ▪ Institutional structures for improved feedback loops on environmental outcomes
Non timber forest products (NTFPs) **(commercialisation for livelihood diversification, as an adaptation strategy)**	▪ Limited knowledge on how to use NTFPs for livelihood adaptations ▪ Baseline information on key growing specifications for e.g. chillies, naras, dates, olives, Ziminia	▪ Improved adaptive varieties ▪ Agronomic studies on e.g. water demand requirements, most suited soils for growing specific products ▪ Integrated pest management ▪ Assessments of economic potential	▪ Maths and science skills, relating to quality of education ▪ Insufficient traditional knowledge	▪ Enhanced quality of education and applied teaching ▪ Exposure e.g. internship of students ▪ Traditional knowledge to be incorporated into formal education curricula ▪ Financial resources ▪ Recognition of customary rights and rewards for people
Sea level rise, coastal erosion, increased storm activity at sea	▪ Limited knowledge on local impacts ▪ Uncertainty regarding costs of impacts	▪ National and local downscaled projections and modelling of impacts ▪ Economic and strategic assessments	▪ Advocacy skills to keep leaders accountable ▪ Litigation skills ▪ Continuous re-evaluation(constant updating of information-info is outdated and not relevant)	▪ Regulatory issue (need to hold people accountable) ▪ Enhanced disaster risk reduction and management systems ▪ Systems to promote coordinated use of readily available information

Note: Workshop participants also identified individual capacity gaps, and institutional capacity gaps associated with priorities and research and knowledge needs.

Importantly, workshop and questionnaire responses show ***additional research and knowledge gaps*** that are not outlined in as much detail in the CCS&AP (2012) – see Table 4 below.

Table 4: Prioritised needs for CCD, knowledge and institutional gaps and capacity for CCD (identified in the workshop), not reflected in the CCS&AP (as explicit research themes)

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Mainstreaming of environmental awareness and building resilience and adaptive capacity amongst communities for responding to and preparing for climate change	▪ Inadequate knowledge of how information and awareness is used in adaptation practices and for changing behaviour and practice ▪ Inadequate knowledge on how to mainstream environmental education and training into the systems	▪ Investigate how climate change knowledge is used by communities from remote, rural and urban areas ▪ Understand the relationship between awareness and practices better (don't just make assumptions that awareness leads to behaviour or practice changes) ▪ Develop in-depth understanding of the factors that influence (enable and constrain) people's abilities to adapt and use environmental knowledge	▪ Need for trainers with the capacity to integrate climate change development knowledge into existing training programmes for individuals already in the workforce ▪ Need more teachers (and teacher educators) who understand climate compatible development concepts and practices	▪ Improvement of institutions' capacity for mobilising awareness and use of knowledge in practice and for changes in practice ▪ Institutions and teachers need to be more involved in environmental education and EE (with a focus on climate compatible development) should be readily available to all sectors of society ▪ Identification and strengthening of existing networks that contribute to environmental education and CCD education ▪ Improved coordination efforts to avoid duplication ▪ Decentralisation of availing information from Ministry of Environment
Cultural norms and how to bring about cultural and behavioural change	▪ Inadequate knowledge of how cultural beliefs influence social and individual behaviours and possibilities for adaptation	▪ What cultural factors mitigate people's ability to adapt? ▪ What kind of cultural changes are needed for adaptation? ▪ How can cultural change be facilitated? ▪ Gender roles and how CC impacts on these ▪ Cultural change and adaptation capacity ▪ Shifting perspective from seeing CC as a rural issue to making it everyone's problem	▪ Need social scientists such as sociologists, anthropologists and gender specialists who understand and engage with climate compatible development issues and challenges	▪ Social science courses should include a focus on the social and cultural aspects of climate compatible development

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Leadership commitment and political will	▪ Decisions often based on narrow economic factors or politics, not evidence ▪ Appropriate flexible management techniques ▪ Ongoing reflexivity in policy making to re-work and expand on current strategies to adapt to climate change	▪ Studies to explore how to close the gaps between politics and science ▪ Studies on public participation and how to access social justice	▪ Lack of integrity and accountability creates problems ▪ Skills for collaborative research e.g. psychologists and political scientists working together to develop solutions ▪ Skills to engage with power relations	▪ How local realities are accommodated in policies ▪ Constant engagement ▪ Lack of sustainability planning and follow through ▪ Poor balance between managing the dilemma between short and long term gain

Of interest too, is the fact that some of these research and knowledge gaps identified in the workshops (Table 4 above) begin to address the process issues necessary for successful implementation of policies, new technologies and strategies that respond to CCD priorities in Namibia. There was also discussion on qualitative aspects of research needs, for example, there was emphasis on the need for more sophisticated approaches to modelling, evaluating and assessing CCD related concerns, especially to strengthen climate change policy implementation. Additionally, there was discussion on ways of integrating new knowledge into action planning, and into practice. This discussion pointed to a lack of synergy between policy, research and practice. Congruent with the emphasis on sociological / social change related priorities for CCD (Table 4 above), knowledge and research needs are recommended to not only move towards CCD, but also to deal with the social processes necessary to **implement policies and strategies related to CCD.**

A further part of addressing the process question related to CCD policy implementation is a strong analysis of individual and institutional capacity gaps, which are addressed in the following two sections.

3.4.2 Needs analysis: Individual capacity gaps

The Second National Communication (GRN 2011a) notes the need for well-trained scientific, technical and managerial staff that not only understands climate change but is also involved in responses to climate change.

The SNC (GRN 2011a) identifies the following specific capacity building needs:

- **Improved spatial planning**, including town and regional planning and engineering, to include ecosystem requirements;
- **Capacity building for academics and professionals** to apply and interpret climate models and impact models in sectors that are considered critical for the development of Namibia, to build a broader understanding of the vulnerability of various sectors to climate variability and change;
- **Application of economic principles** to quantify/compare the impacts of certain changes and policy interventions to foster fact-based decision-making when allocating very scarce public resources to programmes or interventions;
- Capacity building for the **identification, preparation (incl. design) and appraisal of potential CDM projects** (many projects elsewhere fail to qualify for CDM status due to design shortcomings);
- Capacity building for **local commercial banks** as an important source of clean energy loans and debt funds, and project bundling; and
- Further **theoretical and practical training of renewable energy technologies (RETs) technicians, government officials and NGOs** throughout the country, to make renewable energy technical skills available countrywide. This to be accompanied by capacity support for the adoption of nation-wide regulatory policy to enforce standards for RETs currently perceived as barriers that prevent the roll-out of renewable energy projects in the country.

The **Climate Change Strategy and Action Plan for Namibia** (CCS&AP, GRN 2012b) has a specific objective on capacity building, training and institutional strengthening under *Aspect C: Cross-Cutting Issues 'Theme 1: Capacity building, Training and Institutional strengthening*'. Besides the recommendations for individual capacity development made under this theme of the CCS&AP, there

were many other recommendations for individual capacity development, embedded in the other themes of the CCS&AP (see Table 5 below), which were expanded upon in the workshop, and in questionnaires.

Table 5: Individual capacity gaps identified in CCS&AP, supplemented by workshop and questionnaire data (GRN 2012b)

Aspect A: ADAPTATION

Theme 1: Food Security and Sustainable Resource Base

- *Rural communities:* Strengthen information sharing on resilient seeds for climate change adaptation, aquaculture, community-based natural resource management, and other adaptation strategies amongst rural communities
- *Research scientists:* Build capacity of research scientists to undertake research on crop varieties that are climate resistant and resilient; and research on climate change impacts on the livestock industry
- *Women:* Ensure full participation of women in securing food (from a diversity of strategies)
- *Coastal communities and coastal zone management stakeholders:* Raise awareness amongst coastal communities on climate change, and develop action competence of communities and coastal zone management practitioners to lead and participate in adaptation strategies
- *Foresters and forest management experts:* Capacity for addressing deforestation and forest management is needed
- *Natural resource managers:* Capacity for conservation and sustainable management approaches to enhance carbon stocks is needed

Theme 2: Sustainable Water Resources Base

- *Training at different levels:* Develop and undertake training programmes at different levels i.e. household, community and watershed management levels

Theme 3: Human Health and Well-being

- *Health care workers:* Disseminate the impacts of climate change and human health and well-being to all health care workers in health care centres
- *Vulnerable populations:* Review outreach programmes to include areas that are vulnerable to climate change and related health risks
- *General community:* Raise awareness of sanitation

Theme 4: Infrastructure

- *Infrastructure sector specific experts*: Train sector specific experts in infrastructure to apply risk assessment methodologies
- *General community*: Raise awareness about the guidelines and preferred protection options for the protection of coastal infrastructure; and for preparedness programmes and climate proofing

ASPECT B: MITIGATION

Theme 1: Sustainable Energy and Low Carbon Development

- *Agricultural extension services*: Initiate and support agricultural extension services to popularise new agricultural practices that will contribute to GHG reduction at local and commercial farm levels
- *Land use resource users (including women):* Empower local level and other land resource users including women to conduct land use planning
- *Waste management stakeholders:* Empower waste management stakeholders to make use of better technologies, innovation and communication.

Theme 2: Transport

- *General consumers and private sector:* Encourage fuel switching, for instance to use of LPG and regular vehicle testing

ASPECT C: CROSS-CUTTING ISSUES

Theme 1: Capacity Building, Training and Institutional Strengthening [institutional strengthening is dealt with in the next section]

Strengthen human resource capacity building for climate change, focussing specifically on:

- *Climate change policy, planning and management stakeholders:* Support capacity enhancement of stakeholders involved in CC planning, policy, management, programme and project formulation and implementation
- *Environmental engineers, agriculturalists, meteorologists and foresters:* Develop targeted courses or short courses on climate change [and CCD] tailor-made for these key occupations
- *Extension agents:* Provide training for extension agents to use climate data and climate change related research results
- *Youth and student population:* Integrate climate change into school, tertiary and Vocational Training Centre curricula; develop learning and training programmes on disaster risk reduction in schools and institutions of higher learning
- *General public and communities:* Support annual activities on climate change issues or topics; promote community-based training on disaster risk reduction
- *Journalists:* Build capacity of, and train mass media journalists in CC issues and reporting; and expose journalists to CC negotiations and agreements, and to scientific meetings on CC. Improve the interface between journalists and scientists and support media networking
- *Government officials:* Assess disaster risk reduction human resource capacity at all levels of government and develop training programmes for disaster risk reduction and preparedness
- *NGOs, civil society and private organisations:* Develop training programmes for NGOs, CSOs and private organisations on CC [and CCD] in collaboration with research centres and universities

Theme 2: Research and Information Needs, including how to use climate change information

- Researchers and research skills: As shown in section 3.3.2 above, this Theme identifies important areas for research on CC and CCD. However, nothing is said about building and developing the research skills to undertake these new areas of research. The only mention is to 'build capacity' for estimating the cost of adaptation and mitigation.

Theme 3: Public Awareness, Participation and Access to Information

- *Farmers and general public:* Sensitise farmers and general public on what CC is and how CC affects their daily lives; encourage participation in national CC days and events
- *Policy makers:* Conduct CC awareness seminars / workshops for various stakeholders such as policy makers (MPs), Permanent Secretaries, Directors of Government Departments
- *Private sector:* Conduct CC awareness seminars / workshops for various stakeholders in the private sector
- *Media:* Invite media to attend and cover organised national and international climate change public education events
- *Professionals:* Support attendance of professionals and national and international climate change workshops / seminars and conferences.

Theme 4: Action Plan for Disaster Reduction and Risk Management

- *Weather forecasting professionals:* Training of human resources to enhance forecasting of weather and use of early warning systems
- *Communities:* Undertake awareness building programmes at community level on early warnings, how to respond appropriately; and how to be more prepared for disasters and risks
- *Local governments and community organisations:* Train local communities and other stakeholders and support organisations on shelter management, search and rescue, first aid and health issues related to disaster management

Theme 5: Financial Resource Mobilisation and Management

- *Adaptation and mitigation cost assessors:* Develop human resources for adaptation and mitigation cost assessments
- *Climate fund resource managers:* Provide financial and technical support for capacity building and management of resources earmarked for climate change mitigation and adaptation

Theme 6: Action Plan for International Cooperation and Networking

- *Scientific and technical experts:* Encourage exchange of scientific and technical experts and secondment of personnel on climate change issues; support their participation in national and international climate change conferences and workshops
- *Government officials*: Develop capacity for timely reporting on climate change in national and international forums

As can be seen from the above CCD involves individual capacity development amongst a wide range of societal actors. A few of these are worth mentioning in more detail, given the attention placed on them in the national workshop:

- ***Training of researchers / scientists***: As noted above in Tables 3 and 5, while a theme on research is included in the CCS&AP, the training of researchers/ scientists is not prioritised. Workshop data emphasised the importance of **training and capacity building of scientists and researchers to take up and respond to the new scientific demands that are being created by CC and CCD.** It was said in the workshop that such training should be oriented to a) understanding CC science, impacts and vulnerabilities in different sectors; b) the contributions of different disciplines to adaptation and mitigation; c) how to conduct collaborative research; and d) how to establish inter- and transdisciplinary research programmes that also had community-based and societal benefits and outcomes. Research capacity for adaptation in agriculture and health were noted specifically. Social sciences / cultural studies research capacity was also noted, including capacity of political sciences and educational sciences for increased engagement with CCD and CCD research and capacity building.
- ***Curriculum developers***: Capacity for designing new courses and programmes that address CCD in various disciplines was also identified as an individual capacity gap, especially for using multi-, inter- and transdisciplinary approaches to teaching and curriculum design and implementation.
- ***Youth***: The CCS&AP does not make much mention of youth. This category was however emphasised in the workshops and in questionnaire data, especially for general orientation to CCD but also to practical citizenship roles and actions for youth.
- ***Local government officials***: The CCS&AP broadly recognises the role of local government, but workshop participants emphasised the important role they play as mediators of knowledge, and in supporting local communities to adapt and participate in practical mitigation activities.
- ***Political leaders and political parties:*** This category was also prioritised in the workshops and questionnaire data especially for leadership and ethics training related to CC and CCD. Leadership and co-ordination of activities was needed.
- ***University leaders***: This category was also prioritised in the workshops and questionnaire data, especially for engagement around research leadership and new forms of teaching, learning and research that are necessary for engaging with CC and CCD issues.

- ***Environmental educators and trainers***: Capacity for environmental educators to mainstream CCD through environmental education approaches was also needed.
- ***Financial and technical managers***: Financial and technical management for CCD policy implementation were also identified as capacity gaps.
- ***Specialist scientists***: e.g. marine scientists, non-timber forest management scientists etc.

Further perspective on individual capacity gaps can be found in a short review of capacity needs identified in Namibia in 2010 by the SADC REEP (2010) outlined in Box 1 below. This analysis identifies a number of additional specialist skills such as environmental economics, environmental law, and biostatistics which were not identified in any of the other data sources used to construct this needs analysis.

Box 1: Capacity Needs identified in Namibia by the SADC REEP (2010)

In 2010, the Southern African Development Community Regional Environmental Education Programme (SADC REEP) assessed the capacity of SADC and its member states to implement Multilateral Environmental Agreements (MEAs), including the United Nations Framework Convention on Climate Change (UNFCCC). It identified the following climate change related priority skills:

- Climate change modelling and reporting;
- Climate change mitigation and adaptation (e.g. land use and forestry management to enhance carbon sinks, and harnessing the country's vast solar energy);
- Clean and renewable energy development (e.g. absorbing clean technologies from outside the country);
- Biostatistics;
- Environmental economics; and
- Environmental law.

Leadership and integrative skills also need to be improved for managing talent, complex environmental issues and competing stakeholder interests. The priority integrative skills identified were: stakeholder engagement, negotiation at international level, multiple sector coordination (e.g. creating synergies among climate change sensitive sectors) and mainstreaming climate change into national policies and strategies. Information management and use, and technology transfer were also identified as priority cross-cutting skills.

3.4.3 Needs analysis: Institutional capacity gaps

Namibia's Second National Communication identifies the need for institutional capacity building in a range of key areas. This includes the need for capacity building of boundary organisations to facilitate climate change feedback loops between science institutions, policy makers, and land users, noting that this requires capacity to access, interpret, translate and communicate climate change science and concomitant local level indicators. Climate change research must be properly coordinated and the benefits optimised to meet the needs of policy makers in Namibia. The National Climate Change Policy makes provision for international cooperation, collaboration and networking

to achieve effective responses, including the promotion of international North-South and South-South collaborative research that will facilitate generation of climate change adaptation and mitigation evidence-based information. Attention must be focused on projects that will assist with mitigation of, and adaptation to climate change, and address specific areas of vulnerability. Further, development and demonstration projects are required to show the advantages and acceptability of a variety of technologies. Public awareness raising using accurate up-to-date information is required to empower stakeholders, especially local subsistence and commercial farmers, to participate in adaptive response activities. The SNC (GRN 2011a) further highlights the need for institutional structures that are adequately equipped and able to provide facilities and finances to support climate change programmes and activities.

The Namibian Climate Change Strategy and Action Plan for Namibia (GRN 2012b) provides further detail on the kinds of institutional capacity gaps that exist in Namibia for CCD. These are listed in Table 6, with additional insights from workshop and questionnaire data following Table 6.

Table 6: Institutional Capacity Gaps identified in the Namibian Climate Change Strategy & Action Plan for Namibia (2012)

Aspect A: ADAPTATION

Theme 1: Food Security and Sustainable Resource Base

- *Enabling scientific environments:* Create enabling research environments for scientists to undertake climate resistant crop varieties research, and research on climate impacts on the livestock industry
- *Institutions for undertaking livestock research:* Strengthen scientific institutions for undertaking climate resilient livestock research
- *Supply of seeds:* Enhance capacity for supply of climate resilient seeds to farmers in communities
- *Awareness raising /extension services in rural communities*: Strengthen mechanisms for ongoing dissemination of information and awareness raising and practice guidance for adaptation and resilience to climate change in rural communities
- *Regional contingency planning*: Strengthen institutional capacity for regional contingency planning
- *Veterinary services*: Strengthen veterinary services, including animal health measures to address likely increase in disease prevalence due to climate change

Theme 2: Sustainable Water Resources Base

- *Integrated water resources management planning:* Develop and implement IWRM plans that include water and land use planning
- *Water governance and decentralisation of IWRM:* Decentralise management of water to catchment management zones and improve water governance through increased co-ordination and collaboration between various water sectors such as drinking water supply and sanitation, irrigation and ecosystem maintenance
- *Conflict resolution:* Develop agreed upon procedure for conflict resolution regarding water use and management

Theme 3: Human Health and Well-being (or Security)

- *Preparedness and contingency planning:* Develop a preparedness programme and contingency plans for time of floods for health services
- *Health facilities in vulnerable areas*: Improve health facilities in areas that are vulnerable to health risks to enable them to cope with the predicted health risks
- *Sanitation facilities and planning*: Provide sanitary services or alternatives where there is a lack of services and develop disaster management plan for provision of sanitary services when needed
- *Transport planning and social grant access*: Put in place transport measures to allow vulnerable people to access social grants during flood disaster periods (especially consider women and children at such times)

Theme 4: Infrastructure

- *Climate change risk preparedness and infrastructure planning:* Develop climate change infrastructure risk preparedness plan and response and integrate CC risks in the design and implementation of infrastructure development plans
- *Town and regional planning:* Design and invest in improvements in the drainage capacities of flood prone cities / settlements
- Guidelines and regulations for infrastructure protection of infrastructure: Develop and disseminate these guidelines with stakeholders
- *Rehabilitation and climate proof design capacity:* Rehabilitate and improve existing infrastructure to be more 'climate proof' and design and construct infrastructure that is climate resistant and resilient (climate proofed)

ASPECT B: MITIGATION

Theme 1: Sustainable Energy and Low Carbon Development

- *Policies, investments and incentives:* Improve energy efficiency in domestic and commercial sector (including agriculture and industrial processes) and the transport sector through appropriate policies, investments and incentives
- *Renewable energy technology and energy efficiency capacity:* Understand and address techno-economic, social and institutional constraints and build capacity for adoption of renewable energy technologies (including biomass, wind, solar). Promote and develop production approaches that ensure energy efficiency.
- *Environmental Management Systems and Standards development:* Promote and implement EMS and apply standards that integrate reduction of GHG emissions
- *Community Forestry:* Develop, support and expand community forestry
- *Waste Management System Design:* Improve design and functioning of rural and urban waste management systems and use of biogas products (methane)

Theme 2: Transport

- *Climate resilient transport infrastructure:* Including analysis of options, development of new standards and regulations, consultations with stakeholders, technology and consumption incentives etc.
- *Transport service provision quality:* Improve quality of transport service provision
- *Public transport system innovation:* Including affordability, access, transport pathways development, zoning systems, and provisioning of viable alternatives

ASPECT 3: CROSS-CUTTING ISSUES

Theme 1: Capacity building, training and institutional strengthening

- *Mainstreaming CC into development planning:* Integrate CC in local, regional, national and sectoral policies, plans and programmes of development action
- *Mainstreaming CC into Co-ordination*: Support inter-ministerial and inter-institutional co-ordination at various levels of government and other organisations on climate change related issues. *Workshop data noted that this should include leadership aspects.*
- *Organisational restructuring and reform:* Undertake organisational restructuring and reform and strengthen key government (e.g. Ministry of Environment and Tourism) and other agencies that deal with CC related issues; establish new organisations or departments to address CC adaptation or mitigation. *Workshop data indicated that mechanisms that facilitate greater co-operation between different organisations should be put in place.*
- *National Climate Change Agency:* Establish a new CC agency / organisation that will co-ordinate all CC issues in Namibia (piloted)
- *Data management and dissemination (Knowledge Management):* Co-ordinate generation, processing and storage of CC information, facilitate access to the information, and ensure successful dissemination

Theme 2: Research and information needs, including how to use CC information

- *Monitoring systems and organisations*: Set up monitoring systems and support institutions that are engaged with monitoring (e.g. Namibia Environmental Observatories Network); and develop and support participatory monitoring systems; ensure effective reporting of data to communities for decision making
- *Data collection stations and modelling:* Develop new and strengthen existing data collection stations to monitor sea level rise and salinity along the coast of Namibia; expand modelling capacity. *Workshop data noted that strategies to more effectively use existing data are also needed, especially strategies for co-operatively using data across institutions (e.g. local government and universities)*
- *Research institute and network:* Establish a research institute and/or network for research on CC and impacts of CC and adaptation; develop database, web portal and training programmes. *Workshop data indicated that such an institute should include objectives of building scientific capacity (i.e. it should have a postgraduate focus, and should be multidisciplinary).*
- *Costing models and financial instruments:* Develop appropriate costing models that can be used for costing adaptation and mitigation. *Questionnaire data indicated that this should be accompanied by appropriate financial instruments and processes.*
- *System models and impact analysis*: Develop and use system and sector wide models and approaches for macro-economic sectoral impact analysis.

Theme 3: Public awareness, participation and access to information

- *Communication strategy:* Develop a CC communication strategy that can service all sectors and stakeholders
- *Knowledge dissemination structures and approaches:* Materials development, translation of information into vernacular, demonstration project development, copyright free materials production, and involvement of the media are all aspects of knowledge dissemination that need to be addressed

Theme 4: Action Plan for Disaster Reduction and Risk Management

- *Regional early warning systems and climate information centres*: Establish such centres, and train human resources to generate and work with early warning information and forecasts
- *Preparedness of emergency services:* Improve capacity and preparedness of emergency services (e.g. police, health personnel) to respond effectively and in time
- *Risk reduction systems*: Develop effective risk reduction systems (e.g. insurance schemes)
- *CC impact and risk assessment programme:* Develop a national programme that uses decision making tools that are user friendly

Theme 5: Financial Resource Mobilisation and Management

- *Funding mechanisms development:* Funding mechanism developed to support implementation of CC activities including cost analysis of adaptation and mitigation, development of projects under designated donors and UNFCC (e.g. GEF/SGP, GCF, CDM) etc.; including CC in annual budgeting; partnerships with private sector; and development of financial and technical capacity and skills
- *CC resources management system:* Effective and efficient system for management of resources; funds and financial management accountability; capacity building; enabling access to resources etc.

Theme 6: Action Plan for International Co-operation and Networking

- *Directory and network development:* Develop a directory of organisations and individuals, listing experience and expertise related to CC; initiate and build an active network of CC stakeholders; support existing networks (e.g. NaNEON) and the Long Term Ecological Research Network (ILTER)
- *Exchange / conferencing funding mechanism:* Establish mechanisms to support local and international conference participation, and technical skills exchange, and international collaboration
- *Collaborative research infrastructure and partnership mechanisms*: Identify areas of N-S and S-S collaborative research, and access funding and other support mechanisms to facilitate such research

Theme 7: Action Plan for Technology Development and Transfer

- *Technology development, research and demonstration capacity:* Develop technology to improve crop yields and livestock production, energy efficiency, renewable energy, CDM projects, international partnerships for technology development and IP management and protection
- *Technology transfer structures and mechanisms:* Structures for identifying and testing new technologies, CDM project technology transfer projects, IP management and protection, partnership building

Workshop and questionnaire data identified a number of additional institutional capacity gaps (additional to what were identified above). These related to the themes of research capacity building and it was said that there was a need to establish more enabling research infrastructure and systems that facilitate multi-, inter-, trans disciplinary and collaborative research. Here the issue of researcher capacity building, and opportunities for youth to come into the research stream were discussed e.g. via exchange programmes and internships.

Discussion also centred on institutional issues associated with educational quality, and it was said that the wider system of education needed strong interventions to improve the quality of education, especially maths and sciences, curriculum development and teacher capacity for addressing new issues such as CCD. It was also said that there is a need to incorporate traditional knowledge systems more effectively into education, and to engage seriously with the issues of mainstreaming of climate change and environment into the education and training system, and to build adequate capacity to do so amongst curriculum developers, educational leaders and teachers.

Other institutional needs discussions were focused on the efficacy of political structures, which tend to foreground short term decision making instead of the longer term decision making windows that are needed for CCD, and which tend also to lack accountability mechanisms and feedback loops. This was said to be related to inadequate leadership development structures and interventions. Also noted was a lack of adequate sustainable development planning, and a lack of follow-through to ensure sustainable development.

A fourth area of institutional need discussed in the workshops was related to financing mechanisms for social change, and for climate responsiveness. And this in turn was linked to the lack of efficacy of regulatory systems and a general lack of close alignment between policy and realities on the ground.

4 INSTITUTIONAL ANALYSIS

4.1 Introducing the institutional analysis

This section describes the current responses of different institutions (higher education, government, NGO/CBO, private sector) to addressing climate change and promoting CCD, within the broad context of the above-mentioned research, knowledge and capacity gaps. Core emphasis is placed on higher education institutions, as it is widely recognised that they have an important role to play in research, education and training, and in providing policy and strategy support and leadership for development.

The institutional review begins by mentioning wider institutional arrangements for addressing climate change and moving towards CCD, and any relevant research and development frameworks. It then goes on to discuss some of the current climate change and CCD initiatives and programmes that are taking place in Namibia, and identifies some key stakeholders that could form part of a Namibian CCD knowledge co-production framework.

Following this, it examines understandings of CCD amongst stakeholders and university staff, and then begins to probe research practice and capacity, as well as curriculum, teaching and learning programmes and capacity in the higher education sector. From there, it also considers other aspects of higher education interaction with climate change and CCD, namely community engagement, student involvement, policy engagement and campus sustainability initiatives.

4.2 Policy and institutional arrangements

4.2.1 Policy and institutional arrangements governing higher education in Namibia[11]

Higher education was developed in Namibia in the early 1980s. Before that, students attained tertiary education outside of Namibia. In the mid-1980s an academy was established comprising university components, technical colleges and colleges for out-of-school training. After independence the components of the academy were transformed into two higher education institutions, the University of Namibia (UNAM) (established in 1992) and the Polytechnic of Namibia (established in 1994). Higher Education in Namibia is primarily governed by the Namibian Higher Education Act of 2003 (GRN 2003). Namibia has statutory bodies that help regulate and ensure the quality of higher education in Namibia. The main one is the National Council for Higher Education (NCHE), which was established by the Education Act of 2003. The Namibian Quality Authority (NQA) supports quality enhancement in Namibian higher education.

Almost all students in Namibia (93 percent) are enrolled in the two public higher education institutions. The private sector accounts for only a small percentage (7 percent) of student

[11] This short summary is derived from a SARUA 'Country Profile' publication by Mahlaha, N. 2011. *Chapter 10: Namibia. A profile of Higher Education in Southern Africa. Volume 2.* (www.sarua.org).

enrolments. There is generally a high demand for higher education in Namibia with only about a third of applicants being accepted due to space constraints (SARUA, drawing on 2010 data). The demand for postgraduate studies is also high, with only a little over half of postgraduate applications being accepted. Total enrolment in the 2009/10 academic year was 22 698 students (SARUA 2011). The Namibian public universities reported having 858 academic and research staff, the majority of whom are national citizens (93.4 percent)[12]. Approximately 43.1 percent of staff are female, and the majority of academic and research staff at UNAM have masters and doctorate degrees, but the majority of staff at the Polytechnic of Namibia have undergraduate degrees as their highest qualification. Research outputs at the University of Namibia are increasing, and the institution encourages research activity. Young academics are encouraged to participate in research under mentorship of senior researchers. The university receives 66.4 percent of its research funds from the government, 21 per cent from private individuals and trusts, and only 2.4 per cent from international funders. In 2010, 98 peer reviewed journals were produced by academics and the following numbers by UNAM in 2010 and 2012:

Table 7: UNAM publications: 2010 and 2012

Publication	2011	2012
Journal papers	137	168
Books	18	19
Chapters in books	24	35
Conference papers	nd	145

The Polytechnic is not a research-focused institution at present, and its records of research are said to be sketchy (Mahlaha 2011).

4.2.2 Wider policy context for climate change

The Namibian government was a signatory to Agenda 21, the Johannesburg Plan of Implementation and also participated in the Rio+20 Earth Summit, thus committing the country to sustainable development, within which the country's climate change policy approach lies. Namibia's National Climate Change Policy (NCCP) (GRN 2011b), completed in 2011, calls for enhanced synergies between sectors, with every sector required to prepare and implement a sector strategy to address the impacts of climate change. This includes the higher education sector. No evidence of such a sectoral strategy for Higher Education was found during the mapping study.

In addition to the Second National Communication to the UNFCCC (GRN 2011a), an Investment and Financial Flows (I&FF) assessment has been completed, and a Climate Change Vulnerability and Adaptation Assessment for the country's Biodiversity and Protected Areas completed (2008). The I&FF describes and quantifies the implications of national policy options to address climate change in the country's energy and land use, land use change and forest (LULUCF) sectors – identified as

[12] The University of Namibia in 2013 has 570 academic staff.

Namibia's key sectors for enhanced mitigation and adaptation activities. Namibia's Fourth National Development Plan (NDP4), covering 2012/13 to 2016/17, identifies climate as one of its six priority issues with potential to diminish the country's relative competitiveness.

The Climate Change Strategy and Action Plan for Namibia (GRN 2012b) identifies four key thematic areas for Adaptation, two key thematic areas for Mitigation, and seven cross-cutting thematic areas, as outlined in the Needs Analysis section above. Activities and partner organisations are identified to assist in the implementation of the strategy, which has been developed as a tool to implement the National Climate Change Policy (NCPP). As mentioned in section 3 above, UNAM and the Polytechnic of Namibia are seen as important research, policy implementation and capacity building partners in Namibian climate change policy and strategy implementation.

While Namibia has a strong policy regime for CCD, there is also recognition that while Namibia had made significant progress with regard to its CCD policy development, this process was far from complete, and that there was a need for ongoing, reflexive policy making, as stated by one workshop participant who said:

> *"Policy formulation will become a critical issue in this process. We are talking about low carbon development, but this needs to be guided by policies and strategies."*

4.2.3 Institutional arrangements for Climate Change

The Cabinet of Namibia is the Government agency with overall responsibility for all climate change policy decisions, with relevant advice provided by the Parliamentary Standing Committee on Economics, Natural Resources and Public Administration. The Ministry of Environment and Tourism (MET), responsible for all environmental issues in the country, is the climate change coordinating Ministry, through its Climate Change Unit (CCU), and oversees the country's obligations to the UNFCCC. The CCU is supported directly by a formalised multi-sectoral National Climate Change Committee (NCCC) for sector-specific and cross-sector implementation and coordination advice and guidance. The preparation of Namibia's SNC drew on relevant stakeholders such as central government, academic and research institutions, and non-governmental organisations. In addition to the restructured National Committee on Climate Change (NCCC), Namibia has established a National Designated Authority (DNA) office for Clean Development Mechanism (CDM) projects. Following on from the National Policy on Climate Change (NPCC), which was launched in 2011, is the 2012 Climate Change Strategy and Action Plan for Namibia (CCS&AP), of which a revised version became available in November 2013. Institutional arrangements for the implementation of the CCS&AP are within the boundaries of the NPCC. The CCS&AP aims to facilitate implementation of the NPCC. The University of Namibia and the Polytechnic of Namibia are both seen as important contributors to the ongoing development and review of this policy, as well as its implementation. The Multidisciplinary Research Centre at UNAM, for example, had representation on the National Climate Change Committee until March 2013 and the Department of Geography, History and Environmental Studies now represents the entire University in the National Climate Change Committee.

4.3 Research and development frameworks

Namibia's main framework for research and development appears to be the Research, Science and Technology Act (2004), which provides for the establishment of a National Commission on Research, Science and Technology and an associated research fund. The National Commission on Research, Science and Technology (RS&T) has specific functions which are: coordination, monitoring and supervision of RS&T in Namibia, promotion and development of RS&T in Namibia, promotion of common ground in research, scientific and technological thinking across all the disciplines, encouragement and promotion of innovation, enhancing the RS&T agenda setting processes and prioritisation of systematic funding for RS&T including the promotion of linkages, networks and strategic alliances at national, regional and international levels.

Research regulations emerging from the RS&T have recently been published, but appear to be contested and are said to be restrictive. The main university institution that is connected to the provisions of the Act is the Multidisciplinary Research Centre (MRC) of the University of Namibia. It was established to conduct basic and applied research in national priority areas; conduct human and institutional capacity building in national priority areas; and coordinate the implementation and management of research and development activities, product development, innovation, value addition and patenting. The overall vision of the national research policy (which includes the contribution of the MRC) is to transform Namibia into a Knowledge Based Society. The Climate Change Strategy and Action Plan for Namibia (CCS&AP) describes the possible development of a national research centre / network to co-ordinate climate change research. It was not clear whether the MRC would fill this role, of if another centre is envisaged.

The CCS&AP also identifies the following potential sources of funding for implementation of the strategy (which would include the research and capacity building objectives):

- **National level funding** (including national budget funding, and the government Environmental Investment Fund). It is envisaged that government will provide at least 70 percent of the funding needed for adaption and mitigation, through a multi-sectoral approach (which would include higher education).
- **Multilateral funding**[13] especially funding available under the UNFCC
- The Adaptation Fund (which became operational late in 2010) for the funding of concrete adaptation projects and programmes in any sector – water, coastal, food security, agriculture, urban/rural development, disaster risk reduction). Access to funding under this window depends on the country's ability to develop project proposals subject to a country cap of US$10 million. Funding can be accessed at national level through National Implementing Entities (NIEs) for project level grant finance, or by a group of countries nominating a regional or sub regional entity in lieu of an NIE.

[13] Key to all these sources of funding is that they mostly require concrete projects – i.e. implementation on the ground. This is especially so for the Adaptation Fund. These will therefore only be applicable as research funds if the research is integral to concrete projects and their development.

- Global Environmental Facility Funding (GEF), which focuses on global environmental benefit. It funds projects focusing on climate change mitigation, and also supports the development of NAPAs (National Adaptation Strategies). Funding windows include biodiversity, climate change and land degradation.
- Green Climate Fund (GCF) to assist with adaptation and mitigation in developing countries. The fund is yet to be operational, but could potentially provide substantive funding.

There are also other sources of research funding available for climate change research, both from national and international sources. For example, the European Commission provides research funding, as does the African Union, the IDRC, the DfID ESPA programme and so forth. Often co-operative partnerships provide a stronger platform for access to such funds.

4.4 Some current CCD initiatives and programmes

There are a number of climate change- and CCD-related initiatives and programmes active in Namibia. This institutional analysis was only able to identify *some* of these (see Table 8). More comprehensive national analysis would be able to expand the insights into existing active programmes.

Table 8: Some climate change and CCD initiatives and programmes in Namibia

Programme / initiative	Driving agency / department	Focus and time frame	Status / additional comments
Adapting to climate change through improved traditional crops and livestock	Implementer: Ministry of Agriculture, Water and Forestry; Funder: Global Environmental Facility	▪ Implemented in the Omusati north-central region of Namibia, with the aim of reducing vulnerability of farmers and pastoralists to climate change and vulnerability ▪ 2008	Completed. Piloted and rested rural communities' adaptation measures, providing information on climate change and variability to users. Climate change issues were integrated into the planning process.
Building the foundation for a national approach to climate change adaptation in Namibia	Ministry of Environment and Tourism with UNDP Africa Adaptation Programme, funded by the Government of Japan	▪ Develop the institutional, individual and systematic capacity to address climate change risks and opportunities through a national approach to adaptation ▪ 2009–2013	
Climate variability and Change Research Programme	Multidisciplinary research centre, UNAM	▪ Started in 2011. Currently setting up various research programmes (see detail below in section on research taking place)	Beginning to do important climate change research, but is calling for additional capacity building and support, and improved co-ordination.
Let's Act to Adapt Programme	Ministry of Environmental Affairs and Tourism, funded by AAP-NAM, and prepared by Integrated Environmental Consultants Namibia (IECN)	▪ Started in 2010. Involved consultations with farmers and representatives of key constituencies in each region of Namibia. They identified key issues relevant to the regions. Toolkits (materials) provide approaches for community-based adaptation strategies at local level.	The materials provide useful guidance for local level adaptation in the form of participatory tools to identify issues and develop action plans. They fall short, however, on providing guidance on actual structural interventions and how to achieve these to address situational problems.
Environmental Education Policy (in development)	Ministry of Environmental Affairs and Tourism	▪ Policy development in process – needs to be completed and implemented via the EE centres	The analysis in this document could provide further orientation to the EE strategy.
International curriculum development project on land use management	Polytechnic of Namibia in partnership with multiple universities and external funding	▪ Curriculum development project underway	The curriculum innovation process could offer an example.

Programme / initiative	Driving agency / department	Focus and time frame	Status / additional comments
Development of Innovative Science and Technology systems for Sustainable Development. Under the initiative 'Innovative Technology for Enhancement of Production Systems and Management of the Environment' (ITEM) project case studies on climate change adaptation and mitigation were commissioned.	RAEIN-Africa (Regional Agricultural and Environmental Initiatives Networks – Africa (www.raeinafrica.org), a southern African network with a secretariat located at the University of Namibia. RAEIN-Africa operates in all 15 southern African countries.	▪ Based in Namibia (secretariat is based at UNAM), RAEIN-Africa is a network that interfaces science, policy and society using participatory and innovative approaches. It has two main projects: Regulatory Innovation: breaking biosafety boundaries in southern Africa (RIBBB-SA), and Innovative technologies for the enhancement of production systems and management of the environment (ITEM). ▪ ITEM studies commissioned in 2009/10, presented at conference in 2010 and edited into a book in 2011	RAEIN-Africa supported a conference on Mitigation and Adaptation Strategies to Climate Change in 2010 under the initiative 'Innovative Technology for Enhancement of Production Systems and Management of the Environment' (ITEM) project. Studies were commissioned through this project (3 case studies, 5 country status studies, and 8 status papers) – published in the book edited by Namibian scientists (Mapaure et al. 2011)
Energy Mitigation Projects (funded under GEF): Barrier removal to Namibian Renewable Energy Programme (NAMREP) Namibia Energy Efficiency Programme (NEEP) Concentrating Solar Power Technology Transfer to Electricity Generation in Namibia	Ministry of Mining and Energy (MME), with GEF funding. Development agencies from Denmark, Sweden and Finland have also contributed to development of renewable energy.	▪ NAMREP Phase 1 & 2 (2003–2011) ▪ NEEP (2009–2013) ▪ Solar Power project (2010–ongoing)	These projects provide valuable support, particularly in the areas of capacity building, technology transfer, research and awareness raising of renewable energy.

Programme / initiative	Driving agency / department	Focus and time frame	Status / additional comments
National Climate change research	African Adaptation Project Namibia (AAP NAM) – ended in 2013 Ministry of Environmental Affairs and Tourism	▪ Research undertaken and ongoing since the SNC (2010 – ongoing) ▪ Early Warning System (EWS) and EWS information centres study ▪ Dynamic systems modelling to undertake cross sectoral analysis of climate change impacts, climate change adaptation and policy, and adaptation options ▪ GIS climate risk and vulnerability assessment ▪ Climate Change Vulnerability and Adaptation Assessment for Namibia's biodiversity and protected area system (SPAN Project)	From this it is clear to see that the African Adaptation Project (AAP NAM) is an important resource for expansion of climate change research and research partnerships. It also shows that the research agenda outlined above, is being implemented via this mechanism.
Climate Change Awareness Raising and Environmental Education	African Adaptation Project Namibia (AAP NAM) Ministry of Environmental Affairs and Tourism	▪ Ongoing since SNC and since launch of AAP NAM in 2010 ▪ Climate Change Ambassadors Programme (educated over 80 representatives from line ministries, civil society and the private sector) ▪ Youth Action Programme on Climate Change (network, festivals, conferences) ▪ Community Climate Change Adaptation Toolkits for different regions ▪ Dissemination briefs to parliamentarians ▪ Nationwide sensitisation for regional councils, MET staff and extension officers	From this it is clear that the AAP NAM is assisting Namibia to implement some of the capacity building programmes that have been identified as being important in policy and strategy.
Bush encroachment into energy project.	DRFN, with support from the European Commission.	▪ Energy generation from encroached bush. Construction of Namibia's first wood gasifying plant has begun through this project, which is to provide 250kw/h to the electricity grid.	
Climate Change Adaptation and Mitigation Grants to School Environmental Clubs	Ministry of Environment and Tourism	▪ 2011. MET, through the Environmental Education Unit and the AAP-NAM, the UNDP and the Government of Japan provided grants of NS50,000 to ten environmental school clubs to implement climate change adaptation activities.	Most of the projects are focused on school greening, food production and plant diversity; school clean ups and renewable energy use in schools.

Note: The table above is not comprehensive but is illustrative of how some of the issues identified above are already being addressed.

The analysis above shows that the Africa Adaptation Programme for Namibia did focus on research priorities and capacity building priorities as outlined in policy. This provides a basis that, together with GEF funding and other CC research and capacity building funding, could be built upon to develop ongoing support for CCD studies and capacity building.

4.5 Existing status of CCD research, education, outreach and networking in Namibia

4.5.1 Understandings of CCD: National policy, stakeholders and university staff

As shown in sections 3 and 4.2 above, national policy documentation identifies a clear link between climate change adaptation, mitigation and development. It states that:

> *"The goal of the National Policy on Climate Change is to contribute to the attainment of sustainable development in line with Namibia's Vision 2030 through strengthening of national capacities to reduce climate change risk and build resilience for any climate change shocks." (GRN 2011: iv)*

In line with this, the Climate Change Strategy and Action Plan for Namibia of 2012 includes adaptation, mitigation and cross-cutting priorities, showing a commitment to broader institutional changes to support adaptation and mitigation within a national development planning framework, as also outlined above. This understanding is not explicitly stated as CCD, and does not necessarily always recognise the need for simultaneous integration of adaptation, mitigation and development that is central to the concept of CCD, which is very clear in calling for a 'triple bottom line' approach.

However, while national policy recognises the importance of all three aspects of climate compatible development, all stakeholders may not share a clear understanding of the simultaneous integration of the three aspects of adaptation, mitigation and development. Developing a common understanding of the integrative nature of the CCD concept is therefore necessary for knowledge co-production.

Discussion on the meaning of climate compatible development in the workshops centred on the core definition provided by the facilitators:

- Climate compatible development (CCD) is low carbon, climate resilient development – in other words, development that integrates current and future climate risks, adaptation to climate change, and mitigation (or reduction) of greenhouse gas emissions.
- Given uncertainties in climate projections, and the complex manner in which climate change and other drivers such as environmental degradation, globalisation and economic development processes interact, climate compatible development (CCD) necessitates an iterative, learning-by-doing approach, that involves ongoing adaptation.

In general, as expressed during the workshop, sustainable development remains an important context for climate compatible development policy and practice, and provides an overarching goal and direction which is already well developed in policy for CCD. Responses from workshop participants showed their 'meaning making' which involved careful contextualisation into their

particular areas of expertise or operation, shown by the following two responses defining and clarifying the meaning/s of Climate Compatible Development:

- The CETN representative from Walvisbay noted that increased water temperatures mean that certain species of fish will no longer be available for harvest, which translates into: loss of jobs, rise in unemployment, decrease in exports, rise in poverty and negative impact on Namibia's GDP.
- The Environmental Co-coordinator for De Beers Marine Namibia mentioned that with increasing storm swells and storms at sea linked to climate change, anchors will be damaged and mining activities will be disrupted. Her interpretation of CCD was that new and improved technologies in mining will be needed to sustain economic activity.

Of interest here, and important to the development of a knowledge co-production framework, is the contextualised interpretations of workshop participants who tended to focus more on the impacts of climate change on their development activities, than on new pathways for CCD. This shows that making meaning of CCD requires a contextualised form of engagement, and that engaging with issues that influence people may provide a good starting point for such meaning making. Amongst the stakeholders involved in CCD related policy and knowledge mediation activities, different understandings of what CCD would entail exist, as shown by these extracts from the questionnaire data:

- 'Process or action of adjusting to different circumstances or conditions in this case results of climate change. Climate change and responses to it are changing pattern of innovation, trade, production, pollution distribution and risk in complex ways.'
- 'Development plans, policies and programmes that are aligned with the projected impacts of climate change in order to foster adaptation and resilience.'
- 'Development e.g. urban development that is conservative in use of resources – energy, water, materials and emphasis renewable resources. Design is an individual choice so awareness and sensitivity need enhancement.'
- 'After today I understand quite a lot and all of the broader issues such as temperature and water issues. I learned a new word: Climate Compatible Development!'

Within the University of Namibia too, there are different understandings of CCD, as shown by these extracts from the questionnaire data obtained from the university respondents:

- 'The harmonisation of developmental efforts as policies toward climate change in the region.'
- 'Development planning and policies that are tailored with causes and impacts of climate change. Development that reduces community vulnerability, and at the same time increases adaptation and resilience. CCD should reduce climate change impacts (emissions).'
- 'The term CCD is relatively new to me. It seems to be close to the concept of clean development mechanisms (CDM). If so, this is development that takes cognisance of impacts of developments on the environment.'
- 'CCD – Climate compatible development can affect the work that I'm doing. People will be more affected by sickness. Too hot ultraviolet rays affect skin cancer. I understand the term as new development to resist/change of nature concerning global warming.'

- 'I would think it's the same as climate change adaptation strategies. In my work it would mean sharing knowledge in teaching especially in education where the concept of CC is not mainstreamed in environmental education.'
- 'Development that does not harm the environment and does not affect or impact biodiversity negatively. Sustainable development.'
- 'Development that incorporates adaptation and investigations for climate change.'
- 'It's an initiative similar to other initiatives – climate proofing, cleaner development or greener economy. It means development that take cognisance of climate change impacts and that put adaptation strategies in place.'

From this it is possible to see that although understandings of CCD differ amongst and between stakeholders and university staff involved in climate change- and CCD-related work, there is generally a close conceptual association between climate compatible development and **adaptation and mitigation**, and climate compatible development and **sustainable development**. It is also apparent that **the concept of CCD is relatively new** to some of the stakeholders and academics involved in CC-related teaching and research at UNAM. **Context** also has an influence on how CCD is understood, and influences meaning making and understanding of the concept. This has important implications for knowledge co-production processes, and will require careful engagement in development of mutual understanding in such processes.

4.5.2 Current research related to Climate Compatible Development

4.5.2.1 General view

The Namibian National Policy on Climate Change (2011) and other related national CCD-related documents identify a range of priorities for CC and CCD research and knowledge production in Namibia, as discussed in detail in section 3 above. While these documents set an ambitious and multidisciplinary research agenda for CCD in Namibia, they say little about *how* such research outcomes are to be achieved (beyond identifying possible stakeholders). They also provide no information on what research *is already being done.* This section seeks to provide some insight into this question.

A detailed database search of all research published on climate change / sustainable development research in Namibia would provide substantive detail on what research is already being conducted in Namibia. As this fell outside of the scope of this study, it is only possible to show ***some*** of the research that is currently being undertaken on climate change in Namibia.

The Namibian National Report to the United Nations Commission on Sustainable Development (GRN 2012) shows the following recent[14] research-based initiatives for climate change in Namibia (other, earlier studies have taken place to inform the SNC but are not mentioned here):

[14] In this section research, mostly conducted after 2009, is used as referent (i.e.the last five years).

- Case study of Namibia's vulnerability to extreme events, conducted by the GRN in 2009, which included a review of vulnerability associated with the severe flooding events in 2008, 2009 and 2010 in the northern regions of Namibia. This study included a Post-disaster Needs Assessment, which mapped out two pathways for response: better infrastructure development and transforming agricultural practices. A national Climate Risk Management capacity assessment and capacity plan has been put in place (GRN 2009).
- An inter-ministerial research team, led by the MET's Environmental Economics Unit (supported by UNDP), completed two Investment and Financial Flows assessments in 2010/11, which provide detail on the types and amounts of investments needed for climate change adaptation in the agriculture sector, and mitigation in the energy sectors (MET and UNDP 2011a, 2011b). Partners in this research programme included: Ministry of Environment and Tourism, Ministry of Agriculture, Water and Forestry, UNDP and Integrated Environmental Consultants (IECN), Windhoek.
- Various pilot studies (funded by donor organisations) have taken place focussing on adaptation in the highly vulnerable agriculture and livestock centre, including: a pearl millet breeding programme; conservation agriculture and drip irrigation agriculture; household plastic granaries; promotion of indigenous breeds such as Sanga cattle; wildlife stock breeding loan scheme; livelihood diversification options. The GRN notes that results of these pilot projects need to be replicated on a larger scale (GRN 2012).

This shows that various sources of funding and partnership support CCD research in Namibia, including government funding and donor funding. Government funded research feeds directly into policy, and tends to involve both university and government partners, as well as research consultants and international research organisations such as the IIE. Donor funding appears to fund pilot studies in key intervention areas which needs to further funding to be scaled up.

A rapid review of published research available on Google Scholar (first ten articles listed with 'climate change Namibia' in the search) shows the following research conducted on climate change in Namibia. Of interest here is that not many of the researchers involved in publishing research on climate change in Namibia are Namibian.

- Thuiller, W., G. Midgley, G.O. Hughes, B. Bomhard, G. Drew, M. Rutherford and I. Woodward. 2006. "Endemic Species and Ecosystem Sensitivity to Climate Change in Namibia," *Global Change Biology* 12 (5): 759-776 – NO NAMIBIAN AUTHORS OR CO-AUTHORS
- DuPont, L.M., B. Donner, L. Vidal, E.M. Perez and G. Wefer. 2005. "Linking desert evolution and coastal upswelling: Pliocene climate change in Namibia," *Geology* 33 (6): 461-464 – NO NAMIBIAN AUTHORS OR CO-AUTHORS
- Heine, K. 1998. "Climate change over the past 135,000 years in the Namib Desert (Namibia) derived from proxy data," *Paleoecology of Africa and the surrounding islands* 25, S: 171-198 – AUTHOR NOT NAMIBIAN
- Angula, M. 2010. *Gender and climate change: Namibian case study*. Southern Africa: Heinrich Boll Stiftung. NAMIBIAN AUTHOR
- Reid, H., L. Sahlen, J. Stage and 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," Discussion paper 07-02. London: IIED.

- Newsham, A. and D. Thomas. 2009. "Agricultural adaptation, local knowledge and livelihoods diversification in North-Central Namibia," Tyndall Centre for Climate Change Working Paper No 140: pp48.

Literature collected at the workshop shows the following research taking place on climate change in Namibia (all published in a book edited by Mapaure, I., B. Mhango and D. Mulenga (Eds). 2011. *Mitigation and Adaptation Strategies to Climate Change*. Windhoek: RAEIN-Africa). Of the 19 papers in the book (covering southern Africa), four were on climate change in Namibia, and all these were produced by, or partially by Namibian authors. This shows that Namibian researchers are working in partnership with other southern African universities.

- Nguno, A., M. Coetzee, A. Sheehama and N. Hipangewla. 2011. "Status report on biofuels in Namibia". [Researchers are from the Ministry of Mines and Energy (MME) and Polytechnic of Namibia]
- Ruppel, O. 2011. "Climate change, human vulnerability and environmental law related aspects in Namibia". [Researcher at UNAM]
- Mapani, B., P. Chimwamurombe, I. Mapaure, J. Miller and M. Mileusnic. 2011. "Estimation of climate change and adaptation strategies using water, soil and honey as sampling media: examples from Namibia". [Researchers collaborating from UNAM, University of Stellenbosch and University of Zagreb, Croatia]
- Mhango, B. 2011. "Soil information for adaptation to climate change in Agricultural Land Use Systems". [Author from Polytechnic of Namibia]

A review of references used in main national environmental and climate change reporting documents (GRN 2012; GRN 2011 – SNC) reveal the following additional research organisations that are active in producing climate change knowledge. Only analysis of references after 2009, from Namibian research organisations other than government, were included:

- Namibian Association of CBNRM Support Organisations. 2010. *Namibia's Communal Conservancies: A review of progress and challenges in 2009*. Windhoek: NASCO.
- Ruppel, O.C. and L. Ruppel-Schlichting. 2011. *Environmental Law and Policy in Namibia*. Namibia: Hanns Seidel Foundation.
- Integrated Environmental Consultants Namibia (unpublished). "Biotrade: A Catalyst for transitioning to a Green Economy. A country study for Namibia".
- Country Pilot Partnership. 2011. "Taking it one drop at a time: A case study of drip irrigation systems in Omusati Region, Namibia".
- Consulting Services Africa (CSA), LaquaR Consultancy and Lithon Project Consultants. 2009. "Sea level rise in Namibia's coastal towns and wetlands: projected impacts and recommended adaptation strategies". Bundrit, G., D. Nel, L. Fairhurst and A. Cartwright for the Ministry of Environment and Tourism, Windhoek.
- Desert Research Foundation of Namibia (DRFN). 2009. "Review and Update of National Circumstances". Von Oertzen, D., V. Kinyanga, H. Krugmann and E. Dirkx for the Ministry of Environment and Tourism, Windhoek.
- Henrik, S., R. Bloch, F. Stuer-Lauridsen and D. Uushona. 2009. "Strategic Environmental Assessment (SEA) for the coastal areas of the Karas and Hardap Regions". Namibian Coast Conservation Management Project (NACOMA).

- Karuaihe, S., J.K. Mfune, O. Kakujaha-Matundu, E. Naimwhaka and M.N. Angula. 2007. "Millennium Development Goal 7 and Climate Change: Challenges and Opportunities". Namibia: UNDP.

The review of references / analysis of sources used for national environmental and climate change reporting shows that there is a close relationship between Namibian university researchers, consultants, NGOs and international organisations involved in research, and policy development. Most research is in the form of unpublished consultancies, often conducted with or for government departments (e.g. by the DRFN, the Integrated Environmental Consultants of Namibia (IECN), Consulting Services Africa etc.). This reveals that research on climate change and sustainable development in Namibia is **strongly government driven.** It also shows that **not many Namibian researchers are publishing their climate change research** in the peer-reviewed literature, yet they are producing published reports that are being used at national level**.**

4.5.2.2 University-based research

The Namibian questionnaire and workshop data shows a diversity of university faculty and department involvement in climate change related research, amongst others:

Table 9: Diversity of university faculty and department involvement in CC research

Faculty / School / Centre	Department	Programmes / Institutes
Faculty of Science (UNAM)	▪ Statistics and Population Studies ▪ Biological Science ▪ Geology	▪ Environmental Biology
School of Nursing and Public Health (UNAM)	▪ Community Health	
Faculty of Agriculture and Natural Resources (UNAM)	▪ Fisheries and Aquatic Sciences ▪ Department of Integrated Environmental Science	▪ Integrated Environmental Science
Faculty of Humanities and Social Science (UNAM)	▪ Sociology ▪ Geography, History and Environmental Studies	▪ Tourism management ▪ Geo-Information Science
Faculty of Education (UNAM)	▪ Maths, Science & Sports Education	
School of Natural Resources and Tourism (Polytechnic)	▪ Land Management	▪ Regional and Rural Development
Multidisciplinary Research Centre	▪ Social Sciences Division ▪ Life Sciences Division	▪ Climate Variability and Climate Change Programme with three foci (see below)

Note: Table is not complete, and is therefore indicative rather than definitive.

Table 9 above shows both faculty-based diversity and departmental level diversity of participation in CCD related research and teaching at UNAM. It also shows that at UNAM the newly established Climate Change Programme (established in 2010) and the **Multidisciplinary Research Centre** are 'up and running' and are providing key mechanisms for co-ordination and co-operation in CCD-related research and teaching. The MRC has dedicated staff (senior researchers) who are working on climate change- and CCD-related research, which is also where the most CCD focused research is currently

taking place. The table also shows *few dedicated research programmes* at faculty / school level. Workshop and questionnaire data showed that there is research taking place on a number of topics that are related to CCD (see Table 10), including (but not limited to) those outlined in Table 9.

Table 10: Research projects currently being undertaken in response to CC and the need for CCD

Institution, Faculty, Department	Research Project	Researcher/s or Deans / HODs	Type of Research Project
UNAM: MULTIDISCIPLINARY RESEARCH CENTRE (including researchers from Social Science, Humanities, other sciences)	Migration and population disposition and movement / vulnerability and adaptation / gender and health vulnerability related research	Director (MRC): Dr Nelago Indongo Some participating researchers: Margaret Angula / Maria Kaundjua / Simon Angombe / Alfonse Mosimane / John Mfune / Isaac Mapaure	Interdisciplinary research project (Humanities and Social Sciences / MRC)
UNAM: MULTIDISCIPLINARY RESEARCH CENTRE, Life Sciences Division	Climate Variability and Change Programme, Adaptation and DRR research with three key areas: ▪ DRR, vulnerability assessment, capacity development in the university ▪ Impact assessment on existing community based adaptation projects ▪ How indigenous knowledge systems are incorporated into CC activities	Ms Nguza Siyambango (nsiyambango@unam.na) is currently co-ordinating the climate change and vulnerability research programme Ms Margaret Angula (mangula@unam.na) (previous coordinator until March 2013)	Interdisciplinary research project (Life Sciences / MRC), started in 2011
UNAM: MULTIDISICIPLINARY RESEARCH CENTRE Science, Technology and Innovations Division	Has a research theme on renewable energy technologies and management (RET) with the following aims: ▪ Identify, design and fabricate renewable energy-powered technologies (RET) and service solutions ▪ Scientific investigations to understand and optimally manage energy supply systems	Dr Davis Mumbengegwi (Head: Science, Technology and Innovations research programme)	Interdisciplinary research project (with possible links to Polytechnic of Namibia RET research)
UNAM: MULTIDISCIPLINARY RESEARCH CENTRE, Social Sciences Division	Views from the frontline, collaboration with North West University. Research programme focusing on flooding and the impact of flooding on the livelihoods of communities. This extends beyond Namibia and is co-ordinated by NWU with other universities in the region and globally. Three studies done in Namibia.	Gert van Rooy (gvanrooy@unam.na)	Inter-university programme, but seen as a social science programme
UNAM: FACULTY OF	The Faculty of Agriculture and Natural Resources (FANR), Ogongo Campus in the	Head of Ogongo Campus is the	Disciplinary study

Institution, Faculty, Department	Research Project	Researcher/s or Deans / HODs	Type of Research Project
AGRICULTURE AND NATURAL RESOURCES, Crop Sciences Department	North-central Namibia focus their experiments and research projects on crop production, rangeland practices and integrated environmental management. Academic Departments at Ogongo Campus: Department of Crop Science and Department of Integrated Environmental Science The UNAM/FANR-Ogongo Campus in collaboration with Japanese scientists is engaged in a multidisciplinary research on the viability of intercropping pearl millet (mahangu) with flood-tolerant rice cultivars in order to guarantee reliable crop harvest to local farms. This is also a form of livelihood diversification and the project renders institutional support through training, mentoring, information days and distribution of seeds to local farmers. Ogongo is currently pursuing a comprehensive study on the cultivation and utilisation of artificial pasture in the form of Lucerne cultivation to provide fodder to livestock during the dry months as well as drought occurrences. This is then supported by the use of rice and sweet sorghum stalls as animal feed with or without treatment. Ogongo is an active member of the Cuvelai Basin Management committee looking into Integrated Water Resource Management in various sub basins of the Cuvelai drainage basin.	Deputy Dean: Dr J Njunge (Jnjunge@unam.na)	focusing on adaptation practices
FACULTY OF SCIENCE	Research initiative on carbon dynamics in soils and vegetation structure in the Kalahari Ecosystem in collaboration	UNAM partnership with UKZN, ECT etc.	Inter-institutional research programme
UNAM: FACULTY OF SCIENCE, Department of Biological Sciences	Sampling soils, honey and bees in Oshesa, Kwanyo, Umnati regions in Northern Namibia	Project leader: Dr Mapani (bmapani@unam.na) Including, Dr John Mfune – Mammals and bush encroachment / Prof Isaac Mapaure – Vegetation / Prof Ben Mapani – Sediment analysis and hydrology / Prof Percy Chimnamrube – Plant Diversity	Interdisciplinary research project involving Biological Sciences, Plant Sciences, Geology

Institution, Faculty, Department	Research Project	Researcher/s or Deans / HODs	Type of Research Project
UNAM: FACULTY OF SCIENCE, Department of Geology	Use of radio in hydrological studies of aquifers	Prof Ben Mapani (Geology Department) bmapani@unam.na	
UNAM: FACULTY OF ENGINEERING, Civil and Environmental Department	Designed a 'green faculty' in collaboration with CuveWaters	Prof Kavishe (fkavishe@unam.na)	Sustainable campus design / mitigation research project
POLYTECHNIC OF NAMIBIA: School of Natural Resources and Tourism, Department of Land Management	Integrated Land Management Institute (conducts research on sustainable land use management)	Dr Mutjinde Katjiua (mkatjiua@polytechnic.edu.na)	Single disciplinary research project focusing on mitigation
UNAM: FACULTY OF HUMANITIES, Departments of Geography and Sociology	Collaborative research on: ▪ Perceptions of climate change (Kaundjua, Angula, Angombe) ▪ CC and migration ▪ CC and health ▪ CC and gender	Simon Angombe (sangombe@unam.na) Margaret Angula (mangula@unam.na) Maria Kaundjua (mkaundjua@unam.na)	Single discipline research, but interdisciplinary collaboration across departments within the Faculty
UNAM: FACULTY OF SCIENCE, Department of Geology	Variations in Climate Change in Namibia, and their effects on ecosystems.	Prof Ben Mapani bmapani@unam.na	Single discipline research Specialist areas: water, soil and indicators of climatic variations (using bees and tree species as indicators of climate change)

Note: Table is not complete, and is therefore indicative rather than definitive.

Table 10 above shows that the Multidisciplinary Research Centre has three sub-divisions that are engaged with CCD related research:

- The Life Sciences Division – engaged with a research project on Climate Variability and Climate Change Adaptation and Disaster Risk Reduction which has three sub-programmes on DDR and vulnerability assessments; impact assessment on existing CBA programmes; and IK integration into CC activities;
- The Science, Technology and Innovations Division which has a research theme on renewable energy technologies; and
- The Social Sciences Division which has a research programme on flooding and the impact of flooding on the livelihoods of communities.

The table also shows other active interdisciplinary research programmes in the Faculty of Agriculture and Natural Resources where research focusing on crop varieties resistant to drought was found; the Faculty of Science, where research on carbon dynamics in soils and vegetation is taking place; and where an interdisciplinary research programme is underway focusing on soil, honey and bees in CC adaptation; the Faculty of Humanities where interdisciplinary co-operation is taking place between the Departments of Geography and Sociology to research climate change perceptions, and gender and climate change issues. Other research activities were single discipline studies with no evidence of interdisciplinary interaction. This analysis shows that CCD research is taking place in both the natural and the social sciences, but also that interdisciplinary co-operation, while taking place is still emerging as a new area of practice. Most of the interdisciplinary work taking place was within the same faculty, rather than across faculties, as is also shown by the sub-divisions of the MRC.

There are also individual student research projects that reflect an interest in CCD related issues. For example:

- A PhD study on rainfall analysis and patterns, in the Faculty of Science (Innocent Kamwi, PhD scholar – ikamwi@unam.na). This PhD study has led to the formation of a research group on Climate Change in the Faculty of Science.
- A PhD study on urban food security research (staff member registered with UCT), which will also help to strengthen CC research in the Faculty of Science (Ndeyapo Nickanor, PhD scholar – nnickanor@unam.na).

Associated with these research programmes and other smaller scale research initiative are a number of active researchers, who were mentioned in workshop and questionnaire data (see Appendix B). Not all of these researchers are affiliated to the Multidisciplinary Research Centre, and most have three or more years of engagement with CCD related research.

Questionnaire and workshop participation showed that that there is participation of women scientists in climate related questions in Namibia, although Table 10 and the table in Appendix B show that CCD research is currently still male dominated. Most of those responding to the questionnaire had more than 10-15 years experience in their disciplines, but ***few had more than 3-5 years of experience with climate change research*** / climate compatible development research. This appeared to be a new focus for research and teaching in Namibia. Additionally, of those responding to the questionnaire six did not have PhDs, which shows that this is potentially an area for SARUA to focus on i.e. *new research area capacity development, and support CCD PhD research amongst lecturing staff in universities*.

4.5.2.3 Centres of Expertise, Centres of Excellence and Research Networks

TERMINOLOGY USED IN THIS SECTION:

Nodes of Expertise as used in this document refers to 'clusters of expertise' related to a specific CCD related research area, involving at least one high performing academic with postgraduate scholars.

Centres of Expertise refers to already established research centres or institutes most often operating at university level, or between a number of universities with networked partnership links (these may be national or international).

A **Centre of Excellence** as used in this study refers to a multi-institutional partnership framework that addresses a key CCD research area involving multiple universities, and formalised national and international partnerships.

A **Research Network** refers to interest-based research groupings that convene regularly to discuss or debate research or concerns that are relevant to CCD.

Some **Centres of Expertise** in climate compatible research in Namibia were identified as:

- UNAM's Multidisciplinary Research Centre, and associated researchers and faculties at UNAM;
- Polytechnic (Land use and Non Timber Forest Products; Green Energy Technology); and
- Namibia is also in the process of developing a United Nations University linked Centre of Expertise in Education for Sustainable Development.

A **SADC Centre of Excellence** in CCD research is located in Gobabeb, Namibia. The Gobabeb Centre of Excellence is a joint venture between SADC, the Ministry of Environment and Tourism and the Desert Research Foundation of Namibia. The Gobabeb Centre conducts research in a wide range of fields that have relevance to CCD including: archaeology and anthropology, biodiversity and climate change and ecology in its broadest sense. Its research efforts are directed towards understanding the interactions between the environment and human activities, and contributing to the sustainability of those interactions. As a SADC Centre of Excellence, Gobabeb's role is to illustrate technologies that will lead the SADC region to sustainable development. It tests, demonstrates and promotes Appropriate Technologies. Currently the Gobabeb CoE is developing a Hybrid Energy System.

A number of **Research Networks** were identified:

- Namibian Association of CBNRM Support Organisations (NACSO);
- Namibian Environmental Observation Network (NaEON);
- Benguela Current Commission;
- Regional Agricultural Environmental Initiatives Network – Africa (RAEIN-AFRICA); and
- Africa Monitoring of the Environment for Sustainable Development (AMESD).

Consultancy services that are also engaged with research were identified such as: Integrated Environmental Consultants Namibia; Consulting Services Africa (CSA), LaquaR Consultancy, Lithon

Project Consultants. It was, however, not the purpose of this study to identify all consultancies that are contributing to research on climate change in Namibia; these are included here to show that research is being undertaken by such organisations, normally for government, and they often involve university academics in their research programmes and projects.

This shows that research on climate change and climate compatible development in Namibia is undertaken by government, by Higher Education institutions, by associations and networks, by non-governmental organisations and by consultancy groups. A considerable amount of research is undertaken via consultancies involving academics and/or consultancy organisations. This 'research organisation profile' is important for processes of knowledge co-production.

4.5.3 Curriculum innovations and teaching for CCD

Knowledge co-production does not only involve research however. Teaching and curriculum innovation are important facets of a knowledge co-production process. In the context of the University of Namibia and the Polytechnic this is very important, as these are historically mainly *teaching institutions, which are currently expanding their research mandate.*

The nine respondents from UNAM who responded to the questionnaires indicated that there is some existing work taking place with regard to CCD curriculum innovation at UNAM. Questionnaire responses indicate that ***there are few specialist courses in climate change and CCD*** at UNAM, but that CCD issues are being integrated into existing courses, and that there is cross-faculty teaching on climate change and CCD taking place (the MRC appears to have had a big influence on the possibilities for cross-faculty teaching). According to the respondents (who are also seen to be some of the most active climate change- and CCD-related researchers and lecturers in UNAM, ***there is almost no inter- and transdisciplinary curriculum work taking place*****,** and ***only one faculty member reports making use of a strong service learning approach*****.** Courses that develop critical thinking and integrated problem solving skills are generally seen to be present, while there appears to be a mixed response to whether courses include a focus on development of social and/or technical innovation and ethical actions. Climate change work is seen to be partially integrated into examination and assessment work. Staff willingness and staff ability to get involved in CCD related teaching and learning issues is seen to be relatively high.

The following specific courses were identified as being on offer (cited in the workshop discussions and questionnaire data). As climate change is often infused into existing courses, it is not easy to 'detect' climate change content in existing course descriptions, unless the courses are specifically 'named' as climate change courses. Thus it is not simply a matter of reviewing all the courses in an institution. Identification of climate change content in courses thus requires engaging with those that teach the courses. Data presented is therefore limited by this factor.

Table 11: Courses which are oriented towards climate compatible development

Course/s being developed and run	Who is involved[15]	Type and level of course
SCHOOL OF NATURAL RESOURCES AND TOURISM: DEPARTMENT OF LAND MANAGEMENT, POLYTECHNIC OF NAMIBIA No specific CCD courses, but rather infused into courses: ▪ Undergraduate natural resources management courses ▪ Integrated Land Management MSc degree (modules on Deforestation and Global Warming) ▪ Involved in developing postgraduate curricula in sustainable land management involving several universities: (1) Polytechnic of Namibia, (2) Hawasa University, Ethiopia; (3) Makarere University, Uganda; (4) North West University, South Africa; (5) Justus-Liebig University, Germany, (6) Bangalore University (India) etc.	Brian Mhango, Polytechnic of Namibia (Department of Land Management)	Discipline specific Infusion of CC into existing courses Undergraduate and postgraduate (MSc) Inter-institutional International
FACULTY OF HUMANITIES AND SOCIAL SCIENCE: 1) Department of Sociology ▪ CCD included in 2nd year Social Demography course ▪ CCD included in 4th year Sociology of Health course ▪ CCD included in 4th year Rural Sociology course ▪ A special course on 'Sociology of Environment' is offered ▪ Urban Sociology is a new course being introduced in 2014 2) Department of Geography, History and Environmental Studies ▪ CCD integrated into Honours degree in Environmental Management and Governance (4th year) ▪ CCD integrated into Environmental Studies, GIS and Remote Sensing courses (3rd year)	Dean: Prof Kingo Mchombo Deputy Dean: Dr Simon Angombe Maria Kaundjua, Lecturer in Sociology, Faculty of Humanities and Social Science Ms Margaret Angula, Lecturer in Geography and Environmental Studies, Department of Geography, History and Environmental Studies	Discipline specific Undergraduate Infusion of CC into existing courses Discipline specific Undergraduate and postgraduate Infusion of CC into existing courses
FACULTY OF AGRICULTURE AND NATURAL RESOURCES: 1) Department of Fisheries and Aquatic Sciences Some infusion of CC and CCD into existing courses: ▪ Honours Degree in Environmental Sciences (2nd year) ▪ Honours Degree in Aquatic Ecology (2nd year) ▪ Honours Degree in Integrated Coastal Zone Management (4th year) ▪ Honours Degree in Fisheries Management (3rd 4th yr) ▪ Honours Degree in Biological Oceanography (3rd year)	Mr Lineekela Kandjengo, Lecturer and HOD, Department of Fisheries and Aquatic Sciences, Faculty of Agriculture and Natural Resources	Discipline specific Undergraduate and postgraduate Infusion of CC into existing courses

[15] Note: others may also be involved. These are 'initial contacts' as identified in the workshop and questionnaire data. The UNAM and Polytechnic may want to extend this analysis further across their institutions.

Course/s being developed and run	Who is involved[15]	Type and level of course
CCD infused into three undergraduate modules which have a biodiversity focus (some CCD infusion). A more significant component of CCD is needed in the courses. 2) Department of Animal Sciences Offers an MSc in Rangeland Management which is currently not responding directly to CCD priorities or research needs. 3) Integrated Environmental Science Department BSc Honours Integrated Environmental Science Offers undergraduate courses that are not currently responding directly to CCD priorities or research needs. Crop Science Department CCA research taking place into plant diversity (rice species) in the North of Namibia, but it is not clear how this is reflected in courses or teaching. It is known that postgraduate students, who are also staff at Ogongo Campus work on these projects	Mr Muteka (responsible for the MSc in rangeland management) Dr Nduunyema (responsible for IES Department courses) Ms A Ndeinoma (responsible for BSc. Integrated Environmental Science Programme) Dr C. Gwanama (HOD)	Potential to 'do more' with CCD, and to re-focus and re-prioritise curriculum and research options Undergraduate and postgraduate
FACULTY OF SCIENCE: 1) Department of Biological Sciences No specific CCD courses, they include elements of CCD, usually 'in passing' 2) Department of Statistics and Population Studies Cross-faculty and department teaching in the following subjects: ▪ Sociology of Environment course ▪ Rural sociology ▪ Social demographics ▪ Urban sociology (new in 2014) 2) Department of Geology Engineering and Environmental Geology I and II (3rd and 4th year levels) Hydrology, Remote Sensing and GIS	Professor Isaac Mapaure, Research Co-ordinator and Associate Professor, Faculty of Science, Department of Biological Sciences Dr Isaak Neema Dr. Benjamin Mapani (UNAM) Associate Professor	Discipline specific Some 'in passing' infusion of CCD into existing courses Cross-faculty teaching Undergraduate course
FACULTY OF LAW Teaching issues on climate justice and climate and human rights (gender issues are also included)	Dean of Faculty of Law Prof Oliver Ruppel (recently left for Stellenbosch University)	Disciplinary Integration into existing courses
FACULTY OF EDUCATION Integration of some CCD aspects into courses ▪ Environmental education / Education for Sustainable Development integrated into the Bachelor of Education Degree Programme ▪ A postgraduate degree in Education for Sustainable Development is currently being designed (which could include CCD aspects)	Dr C. Villet (HOD)	Disciplinary focus Integration of CCD into existing courses

As shown in Table 11 above, at least five faculties at UNAM, and one School at the Polytechnic are involved in designing courses that integrate CCD aspects, which shows that it is a relevant multidisciplinary area of innovation in the University. There appears to be a link between those lecturers involved in CC related research and curriculum innovations in this area. This shows that the relationship between CCD research and curriculum innovation should be more clearly understood, which implies that there is a need to examine *how research drives curriculum innovation* in new knowledge areas such as CCD in universities.

As can be seen from Table 11, there are as yet, **no dedicated CC / CCD courses at postgraduate level,** and only a few dedicated modules in existing courses. **The dominant pattern of practice appears to be to 'integrate' aspects of climate change and CCD into existing courses**. It is difficult to examine the scope and focus of such integration without a detailed curriculum analysis. The table above also shows that it may be productive to examine CCD integration within *all faculties and all departments* within the university. The university-based questionnaire (especially Section C) in Appendix C can be used for this purpose. The questionnaire will, however, have to be introduced to all staff in the university, preferably at Departmental level to obtain a clearer view of how CCD is / is not being integrated into teaching, and where the 'gaps' are for new development of CCD content into either a) existing programmes or b) design of new programmes. Such a process would need to be led by the Academic Registrar of the university to ensure consistent and comprehensive data.

Teaching methods that were identified as being potentially effective for CCD in courses included:

- Field attachments to CCD projects / adaptation and mitigation projects operated by government and NGO groups;
- Use of picture-based resources (showing pictures of impacts of CC on vulnerable communities);
- Use of case studies to share new research and technological innovations (e.g. crop varieties research being undertaken in the Northern regions);
- Drawing on and referring to actual life experiences related to CC, such as recent flooding in Northern Namibia;
- Field visits to affected areas; and
- Only one questionnaire respondent noted that he actively used service learning as an approach.

Inter- and transdisciplinary approaches to curriculum innovation are discussed in the next section (section 5).

4.5.4 Community and policy outreach

Workshop data shows that university staff are actively contributing to the following policy processes in Namibia:

- The Multidisciplinary Research Centre used to be represented on the national climate change committee until 2009 and it helped to build the bridge between policy and research;
- Multidisciplinary Research Centre staff and associates have been part of the development of the national CC policy, and have also worked on the CCS&AP;
- MRC staff are contributing to AAP work as part of university community service;
- Members of MRC are participating in the National Disaster Risk Committee;

- Participation in technical working groups – Third National Communication Engagement led by GRN and other stakeholders
- MRC staff are participating in consultancy research teams undertaking CC research (via Multidisciplinary Research Centre and the University Central Consultancy Bureau)
- Education Faculty at UNAM is assisting the Ministry of Environment and Tourism to develop an Environmental Education Policy (still needs to be completed)
- At the moment, Department of Geography, History and Environmental Studies (M. Angula) represent UNAM in a Third National Communication to UNFCC (Vulnerability and Adaptation) Working Group. The Department of Fisheries and Aquatic Sciences (Dr S. Mafwila) represent UNAM on the Third National Communication to UNFCCC on a Capacity Building and Cross-cutting issues Working Group.

Questionnaires show that researchers more involved in policy development were those that were a) more experienced with climate change issues (e.g. Dr Mosimane who is heading up the MRC and who has more than ten years experience of working on CC related issues) b) more senior (e.g. Professor Mapaure who is research co-ordinator in the university and who has also been working on CCD related issues), or c) researchers with specialist skills (e.g. Ms Angula who has done research on gender and CC in Namibia).

In general the workshop and questionnaire data showed a low level of community outreach or engagement amongst university staff, and it seemed that where they had time available it was being used for research support to government, or policy outreach. In general there seemed to be few major community engagement activities, but the Department of Fisheries and Aquatic Sciences cited the 'Marine Fisheries (Henties Bay) initiative, and the MRC cited the Climate Variability and Change Programme as having a strong community outreach component.

4.5.5 Student involvement

The School of Nursing and Health Sciences, Department of Biology in the Faculty of Science, the Department of Geography in the Faculty of Humanities, and the Department of Fisheries and Aquatic Sciences in the Faculty of Agriculture and Natural Resources cited higher levels of student involvement in CCD related matters, than other departments who responded to the questionnaire. The following student organisation was cited as having potential for engaging more with CCD issues:

- UNAM Natural Resources and Environmental Science Society which involves students from the Department of Geography, Department of Biology and the Department of Fisheries and Aquatic Sciences.

4.5.6 University collaboration and networking

Researchers responding to the questionnaire and discussions in the workshop identified the following important **research networks** that university staff were either involved in, or that they could become more involved in and that also supported knowledge production and use that is relevant to climate change:

- The Multidisciplinary Centre's research group;
- Regional Agricultural and Environmental Innovations Network-Africa (RAEIN-AFRICA);

- African Monitoring of the environment for sustainable development (AMESD) and the Namibian Environmental Observation Network (NaNEON);
- Benguela Current Commission;
- Etosha Ecological Research Centre;
- Integrated Environmental Consultants of Namibia (IECN); and
- Desert Research Foundation of Namibia (DRFN), and its research station at Gobabeb (a SADC Centre of Excellence).

4.5.6.1 Potential knowledge co-production partners

The institutional analysis also shows that there is a high level of *potential* for knowledge co-production partnerships, and numerous knowledge partners exist for CCD knowledge co-production in Namibia. Table 12 shows these 'mapped' out, with ascribed roles (as per workshop discussions).

Table 12: CCD Knowledge co-production partners (potential, with some already actualised)

Research organisations	Civil society organisations	Private sector	Government	Regional organisations	International organisations
▪ The Multidisciplinary Centre's research group ▪ Regional Agricultural and Environmental Innovations Network-Africa (RAEIN-Africa) ▪ African Monitoring of the Environment for Sustainable Development (AMESD) and NaEON ▪ Benguela Current Commission and DLIST Benguela ▪ Etosha Ecological Research Centre ▪ IECN – Integrated Environmental Consultants of Namibia (contact: Julianne Zeidler) ▪ DRFN – Desert Research Foundation of Namibia, and its research station at Gobabeb (contact: Vivian Kinyanga) ▪ NACSO – Namibian Conservancy Network	▪ Land owners and land owners associations ▪ Citizen Science NGOs ▪ Namibian Environmental Education Network (NEEN) ▪ Namibia Nature Foundation (NNF) ▪ EIA association and consultants ▪ Namibia Natural Resource Management Network ▪ Environmental Journalism Network of Namibia ▪ CETN Coastal Environmental Trust of Namibia ▪ Local Agenda 21 groups (e.g. City of Windhoek) ▪ Traditional leaders ▪ Youth organisations and student societies	▪ Small and Medium Enterprises (Food and Agriculture processing) ▪ Big industries (e.g. mining industries) ▪ Business Associations ▪ NACOMA	▪ National Committee on Climate Change (NCCC) ▪ CDM (Clean Development Mechanism) ▪ Local municipalities and Town Councils ▪ Namdeb Museums ▪ Ministry of Environment and Tourism ▪ Ministry of Mining and Energy ▪ Ministry of Agriculture, Fisheries and Forestry ▪ Ministry of Education ▪ Ministry of Youth / Culture / Gender	▪ SADC knowledge networks (SADC FEWS-NET) ▪ AMESD ▪ SADC programmes and structures (e.g. SADC FNAR, SADC Water, SADC REEP etc.) ▪ SARUA ▪ Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL)	▪ Donor partners (e.g. Norwegian, Finnish, Swedish, DfID etc.) ▪ UNEP ▪ UNDP ▪ Africa Adaptation Network ▪ GEF and Climate Green Fund

Different roles were ascribed to the different partners involved in the knowledge co-production process. For example, **universities** were seen to have important roles to play in mobilising partnerships and co-operation (national and international, and inter-institutional), and in creating a culture of belonging and research, and in seeking ways of motivating, incentivising and rewarding research and innovations – both for staff and students. The **private sector** on the other hand was seen to play a role through offering relevant and appropriate bursaries for training, sharing and using knowledge and expertise, laboratory facilities and other mechanisms that could enhance research. **Donors** were considered to play an important role in helping through working to national agendas and providing opportunities for research, capacity building and knowledge exchange. **Governments** also had a role to play, and were seen to be important knowledge co-producers through their role in research funding, creating the enabling conditions for research, and strengthening political will to support CCD research activities.

Engaging with such knowledge partners in / for knowledge co-production requires capacity for collaboration. The discussion on university collaboration (and data on this in the questionnaires) on revealed the following status quo:

- **Collaboration inside the university**: Inter-faculty research and teaching partnerships are beginning to emerge, but there is a lack of adequate co-ordination and communication.
- **Collaboration between universities in the country**: There is adequate expertise at both UNAM and the Polytechnic to establish research groups across institutions. This, however, requires stronger support from university leaders and from national policy interventions and incentives, and from researchers themselves.
- **Collaboration with partners nationally**: There is currently limited sharing of data, knowledge and expertise. There is a need to strengthen the joint development of research agendas for CCD, and proposals to support CCD research. Funding instruments should actively encourage such co-operative partnerships and sharing of knowledge and data.
- **Collaboration regionally (in SADC region and Africa)**: There is a high level of opportunity for collaboration between Namibian universities, South African universities, universities in Botswana and universities in Zambia as CCD issues are quite similar in many instances. There is a need for strong communication about regional CCD issues so that regions can be sensitised to new ways of thinking about development. SADC structures could be used to facilitate such co-operation, including SARUA. SADC level programmes such as the Southern African Science Service Centre for **Climate Change** and Adaptive Land Use (SASSCAL) and the SADC Regional Environmental Education Programme (SADC REEP) also appear to have an important role to play in strengthening regional interaction. The African Monitoring of the Environment for Sustainable Development Project (AMESD) has helped to strengthen African National Meteorological and Hydrological Services to provide accurate weather forecasts, monitor extreme weather phenomena and improve disaster management. AMESD is helping to extend the use of remote sensing data to environmental and climate monitoring applications.
- **Collaboration internationally:** There was a general sense that international collaboration was 'quite challenging' to establish. Current initiatives include Finnish support to CCD activities at UNAM, and the Norwegian Institute of Natural Resources on CCD research. Other research funds could be tapped into such as DFID ESPA programme, but this is quite challenging. The UNDP and UNEP are important partners to help facilitate international collaboration (e.g. through the AAP-NAM).

From the above, it seemed that policy and funding instruments could be used to strengthen collaboration, and motivation for collaboration at all levels. It seems that collaboration with southern African universities is 'easiest' at present for Namibian universities, and that support is required for strengthening national partnerships and international partnerships. SADC level programmes and organisations, and UN organisations active at the regional level play an important role in facilitating regional interaction and collaboration.

4.5.7 University policy and campus management

There was no evidence of the University of Namibia or the Polytechnic of Namibia having university policies that are aligned with CCD. The university did, however, have an Environmental Management Committee. It was said that there has been an initiative aimed at recycling on campus but it has not been very active or successful. There were also limited initiatives to ensure 'green building' practices, and in the case of one building, it was linked to a research initiative (as noted in section 4). The university has installed several solar panels for green energy generation, and tree planting activities were also supported.

4.6 What existing practices can be strengthened and what can be done differently?

4.6.1 A multi-faceted process, needing an integrated approach

Discussions in the workshop on 'who is doing what and how' led to some high quality reflections on the status quo, and what could be done differently. These show that Namibian stakeholders, researchers and lecturers have a very clear understanding of what needs to be strengthened and what could be done differently when it comes to CCD in research, teaching, outreach and networking in their contexts. Some direct citations from the workshop report show that responding to climate change and promoting CCD from within the Higher Education system is a multi-faceted process involving a range of different social practices such as curriculum change, research and staff capacity building and support, collaboration mechanisms, and commitment, leadership and will.

> *"We did not know that there were Masters programmes specifically focused on CCD, so maybe it's about time that we all started taking a stake in this venture and this activity, we might as well introduce something like this, because we have already heard climate projections up to 2100, so it is here to stay."*
>
> *"Coordination of climate change research is a big problem, everyone is an 'expert' on climate change and everyone is doing something."*
>
> *"The problem is, we see ourselves as specialists, and we don't see the relation with cross-cutting uses, we don't see any space for example for climate change in gender studies."*
>
> *"Generally the driver for all of these things can only be if university management and stakeholders have the commitment and the determination to succeed."*
>
> UNAM lecturers

This shows that responding to the current situation with a view to 'doing things better, requires an integrated approach, and will require especially the participation of university and government leadership, but also leadership of other stakeholders (e.g. business).

4.6.2 Co-ordination, collaboration and improved partnership building:

Internal co-operation, collaboration and improved partnership building: As indicated above, there was much discussion in the workshop on collaboration, and how collaboration could be improved. Workshop participants agreed that "*Co-ordination is a big 'gap', not only within the university, but also within the country. This results in difficulties in knowing which institution to approach, or what section within the university*". Participants noted that there has been a suggestion for establishing a database for CC expertise within the university (Appendix B could be usefully expanded to take this intention further). However, this had not taken place as yet. It was noted "*We are too sectoral in many respects – we tend to keep things to ourselves*". Workshop data also showed, however, that interactions between academics can lead to closer collaboration as one person said "*We found out during the workshop new areas we could collaborate in*". It was said too that there is a need to expand to other departments such as information and communication to strengthen awareness raising.

External co-ordination, cooperation and collaboration: Other suggestions, e.g. to participate in government conferences and to establish closer links between universities, and between universities and private sector partners and donors were also made, as noted above. An observation was made that "*There is also a need to strengthen the collaboration between UNAM and MET, specifically the Department of Environmental Affairs as they are a strong partner for research and setting the research and capacity building agenda for climate change*". The needs analysis and also some of the funding deployment around key research and capacity gaps in the country shows that this would indeed be an important partnership for CCD research, teaching, outreach and networking activities within the university. However, as the needs analysis and the institutional analysis of research above shows, such a partnership framework should be broadened to include other major national partners involved in CCD research and capacity development such as the Ministry of Agriculture, Water and Forestry, and the Ministry of Mining and Energy, as well as NGOs and other research and capacity building institutions, including private sector partners and donors.

Strengthen the capacity of the MRC: There were numerous comments in the workshops that pointed to the importance of the MRC as a new structure in the university for CC research, and for interdisciplinary co-operation. However, there was also a strong feeling that the MRC needed to be strengthened, especially in its role of providing interdisciplinary co-operation. Staff involved in the MRC identified the need for a strong capacity building initiative to support the work of the MRC as it was said that "*we would like to create an institutional set-up for enhanced knowledge management – all we have is a vision, but no database or other system*".

4.6.3 Strengthen and expand understandings of CCD

As shown in section 4 above, CCD is a relatively new concept, and a new research and teaching area for all disciplines. The concept has different meanings, and lends itself to a diversity of contextual interpretations (as shown above). It is also multidisciplinary, and multi-faceted as shown by the

Thematic Areas in the CCS&AP, and it has diverse research and capacity building implications. It was agreed in the workshop that "*There is a need to strengthen broad-based understandings of CCD in and outside of the institutions as 'CCD does not take centre stage – it is not seen as a priority'*". This is despite the fact that CC has significant implications for the future development of Namibia.

In this context, a discussion was held on how to encourage people to become more involved in CCD issues. Mention was made of the Namibian Climate Change Ambassadors programme. There was a need to hold workshops / discussions with different faculties so that their roles in CCD could be more clearly articulated. It was noted that the Science Faculty was most able to see their role as they have traditionally been the ones who have produced 'climate science', but they have a problem of capacity and specific skills. It was said too that due to poor understandings of the issues, social scientists could be 'put off' by the word climate, as they may think that this means 'climatology', and thus they tend to see it as an area for the natural / geographical science disciplines. This shows that there is a need to develop a clear understanding of different disciplinary roles in CCD research and teaching.

4.6.4 Capacity building for CCD and staffing

There was a strong call for capacity building, particularly for undertaking research but also for content training in CCD for teaching and design of new courses and curricula as CCD is a new area, and there was a lack of adequately skilled personnel. As this is a multidisciplinary issue, such capacity building should take both a specialist (to develop specialist research capacity) e.g. through a PhD support programme, and a multidisciplinary approach that allows for knowledge exchange and the development of collaboration. The MRC provided a platform for such capacity building, but it was, in itself, requesting capacity building.

4.6.5 Curriculum development and curriculum innovation

As shown in the institutional analysis above, CCD is currently mainly being 'integrated' into existing courses. There are no specialist courses, only a few modules. It was also noted that much of the CCD teaching was not highly explicit, but was more 'incidental', and given the severity of the issue, it would be important to make this more explicit. A positive element is that such integration is taking place across a number of different faculties, which provides impetus for further development of an institution-wide approach to CCD curriculum innovation. There are strong links between Education for Sustainable Development (or courses that are oriented towards environmental management, biodiversity management, land use management, natural resource management, environmental engineering, environmental health, sustainable development and CCD (this was where the CCD infusion was currently taking place in most courses). CCD should not replace initiatives for ESD, but should rather form a strong focus within them, or complement ESD efforts. It would, for example, make more sense to continue with the effort to establish the Masters degree in Education for Sustainable Development in the Education Faculty, rather than narrow it to CCD education, which would form a good focus within the ESD degree.

Workshop participants suggested that UNAM has the opportunity to introduce a module / new modules on CCD in some / more of the disciplines and departments, as it is currently not a strong part of the curriculum. The curriculum is reviewed every four to five years (with the next review

coming up in 2015), so suggestions to incorporate CCD into the curriculum or to have a formal programme on CCD will need to be included in the next round of curriculum development. The possibility exists for the MRC to lead such a curriculum group, and to assist them to prepare for the next curriculum review.

It was noted that at UNAM there is no degree yet in Climate Change. It was said that "*however, given the severity of the matter it will be a good idea to introduce it*". There was also a suggestion that UNAM should collaborate for example with the University of Cape Town in South Africa to see how they established a Masters degree in Climate Change and Development. At undergraduate level it was noted that the university already has a tradition of running a 'core course' for all students, which currently is a module on 'Contemporary Social Issues'. This module came into being because of the need to mainstream HIV/AIDs education. Each student, no matter what faculty / course, has to take this. This could provide a model for mainstreaming CCD in the university.

It was noted too that UNAM and the Polytechnic could work more closely together to share knowledge and expertise on CCD. For example, the Polytechnic has other initiatives e.g. renewable energy that also contribute to CCD, and there could be closer sharing and co-operation between the two institutions on such themes.

4.6.6 Research

Many recommendations were made on how research for CCD could be improved in the university and between universities and other stakeholders. Key amongst these were recommendations to strengthen the research culture in the university, and research partnerships. This, however, was dependent on research training and capacity building, and increased recognition and incentives for research, especially community-focussed research (which currently was not highly valued within the incentives system). Also key to taking things forward were processes of collaboration, which are mapped out in some detail above. Capacity building for new areas of technical research, baseline studies, and inter- and transdisciplinary approaches to research were mentioned specifically. Further financial support that is easy to access is needed (it was noted that the national system of research funding was bureaucratic and difficult to access, which did not encourage researchers to apply for this funding). Strategies should also be put in place to deal with 'movement vulnerability' as specific climate change research and teaching capacity are often patchy and at the individual level – e.g. Professor Oliver Ruppel from the Faculty of Law who left the university.

Specific areas of research were also mentioned as possibilities for taking the CCD research agenda forward. For example, the MRC has started taking up work on community based adaptation; and in promoting research on IKS and adaptation; there is strength for this work in other faculties also which needs to be 'tapped into'. UNAM has identified the need to enhance skills on mitigation, and projections / modelling and technical scientific skills, as they currently are stronger on social science dimensions. There is also potential for collaborating between the Departments of Statistics, Geography and Biology – for example on rainfall data etc. Other areas could also be developed as new research areas, for example, remote sensing and GIS – this is done more at the level of teaching, and not enough research is done in this area. It was further noted that it was important to learn from previous research initiatives. For example, the research project 'Views from the floodline'

involved collaboration with North West University in the social science division, but it has lacked a link with other stakeholders, such as the government climate change unit.

It was noted that closer links should be made with the Namibia Climate Change Committee on research issues in the universities as its mandate is to coordinate all climate change activity in the country. It generates more material on CCD than any other institution, but it delegates all work to consultants. They also play a substantive role in supporting research because of the amount of material they are generating, and in terms of outreach. For this reason, they are a strong partner for research, teaching, and CC coordination.

The importance of building research leadership in CCD areas was also noted as it was said "When you deal with cross-cutting issues, there is often lack of a champion who has the time and willingness to push the transdisciplinary / interdisciplinary agenda forward. Trying to do so at a local level is also not influential enough".

UNAM has a research strategy that was approved in 2005. The university has now developed a research policy that will be discussed in Senate in May 2013. The university faculties and centres will need to develop research strategies and activities to respond to the research policy. This presents a new opportunity to re-think the inclusion of CCD research within the university.

4.6.7 Policy and community outreach

In terms of policy engagement in Namibia, researchers provide services to government, such as serving on the National CC committee, making presentations etc. and university departments are guided by key national reports such as the Climate Change Policy, Strategy etc. It was noted however, that it is important for universities to work closely with policy structures on CCD implementation and conceptualisation and more academics should get involved in CCD related policy issues in their respective areas (e.g. Fisheries and Aquatic Sciences, or Agriculture, or Education etc.). It was noted that new laws could be a key driver for promoting CCD – for example, as happened with environmental impact assessment. Researchers involved in the National Climate Change Committee should also keep other staff in the university informed of new developments nationally, and the implications for research, teaching and community outreach.

It was noted that there were few community outreach programmes in the communities at present; it is mainly university lecturers that are doing some research on climate change which "shows a lack of attention to the co-production of knowledge".

4.6.8 University policy and campus management

As noted above, there was not much that was explicit in university policy about sustainable development, environmental management or CCD. The university had an environmental management committee, but did not have an environmental policy. There were some environmental management activities taking place on campus, but these were not elevated to mainstream practice. Such activities provide a 'living laboratory' for students to learn about CCD issues, and the campus and its management therefore presents a potentially powerful 'teaching and research space' for introducing practical approaches to CCD. It was noted in the workshop that:

"There is also a need to start practising what we preach – how do we start to live these issues? For example, if we put up a new building, we just build in the same old way, we usually don't do green building. The hidden curriculum, or what we actually do, is what students respond to, so we should definitely also apply CCD in our activities."

The analysis above shows that there are important starting points for further development of CCD research, teaching, community and policy outreach, and networking in Namibia.

4.7 The role of university leaders

There was broad agreement on the important role that university leaders play in establishing new study fields, and the infrastructure and platforms for collaborative research and knowledge co-production possibilities. For example, university staff noted that university leaders play an important role in:

- "Supporting and sourcing funding for research and the general spearheading of new initiatives at university level";
- "Sensitising staff about CCD related issues, making training accessible to staff, encouraging and supporting research";
- "Motivating staff to take on new thematic areas in their research and teaching";
- "Establishing a sense of urgency around priority social-ecological concerns such as climate change, and facilitating responses to such issues via curriculum review processes and research planning etc."; and
- "Showing commitment 'serious commitment'".

It was noted that there is a need for strong commitment and willingness from university leadership and that there may be a need to look at regulating the inclusion of CCD aspects and making it mandatory. However, for this to be realised, there was need for a champion to take it further – trying to do it at a lower level is not sufficient. It is important to note that the Vice Chancellors play a key role in driving the CCD agenda within universities. Participants asked: "How will we get the real commitment from the VCs to really drive the SARUA Initiative?"

A key point highlighted in discussions was that sensitisation of management is needed as a key way forward, to mobilise resources. All groups highlighted a key management point, which was that endorsement of this SARUA initiative by the VCs does not necessarily mean commitment. They stated that there was a need to take it further than just a signature on paper. This should be a two-way process, with a push from the bottom up as well.

5 KNOWLEDGE CO-PRODUCTION POSSIBILITIES

5.1 Current knowledge co-production practices via multi-, inter- and transdisciplinary approaches

5.1.1 Clarifying the meanings of multi-, inter- and transdisciplinary approaches to research

The scope and scale of problems and challenges associated with climate change, and climate compatible development – as shown in the needs analysis of this mapping study Country Report – require new forms of knowledge production. Multi-, inter- and transdisciplinary approaches to research are emerging in this context, from an understanding that research modelled on a 'business as usual' approach will not drive ingenuity in resolving complex social-ecological challenges like climate change.

Historically, the dominant approach to research is based on research in the single discipline. While single discipline research remains extremely important for development of in-depth and high quality knowledge, there is also a need to expand these approaches over time towards new, institutionally more complex forms of knowledge production.[16] Figure 5 below shows that over time, research can build towards and include a wider range of research approaches that include multi-, inter- and transdisciplinary research approaches.

Note: Diagram showing research approaches and how they can emerge over time, in relation to outcomes that meet societal needs in the context of complex problems that need to be resolved such as climate resilient development.[17]

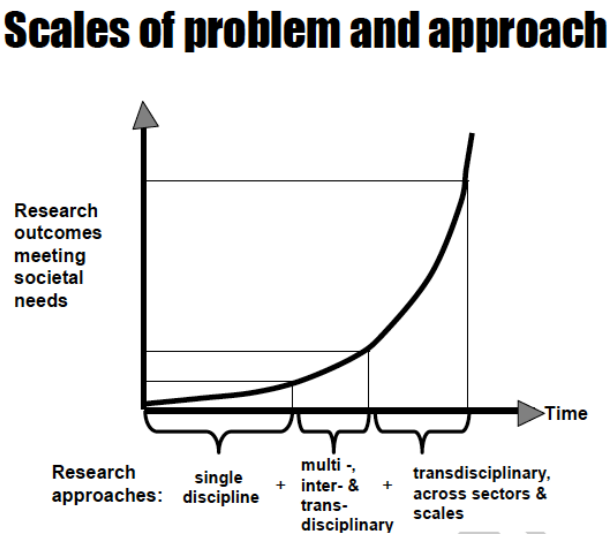


Figure 5: Research approaches

[16] This is because universities are organised and established around a disciplinary knowledge production structure.

[17] Source: Palmer, Lotz-Sisitka, Fabricius, le Roux & Mbingi, in press.

There is global evidence that more researchers are beginning to expand the single discipline approach to research, to include multi-, inter- and transdisciplinary approaches, and through this, their research is engaging across sectors and scales, and with changing social-ecological systems, complexity and integration.

Researchers working with these approaches argue that research outcomes that are generated in this manner have a greater chance of meeting societal needs.[18]

These emerging approaches to research are clarified below.

Multidisciplinarity

This involves using different disciplinary studies to address a common empirical focus or problem. Existing disciplinary methods and structures are not changed in multidisciplinary research. Multidisciplinary research helps to develop different 'angles' or different understandings of a problem, from the vantage point of different disciplines.

Interdisciplinarity

This marks a position between multi- and transdisciplinarity. It involves multidisciplinary studies, but takes these further by synthesis work that takes place *across* the different disciplines. It involves the development of a common framework and perhaps the use of discipline-transcending terminology and methodologies while maintaining certain critical disciplinary distinctions. Important in interdisciplinary research are processes of synthesis and a 'blending' or relating of knowledge from different disciplines.

Transdisciplinarity

This entails using strategies from interdisciplinary research, but it also involves taking this further into development of new theoretical understanding and new forms of praxis that are needed across sectors and at different scales. These are based on an inter-penetration of disciplinary perspectives or understandings, and a 'creative re-deployment' of these in contexts of practice[19], often contexts that are complex.

It is possible to differentiate between 'weak transdisciplinarity', which only relates existing knowledge to practice and 'strong transdisciplinarity', which goes more deeply into developing new and more complex ways of understanding and engagement in contexts where new forms of theory and practice come together[20] across sectors and at different scales.

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[18] There is a growing body of scientific work that reflects this perspective. See for example: Hirsch Hadorn, G., H. Hoffmann-Riem, S. Biber-Klemm, W. Grossenbacher-Mansuy, D. Joye, C. Phol, U. Wiesmann and E. Zemp (eds). 2008. *Handbook of Transdisciplinary Research*. Springer.

[19] Bhaskar, R. 2010. "Contexts of interdisciplinarity: interdisciplinarity and climate change." In *Interdisciplinarity and Climate Change. Transforming knowledge and practice for our global future,* edited by R. Bhaskar, F. Frank, K. Hoyer, P. Naess and J. Parker. London: Routledge.

[20] Max Neef, M. A. 2005. "Commentary: Foundations of Transdisciplinarity," *Ecological Economics* 53: 5-16.

Transdisciplinarity involves different modes of reasoning: the rational, the relational and the practical. Transdisciplinarity research presents an 'unfinished scientific programme' that offers fascinating possibilities for advanced reflection and research[21]. This is increasingly being seen as a real opportunity for innovation. Transdisciplinary research, oriented towards knowledge production for societal change, can be seen as a process that can develop over time.

Knowledge co-production

Traditionally (and currently) most research partnerships and funding arrangements still focus on the single discipline. However, international research platforms are changing towards inter- and transdisciplinary knowledge production, especially in the social-ecological sciences. Engaging in inter- and transdisciplinary knowledge production (because of its interest in new synthesis and creative deployment of knowledge in contexts of practice across scales and sectors) requires new ways of relating, thinking and doing.

As a result, new partnerships are needed between researchers and a wider range of societal actors. Movement in this direction depends on: 1) society becoming widely involved in the research domain (this includes researchers, managers, practitioners and civil society); 2) time investments to develop the trust between and competence of research partners and participants; 3) a willingness to recognise that there are different forms of knowledge that need to interact for societal change to occur; and 4) learning by doing, or social learning.[22] Knowledge co-production is also referred to as knowledge co-creation. This requires working to bring together different contributions in the knowledge production process.

5.1.2 The current 'status' of multi-, inter- and transdisciplinary approaches to research and knowledge co-production

Participants agreed that the majority of the work they do is not well coordinated, and that most of their research tended to be disciplinary based, rather than multi-, inter-, or transdisciplinary, although there were a few cases of research where efforts were being made to engage in collaborative knowledge production and use processes (e.g. through the newly formed MRC and through other community engagement linked research).

The Needs Analysis (section 3) and the Institutional Analysis (section 4) provide detailed information on the status quo in terms of CCD related knowledge, research, individual and institutional capacity needs; and existing research, teaching and collaboration practices and possibilities.

As mentioned above, the research and capacity building agenda for CCD in Namibia is both multi-faceted and multidisciplinary in nature. The institutional analysis shows that there is already a sophisticated grasp of multidisciplinary approaches to CCD in the UNAM, even though this is a development in its infancy. The establishment of a **Multidisciplinary Research Centre** and its Climate

[21] Max-Neef. 2005. "Commentary: Foundations of Transdisciplinarity".

[22] Adapted from the Akili Complexity Forum draft proposal, NRF South Africa (March 2010).

Change research programme (in 2010) is a strong institutional move to strengthen multidisciplinary approaches to dealing with CCD knowledge co-production in Namibia, and an agenda is already being set for such co-operation (e.g. around the IK and CCD research theme). As noted above, however, this MRC requires additional capacity development investments in the form of research training and support for it to realise its potential.

Inter- and transdisciplinary approaches are not strongly developed as knowledge co-production processes in Namibia. However, such practices were not absent, and there were a few examples of interdisciplinary teaching (mostly in the form of cross-faculty / cross-departmental teaching) taking place, and the MRC were trying to support interdisciplinary research teams but were still essentially divided into a Life Sciences and a Social Sciences research group (although inter-departmental teaching and research links were operational within these research groups) with a third group focusing on Science, Technology and Engineering.

The Faculty of Science was implementing an interdisciplinary research project, working mostly with different science departments and agricultural science departments. The Faculty of Humanities was also involved in interdisciplinary work, but this also mainly involved departments within the Faculty of Humanities. Interdisciplinarity was therefore taking place mainly at the inter-departmental level, rather than at inter-faculty levels, and one example of transdisciplinary research was identified (see Box 4 below). The interdisciplinary research projects noted in Boxes 2 and 3, potentially also have elements of transdisciplinary knowledge co-production elements embedded in them, should stronger policy and community engagement emerge.

Box 2: Example of interdisciplinary research project at UNAM – Indigenous Knowledge

The MRC is spearheading multidisciplinary research into climate change vulnerability and resilience, with a focus on indigenous knowledge. It has two active 'research clusters': a Life Science Cluster and a Social Sciences cluster, each of which is using inter-departmental co-operation strategies. There is also an interest in bringing social and natural scientists closer together, but this still needs practical impetus and realisation. The MRC is linked to the National Climate Change Committee, and has direct policy-science links through this link. This can, however, be expanded and extended. It is also planning to conduct research for community benefit (the IK research) so will probably also develop strong community linkages in and through its research.

Contacts: Dr Alfonse Mosimane (Life Science co-ordinator)

Box 3: Example of interdisciplinary research project at UNAM – Water, soil and honey

A research project into the estimation of climate change and adaptation strategies using water, soil and honey as sampling media is being conducted by researchers from the Geology Department, the Department of Biological Sciences and the Faculty of Mining in Croatia. The research focussed on sampling unprocessed honey from combs, soil in the vicinity of honey samples, and groundwater where possible in the Omusati, Ohangwena, Kavango (now Kavango East and Kavango West), Otjozondjupa and Zambezi regions of Namibia. Honey samples were analysed for pollen density. This is to enable species identification (of wild species via the pollen). Pollen grains do not degrade over time; they retain their integrity, and are known to be resilient natural products. Pollen from honey and soils has potential to reveal accurate data. Soil samples are being taken and monitored, and grain mounts made to study extreme event frequency and groundwater peturbations. Soil profiles are being dated to obtain exact dates and time frames reflecting flooding events in the past few hundred years to the present. A questionnaire is also being used to assess commuinty adaptation. This combined pool of information is yielding three main lines of evidence: bee colony stability, pollen health and environmental change. This provides insight into changes taking place in a shorter five-year time frame. Water and soil samples will help to compare changes from honey samples with past events in the last 100 to 200 years. The data obtained will be treated on a fractal dimension of both space and time, contributing to predicting crop stability in the future, and potentially contributing to addressing issues of food security and water scarcity, so as to inform and/or enhance traditional methods of adaptation in the study areas.

(Summarised from Mapani, B., P. Chimwamurombe, I. Mapaure, J. Miller and M. Mileusnic. 2011. "Estimation of climate change and adaptation strategies using water, soil and honey as sampling media: examples from Namibia".)

Contact: Professor Mapani, Geology Department, UNAM

Box 4: Example of transdisciplinary research project at UNAM – NACSO

Dr Alfons Mosimane, Head of the Life Science Division of the Multidisciplinary Research Centre of UNAM, mentioned the engagement with Namibia's community based natural resource management (CBNRM) programme, through the Namibian Association of CBNRM Support Organisations (NACSO). This engagement contributes towards improving the implementation of the CBNRM programme. Findings are presented at a platform in which all the NGOs that work directly with community members get feedback on what has changed on the ground, and then follow this up. This work has been ongoing since 1996. When started in 1996, all communities were self-defining, and no baseline data existed. The research started with baseline surveys, then gender analysis etc. The idea was that findings must always come up with recommendations. The advantage of this work is that it constitutes a longer social engagement over time. Themes that have been dealt with in this way over the years include: democratic processes, gender, governance. Dr Mosimane noted that "now that the communities are income generating, we are looking at what are the benefits and who do they reach – so we see from this example that collaborative knowledge sharing has a benefit to community development – it's a social engagement."

5.2 Multi-, inter- and transdisciplinary research possibilities: Benefits and constraints

5.2.1 Benefits and constraints

The benefits and concerns of transdisciplinary research were discussed, and are captured briefly in the table, and elaborated below.

Table 13: Benefits of and concerns over transdisciplinary research

Benefits	Concerns
▪ Making a difference to the livelihoods of those on the ground ▪ New opportunities for further research ▪ Being and staying relevant	▪ Having to get out of our comfort zone and collaborate with others ▪ Fear of being dominated by others and fear for the unknown ▪ Limited opportunities to further one's qualifications ▪ No incentive or recognition from university for transdisciplinary research ▪ Getting acceptance for our work when there are more disciplines involved ▪ Old versus new culture ▪ Academics tend to work with the same groups of peers

5.2.2 Possibilities

From this discussion it is clear that some of the following need to be addressed if transdisciplinary knowledge co-production processes are to emerge in response to CCD concerns:

- Strengthening of research collaboration;
- Incentives for inter- and transdisciplinary research;
- Examples of best practice to reduce 'fear of the unknown';
- Bursaries and study programmes for PhD and Masters study;
- Publishing support; and
- Changing research cultures.

As indicated above there is need for such research, multiple research partnerships are possible within the stakeholder networks that are interested in CCD research, and there is an understanding of the societal benefit of such approaches to research. However, research systems and cultures of practice in universities are not 'set up' to support such research innovation.

In the next section, some possible CCD knowledge co-production pathways will be mapped out based on the analysis in sections 2, 3 and 4. These may assist in developing a broad-based knowledge co-production agenda for CCD in Namibia (involving research, teaching and community engagement), which will need to be refined at a local level by participating organisations and groups.

Box 5: Benefits and Concerns relating to transdisciplinary research appraoches (workshop discussion)

Benefits

- Making a difference to the livelihoods of those on the ground. It was said: "With this important point, it is not necessary to list a whole lot of benefits to counter the long list of concerns".
- New opportunities for further research. When you engage with the community, it is possible to identify many different opportunities for relevant research and knowledge production.
- Being and staying relevant. Research that involves the community remains relevant and will in the end generate more public interest.

Concerns

- Having to get out of our comfort zone and collaborate with others. "The Challenge with interdisciplinary research is being able to reach consensus on the research protocol. But when we go to transdisciplinary, we need to be able to move out of our box – this is more difficult for academics: we are a different species, we do not mingle easily."
- Fear of being dominated by others and fear for the unknown. Everyone wants to defend their own territory; no-one wants to see their discipline being dominated by others: "Most of the time it's also the fear of the unknown, we don't know the territory of the other. "
- Limited opportunities to further one's qualifications. "At our university we have a lot of staff members who still want to go for further studies, for Masters, for PhDs, so opportunities are limited and you tend to not want to involve so many other people in your research because of this."
- No incentive or recognition from university for transdisciplinary research. "The challenge to get to transdisciplinary is its level of practice. When we do research we tend not to think about its real impact"… "It's true, we may not see this as scientific (practice). And the university does not incentivise us to do this, we get rewarded for publications."
- Getting acceptance for our work when there are more disciplines involved. "The journals that have to accept our work, when there are too many disciplines, our methodology tends to be judged, we may not get our publications published."
- Old versus new culture. "The major problem – the senior academics are resistant to change, the junior and emerging academics are open to this change, but the senior academics are more resistant."
- Academics tend to work with the same groups of the peers. "Major problem for young professionals to penetrate these established research groups."

6 SUMMARY AND CONCLUSION

6.1 Synthesis perspective on the knowledge, research, individual and institutional capacity needs analysis

6.1.1 Context that frames needs

Namibia is one of the driest countries south of the Sahara, with a mean annual rainfall ranging from less than 25 mm in the southwest and west to just above 700 mm in the north-east of the country. The warming trend is already well established in Namibia, with maximum temperatures increasing over the past 40 years, as observed in the frequency of days exceeding 35°C, and a reduction in days below 5°C. There is a high degree of certainty that the country will become hotter throughout the year, with a projected increase in temperature of between 1°C and 3.5°C in summer and 1°C to 4°C in winter in the period 2046–2065. The projected temperature increases will result in increased evaporation and evapotranspiration of 5-15 percent, further reducing water resource availability and dam yields. Groundwater recharge may suffer a reduction of 30-70 percent across the country, with a potential exception in the recharge of alluvial aquifers originating in central areas. The dryland conditions, and the high dependence on traditional subsistence sector economic activities, as well as the resource-intensive nature of the primary economic sector activities, make Namibia vulnerable to climate change, and are key drivers of the need for CCD responses in Namibia.

Within this context, the mapping study needs analysis for Namibia revealed while much progress has been made in identifying research and capacity needs in broad terms, the status of CCD knowledge and research is inadequate for the responses that are required. The recent Climate Change Strategy and Action Plan (CCS&AP) for Namibia (GRN 2012b), clearly defines thematic areas for adaptation, mitigation and cross-cutting issues. A major priority that cuts across all sectors is the need to generate information and knowledge for all adaptation and mitigation priorities that have been identified so far.

Consistent with the socio-economic context, overarching barriers to adaptation indicated in all three data sources used in this mapping study (document analysis, workshop and questionnaire data) include the recognition of insufficient information and knowledge of the nature of climate change risks and appropriate adaptation, mitigation and CCD responses; political and institutional barriers, and socio-cultural barriers. The workshop responses identified a range of cross-cutting needs for responding better to CCD, amongst which are the need for political leadership; education, training and public participation, and cultural change. There was recognition that Namibia had made good progress with CCD related policy development, but implementation and policy coherence across sectors remained a challenge. Other discussions pointed to the deep seated paradoxes that are situated in the social change process that is needed for climate compatible development. It was said for example that:

> *"There is a need to confront the paradoxes within trends of developed countries for consumerism and high levels of resource utilisation, and the aspirations of developing countries, which are now following this path."*

6.1.2 Specific adaptation and mitigation priorities

Namibia's Second National Communication to the UNFCCC (GRN 2011a) commits the country to focus predominantly on low carbon development and to secure appropriate long-term sustainable resources for adaptation to the effects of climate change. Associated with the vulnerabilities to CC and a policy commitment to climate resilient, low carbon development are clearly identified thematic areas for adaptation, mitigation and cross-cutting issues, which are identified for action in the Climate Change Strategy and Action Plan (CCS&AP) for Namibia (GRN 2012b). Climate change **adaptation** is addressed through four themes: 1) Food security and sustainable biological resource base; 2) Sustainable water resources base; 3) Human health and well-being (or Security); and 4) Infrastructure development. **Mitigation** is addressed through the following themes 1) Sustainable energy and low-carbon development; and 2) Transport. A number of **cross-cutting issues** or themes on adaptation and mitigation are also identified and are included in the strategy and action plan. These include: 1) Capacity building, training and institutional strengthening; 2) Research and information needs, including how to use climate change information; 3) Public awareness, participation and access to information; 4) Disaster reduction and risk management; 5) Financial, resource mobilisation and management; 6) International cooperation and networking; 7)Technology development and transfer; and 8) Legislative development.

6.1.3 Specific knowledge and research gaps

The Climate Change Strategy and Action Plan for Namibia (CCS&AP, GRN 2012b) identifies specific knowledge and research needs under 'Cross-Cutting Issues, Theme 2: Research and information needs, including how to use climate change information'. These are: research on the collection and application of data in climate change models at national, regional and local levels, research on monitoring of ecosystem and biodiversity changes and their impacts, climate proofing research especially in relation to crops, livestock, forests and fisheries and water infrastructure. Research on sea level rise was also prioritised, as was research on the macro-economic and sectoral impacts of climate change. A special research theme focussing on the documentation of traditional / indigenous knowledge and coping practices was also identified. Additionally specific research and knowledge needs were identified for all adaptation and mitigation priorities, and for some of the cross-cutting needs. Research related to the following specific adaptation themes were identified: food security and sustainable resource base; water security; human health and well-being; and infrastructure adaptation. Additionally there are research and knowledge needs associated with mitigation priorities especially for sustainable energy and low carbon development. Workshop participants prioritised research in the following, related areas: marine biodiversity management, non-timber forest products and their commercialisation, sea level rise, which included a focus on coastal erosion, and increased storm activity at sea and its potential consequences for offshore mining.

6.1.4 Cross-cutting needs

Key cross-cutting needs are the need for improved co-ordination across sectors within government and implementation partners, improved awareness raising and capacity development, and political leadership and cultural change. Workshop discussions focussed a lot on cultural norms and how to bring about cultural, social and behavioural change, raising this as an important research need. Cross-cutting educational concerns involved the inadequacy of climate change education

programmes in universities, and the lack of inter-disciplinary co-operation on CCD issues. Similarly there was concern about the lack of adequate postgraduate programmes that focus on CCD issues, and the lack of adequate professional development of existing university lecturers and educators to engage with CCD concerns. The issue of community education, as well as training of political leaders, was also mentioned numerous times.

6.1.5 Individual capacity needs

Individual capacity needs were identified for improved spatial planning, including town and regional planning and engineering, capacity building for academics and professionals to apply and interpret climate models, application of economic principles to CCD policy interventions, capacity development for preparation and appraisal of CDM projects, capacity building for local commercial banks, and further theoretical and practical training on renewable energy technologies (RETs) for technicians, government officials and NGOs. Other individual capacity recommendations were for training of rural communities, research scientists, women's groups, coastal communities and coastal zone managers, natural resource managers and foresters and forest management experts. Individual capacity building was also needed at different levels for water resources management i.e. at household, community, and watershed management levels. Local government officials, financial managers, health care workers, and infrastructure sector experts also needed to be trained in CCD related approaches, as well as agricultural extension workers. It was also said that there was a need to strengthen and develop more engineers with CCD expertise, meteorologists and foresters. To strengthen CCD awareness it was noted that there was need for training of journalists, NGOs and civil society organisations to expand CCD activities at community level. A need was also identified to strengthen the individual capacity of curriculum developers to integrate CCD priorities into curricula at all levels of the education and training system. Engaging the youth in CCD was further identified as a key area for individual capacity development.

6.1.6 Institutional capacity gaps

This includes the need for capacity building of boundary organisations to facilitate climate change feedback loops between science institutions, policy makers, and land users, noting that this requires capacity to access, interpret, translate and communicate climate change science and concomitant local level indicators. It was also noted that Climate Change research needed to be properly coordinated and the benefits optimised to meet the needs of policy makers and communities in Namibia. A number of institutional capacity gaps related to specific CCD adaptation and mitigation priorities were identified, including but not limited to: more enabling scientific environments, more effective extension services; improved planning, governance and decentralisation of decision making, improved transport planning and access to social grants, as well as incentives for investments in CCD related technologies and practices. A need was also expressed for organisational restructuring and reform to strengthen key government and other agencies that deal with CC, and to establish institutional capabilities for co-ordinating the generation, processing and storage of CC information, and that could also facilitate access to the information and its successful dissemination. This shows a key gap in CC related knowledge management, which was also raised as an issue amongst workshop participants who noted that while data exists, it is difficult to access it, and data is not being shared across institutions to strengthen knowledge production on CCD. A further

institutional capacity gap identified was for financing mechanisms development for CCD and social change. Workshop participants in particular identified the lack of adequate research infrastructure and funding as a major institutional capacity gap, as well as problems associated with educational quality. The efficacy of political structures was also discussed.

Co-production of knowledge and its reliance on improved cross-sectoral and inter-disciplinary institutional capacities can be seen as a significant area of concern for Namibia. The mapping study identified that there are already some steps in place to begin to address these research and capacity needs. The National Climate Risk Management (CRM) Capacity Development Plan (CDP) for Namibia comprises a detailed five-year strategy and a longer-term vision for addressing climate change adaptation needs in Namibia, based on consultations with public and private sectors. **Key findings are that CRM capacity must be developed cross-sectorally, and that much wider enabling competencies and support are needed, over and above specific knowledge, to engender CRM action**. How data and knowledge is shared, and how research is responded to by decision makers, and how such research benefits communities was of particular concern among workshop participants. Namibian workshop participants were clear that CCD could not emerge without giving attention to social and cultural change, and that educational quality and ethical political leadership were important dimensions of this process.

6.2 Synthesis perspective on the institutional analysis

As noted above, there are numerous, complex knowledge, research, individual and institutional capacity needs expressed by stakeholders and university staff themselves. Activities and partner organisations are identified to assist in the implementation of the Climate Change Strategy and Action Plan for Namibia (GRN 2012), which has been developed as a tool to implement the National Climate Change Policy (NCPP). UNAM and the Polytechnic of Namibia are seen as important research, policy implementation and capacity building partners in Namibian climate change policy and strategy implementation. The **Multidisciplinary Research Centre** at UNAM, for example, used to have representation on the National Climate Change Committee, and there continue to be strong interpersonal relationships between individuals at the MRC.

Namibia's main framework for research and development appears to be the Research, Science and Technology (RS&T) Act (2004), which provides for the establishment of a National Commission on Research, Science and Technology and an associated research fund. Research regulations emerging from the RS&T have recently been published, but appear to be contested and are said to be restrictive. The main university institution that is connected to the provisions of the Act is the Multidisciplinary Research Centre of the University of Namibia. It was established to conduct basic and applied research in national priority areas; conduct human and institutional capacity building in national priority areas; and coordinate the implementation and management of research and development activities, product development, innovation, value addition and patenting. The overall vision of the national research policy (which includes the contribution of the MRC) is to transform Namibia into a Knowledge Based Society. The Climate Change Strategy and Action Plan for Namibia (CCS&AP) describes the possible development of a national research centre / network to co-ordinate climate change research. It was not clear whether the MRC would fill this role, of if another centre is envisaged.

Of greatest significance is the obvious lack of adequate institutional capacity for CCD research in the country in relation to the seriousness of the climate vulnerabilities. The institutional assessment has shown that climate change research is a relatively new area of research and development in Namibia, and most academics engaged in this research area had only been doing so for approximately three to five years. Various sources of funding and partnership support exist for CCD research in Namibia, including government funding and donor funding. Government funded research feeds directly into policy, and tends to involve both university and government partners, as well as research consultants and international research organisations such as the IIE. Donor funding appears to fund pilot studies in key intervention areas which needs further funding to be scaled up. Research tends to be strongly government driven.

There is some research emerging in UNAM and at the Polytechnic of Namibia. CCD related research is strongest in UNAM, especially in the Faculties of Agriculture and Natural Resources, Science (Department of Biological Science), Department of Geology, and there is some social science related CCD research into Gender and CCD taking place in the Faculty of Humanities. At the Polytechnic, the School of Natural Resources and Tourism's Integrated Land Management Institute undertakes CCD related research. The Multidisciplinary Research Centre (relatively newly established – in 2010) is a key institution that is seeking to develop 'critical mass' around CCD research. It has three sub-divisions that are engaged with CCD related research:

- The Life Sciences Division – engaged with a research project on Climate Variability and Climate Change Adaptation and Disaster Risk Reduction which has three sub-programmes (on DDR and vulnerability assessments, impact assessment on existing CBA programmes and IK integration into CC activities);
- The Science, Technology and Innovations Division which has a research theme on renewable energy technologies; and
- The Social Sciences Division which has a research programme on flooding and the impact of flooding on the livelihoods of communities.

There are also other active interdisciplinary research programmes in the Faculty of Agriculture and Natural Resources where research focusing on crop varieties resistant to drought was found; and in the Faculty of Science, where research on carbon dynamics in soils and vegetation is taking place, and where an interdisciplinary research programme is underway focusing on soil, honey and bees in CC adaptation. In the Faculty of Humanities interdisciplinary co-operation is taking place between the Departments of Geography and Sociology to research climate change perceptions, and gender and climate change issues. Other research activities identified were single discipline studies with no evidence of interdisciplinary interaction. CCD research is taking place in both the natural and the social sciences, but interdisciplinary co-operation, while taking place is still emerging as a new area of practice. Most of the interdisciplinary work taking place was within the same Faculty, rather than across faculties, as is also shown by the sub-divisions of the MRC.

The institutional assessment revealed that there is some current work taking place with regard to CCD curriculum innovation at UNAM. Questionnaire responses indicate that *there are few specialist courses in climate change and CCD* at UNAM, but that CCD issues are being integrated into existing courses, and that there is cross-faculty teaching on climate change and CCD taking place (the MRC appears to have had a big influence on the possibilities for cross-faculty teaching). According to the respondents (who are also seen to be some of the most active climate change- and CCD-related

researchers and lecturers in UNAM) *there is almost no inter- and transdisciplinary curriculum work taking place*, and *only one faculty member reports making use of a strong service learning approach*. Courses that develop critical thinking and integrated problem solving skills are generally seen to be present, while there appears to be a mixed response as to whether courses include a focus on development of social and/or technical innovation and ethical actions. Climate change work is seen to be partially integrated into examination and assessment work. Staff willingness and staff ability to get involved in CCD related teaching and learning issues is seen to be relatively high. There is interest in establishing a multi-disciplinary Masters degree in CCD, but this is yet to be planned – "*however, given the severity of the matter it will be a good idea to introduce it*". There was also a suggestion that UNAM should collaborate, for example, with the University of Cape Town in South Africa to see how they established a Masters degree in Climate Change and Development.

The Namibian institutional assessment further revealed that while CCD research activities and institutions (e.g. the MRC) exist, and curriculum integration is emerging, all these are *new and require capacity building*, as indicated by research participants who commented on the lack of resources, capacity and research co-ordination. Staff involved in the MRC identified the need for a strong capacity building initiative to support the work of the MRC as it was said that:

> *"we would like to create an institutional set-up for enhanced knowledge management – all we have is a vision, but no database or other system."*

See Table 18 in Appendix F for a summary of identified sources of expertise for CCD in Namibia.

The School of Nursing and Health Sciences, Department of Biology in the Faculty of Science, the Department of Geography in the Faculty of Humanities, and the Department of Fisheries and Aquatic Sciences in the Faculty of Agriculture and Natural Resources cited higher levels of student involvement in CCD related matters, than other departments who responded to the questionnaire. The following student organisation was cited as having potential for engaging more with CCD issues:

- UNAM Natural Resources and Environmental Science Society which involves students from the Department of Geography, Department of Biology and the Department of Fisheries and Aquatic Sciences.

Stakeholders and university professionals in Mozambique showed a clear understanding that CCD was closely related to both adaptation and mitigation and sustainable development. The institutional analysis identified some examples of interdisciplinary research, and only one example of what can be categorised as transdisciplinary research. The importance of building research leadership in CCD areas was also noted as it was said:

> *"When you deal with cross-cutting issues, there is often a lack of a champion who has the time and willingness to push the transdisciplinary / interdisciplinary agenda forward. Trying to do so at a local level is also not influential enough."*

Workshop participants recognised the need for better co-ordination amongst themselves within universities, and between universities and stakeholders, as well as between the UNAM and Polytechnic, which, it was said, requires university leadership engagement and support. There was also recognition of the importance of working more regionally, and internationally. Questionnaire

data showed, however, that it was the more senior and experienced researchers (with PhDs) that tended to be engaged in international and regional collaborative research. The potential role of regional organisations such as SASSCAL and SADC centres for providing capacity building support in Namibia, and in some cases Namibian researchers are drawing on and contributing to these international research networks such as RAEIN-Africa and the Benguela Current Commission's research programmes. There was a general sense that international collaboration was 'quite challenging' to establish.

The institutional assessment has shown that there is a strong and clearly articulated need for support for research capacity building in Namibia on CCD related research areas, and especially for stronger multi-, inter- and transdisciplinary approaches to research. There is a need for basic disciplinary capacity development for CCD research, as well as for more innovative and expansive forms of transdisciplinary research and teaching.

The institutional assessment has also highlighted that it is extremely important for universities in Namibia to become more strongly engaged with issues of CCD knowledge co-production concerns, so that they can be located more strongly within key climate change dialogues, and so that they are able to better support and inform policy and CCD practice, and provide their students with contemporary perspectives that enhance educational quality and relevance in their teaching. Key areas identified for Mozambique include curriculum development and innovation (potentially also for a Masters degree programme), research institution capacity development especially for multidisciplinary research co-operation and knowledge management, individual professional development and research competence development, knowledge sharing, and community and policy outreach.

6.3 Enhancing knowledge co-production possibilities for CCD in Namibia and SADC

In summary, the national policy and strategy provides a strong platform in which major needs associated with climate compatible development are identified and documented using categories of 'adaptation', 'mitigation' and 'cross-cutting issues' that have been articulated in the form of a Climate Change Strategy and Action Plan for Namibia (CCS&AP), showing the Namibian government's far reaching vision for a climate compatible development pathway. Considering the workshops and questionnaires, as well as other data sets *in relation to each other;* one can begin to map out a CCD capacity development pathway/s for Namibia. Three examples are offered here (Table 14) for one of Namibia's Mitigation Priorities.

Table 14: CCD Knowledge, Research, Capacity Building and Institutional Capacity Gap Analysis for one of the Namibian Mitigation Priorities: Sustainable Energy and Low Carbon Development

CCD PRIORITY	Knowledge and Research Gaps (Research Agenda)	Individual Capacity Gaps (Education and Training Agenda)	Institutional Capacity Gaps (Institutional Capacity Development Agenda)
Mitigation: **Theme 1: Sustainable Energy and**	*Feasibility and Technology Innovation Research* ▪ Investigate future energy needs of Namibia and	*Agricultural extension services* ▪ Initiate and support agricultural extension	*Policies, investments and incentives* ▪ Improve energy efficiency in domestic and

CCD PRIORITY	Knowledge and Research Gaps (Research Agenda)	Individual Capacity Gaps (Education and Training Agenda)	Institutional Capacity Gaps (Institutional Capacity Development Agenda)
Low Carbon Development	choose the most cost effective energy supply ▪ Research and invest in harnessing wind energy, particularly in coastal areas ▪ Undertake feasibility studies for tidal and wave energy, geothermal energy, energy from biomass and solar heating technologies for domestic use ▪ Explore the possibility of the development of CDM projects under the LULUCF sector ▪ Improve design of rural and urban waste dump sites and assess the potential for effective capturing, storage and use of methane produced at the waste dump sites ▪ Support the development of better technologies, innovation and communication amongst all stakeholders in waste management *Impact Research* ▪ Collect and monitor accurate data regarding GHG emissions from the agricultural sector ▪ Undertake studies to quantify the amounts of methane produced at waste dump sites in Windhoek and other cities and towns *Economic Research* ▪ Conduct an assessment of investment and financial flows to address climate change adaptation in the Land use, Land-use Change and Forestry (LULUCF) sector	services to popularise new agricultural practices that will contribute to GHG reduction at local and commercial farm levels *Land use resource users (including women)* ▪ Empower local level and other land resource users including women to conduct land use planning ▪ *Waste management stakeholders:* Empower waste management stakeholders to make use of better technologies, innovation and communication	commercial sector (including agriculture and industrial processes) and the transport sector through appropriate policies, investments and incentives *Renewable Energy Technology and Energy Efficiency Capacity* ▪ Understand and address techno-economic, social and institutional constraints and build capacity for adoption of renewable energy technologies (including biomass, wind, solar). Promote and develop production approaches that ensure energy efficiency. *Environmental Management Systems and Standards development* ▪ Promote and implement EMS and apply standards that integrate reduction of GHG emissions *Community Forestry* ▪ Develop, support and expand community forestry *Waste Management System Design* ▪ Improve design and functioning of rural and urban waste management systems and use of biogas products (methane)

The analysis such as the one modelled above, can be developed for all major CCD priorities, and should ideally form part of national climate change policy development. Such an analysis provides a starting point for knowledge co-production at a national level.

The institutional analysis has shown that Namibia *does* have expertise for beginning to engage with such CCD knowledge co-production pathways. The institutional analysis has also shown, however, that the existing expertise base needs to be expanded and supported in more strategic ways since the knowledge co-production challenges for CCD are vast and complex.

Critical issues to be addressed if Namibia is to expand its CCD knowledge co-production capacity are:

- Further consolidate the national knowledge co-production analyses based on the needs and institutional analyses in this country mapping study, and as modelled in the example above (Table 15), to guide further action at country level.
- Expand the capacity of the MRC and other research institutions. Develop a 'capacity pathway' for strengthening individual research competence, so that individual interest and research capacity can grow into a 'node of expertise' and then into a 'centre of expertise', and potentially in future, a Centre of Excellence. Strategic policy support from the climate compatible development policy community, and the Higher Education community will be needed to facilitate such capacity building pathways in Namibia.
- Improve co-operation, communication and shared access to data at all levels.
- Develop motivation and incentives for researchers, especially for engaging in multi-, inter and transdisciplinary research approaches. Support capacity development of researchers in these areas.
- Strengthen research partnerships and research infrastructure, including research funding and incentives for students.
- Support curriculum innovation to mainstream CCD into existing courses and programmes, and engage in development of Masters degree curriculum design, potentially in partnership with other southern African universities.
- Strengthen existing policy and community outreach activities within a knowledge co-production framework and develop monitoring tools to make the impact of such work visible within the university system, and seek ways of incentivising engagement with policy systems and communities.
- Develop campus management policies and practices that engage students in CCD issues, and that also model solutions and provide demonstrations of CCD learning pathways.

6.4 Possibilities for linking into a networked system of knowledge co-production in the SADC region

Some areas of strength identified in Namibia:

- **CCD, adaptation and NRM research**: Individual researchers with research experience, and nodes of expertise in the following areas of CCA research were identified: Agriculture and Food security; Biodiversity and NRM; Coastal Zone Management; Sea level rise; Fisheries and Aquaculture; Community vulnerability and climate change; Gender and climate change; Landuse management; Early warning studies; Community-based natural resources management; Water management.

- **CCD mitigation research**: Renewable energy technology research – nodes of expertise exist at UNAM and the Polytechnic, and a strong SADC Centre of Excellence at Gobabeb exists for renewable energy technology research. There is also renewable technology research at the Polytechnic of Namibia, and the MRC has a thematic area on renewable technology research. The Faculty of Engineering at UNAM were also engaged with this theme, and were undertaking research on Green Building Design.
- **Education / Education for Sustainable Development research**: Education for sustainable development / environmental education is an emerging area of expertise in Namibia, with an active ESD network and emerging Centre of Expertise linked to the international United Nations University system of Centres of Expertise for ESD, and the SADC Regional Environmental Education Programme network (which has been supporting the UNU Centres of Expertise at SADC level).
- **Systems of social change research**: Climate change and sociology; climate change and gender; climate change / ESD and education.
- **Teaching and curriculum innovation:**
  - Infusion of CC into existing undergraduate and postgraduate degree programmes in diverse disciplines (a multidisciplinary orientation);
  - Social science climate change and development modules;
  - Cross-faculty teaching (in some cases); and
  - Possible link up with other countries planning to develop a Masters Degree in CCD.

APPENDIX A: WORKSHOP ATTENDANCE LIST

List of participants at the Namiba workshop, 13 March 2013 (Day 1)

Protea Hotel Thuringerhof, Windhoek

Full name	Organisation	Designation	Contact number/s	Email address
Absalom Shigwedha	Environmental Journalist	Journalist	+264 81 2950963	absalom.shigwedha@gmail.com
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Nelago Indongo	UNAM	Director: MRC	+264 61 2063004	nkanime@unam.na
Irene !Hoaës	New Era	Journalist	+264 81 2553606	irene@newera.com.na
Brian Mhango	Polytechnic of Namibia	Lecturer	+264 81 3414409	bjmhango@gmail.com
Susan Roux	Conservation and Environment Trust of Namibia (CETN)	Acting Chairperson	+264 81 1294935	cetn@iafrica.com.na
Maria Kaundjua	UNAM	Lecturer	+264 81 1426089	mbkaundjua@unam.na
Nico Shikongo	Nutprox cc	CEO	+264 81 8256486	nnshikongo@gmail.com
Connie Claassen	Debmarine Namibia	Environmental Coordinator	+264 61 2978213	connie.claassen@debeersgroup.com
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Lineekela Kandjengo	UNAM	Lecturer/HOD	+264 81 2612599	lkandjengo@unam.na

List of participants at the Namiba workshop, 14 March 2013 (Day 2)

Protea Hotel Thuringerhof, Windhoek

Full name	Organisation	Designation	Contact number/s	Email address
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APPENDIX B: ACTIVE RESEARCHERS IDENTIFIED WHO ARE CONTRIBUTING TO CC /CCD RELATED RESEARCH ACTIVITIES

Table 15: Active researchers contributing to CC/CCD research activities in Namibia

Name and qualification	Department / Area of expertise	Years of experience: Years of experience in CC research	Contact details
Margaret Angula, MSc	Climate change and vulnerability and adaptation studies Climate change and Gender studies	12 years: 6 years	UNAM, Department of Geography, History & Environmental Studies, Affiliated to the MRC, mangula@unam.na
Maria Kaundjua, MA Population & Development	Sociology – Risk and vulnerability studies	16 years: 3 years	UNAM, Department of Sociology, Faculty of Humanities, mbkaundjua@unam.na
Simon Angombe, PhD	CC research on perceptions, migration and gender	12 years: 5 years	UNAM, Deputy Dean, Faculty of Humanities, Geography Department
Alfonse Mosimane, MSc	Multidisciplinary Centre, Life Science Division Climate Variability and Change research programme	15 years: 10 years	UNAM, Multidisciplinary Centre, amosimane@unam.na
Prof Isaac Mapaure, PhD	Biological Sciences – Environmental Biology	23 years: 6 years	UNAM, Research Co-ordinator, Department of Biological Science, impaure@unam.na
Dr Oliver Ruppel	Environmental Law and Policy / Human Rights / Environmental Justice	Unknown	UNAM, Director: Human Rights and Documentation Centre, ocruppel@unam.na
Mr Brian Mahango, MSc (Soil Science; MSc GIS)	Soil sciences and land use planning; Regional and rural development	25 years: 10 years	Polytechnic, Land Use Planning Department, bmhango@polytechnic.edu.na
Prof Benjamin Mapani	Geology, sediment analysis and geology	23 years: 9 years	UNAM, Senior Lecturer, Geology Department, bmapani@unam.na
Isaak Neema, PhD	Population and Statistics (flood analysis in Namibia)	10 years: 6 months	UNAM, Faculty of Science, Ineema@unam.na
J. Kloppers, PhD	Public Health		UNAM, School of Nursing and Public Health, jkloppers@unam.na
Dietlinde Nakwaya, MSc	Science Education / Environmental Education / Education for Sustainable Development	4 years: 2 years	UNAM, Faculty of Education. Maths, Science and Health Education Department, dnakwaya@unam.na

Name and qualification	Department / Area of expertise	Years of experience: Years of experience in CC research	Contact details
Lineekela Kandjengo, MSc	Fisheries and Aquatic Sciences	11 years: 5 years	UNAM, Faculty of Agriculture and Natural Resources, HOD: Fisheries and Aquatic Sciences, lkandjengo@unam.na
Prof Percy Chimwamurombe	Plant Diversity	Unknown	UNAM, Faculty of Science: Botany
Dr Alex Kanyimba	Education for sustainable development / Environmental Education	Unknown	UNAM, Faculty of Education
Dr R. Osterkamp	Climate Change and Economics	Unknown	UNAM, Faculty of Economics, rosterkamp@unam.na
Dr Jack Kambatuku	Department of Integrated Environmental Science Underground water, Ecology, Ecophysiology, Natural Resource Management	19 years: 3 years	

Note: This list is based on information provided in the country workshop and from completed questionnaires, and is possibly incomplete.

APPENDIX C: UNIVERSITIES QUESTIONNAIRE

QUESTIONNAIRE FOR UNIVERSITY MANAGERS, TEACHING AND RESEARCH STAFF: Status of Climate Compatible Development Research, Teaching and Policy / Community Engagement

A: GENERAL INFORMATION

A1: NAME	
A2: GENDER	
A3: HIGHEST QUALIFICATION	
A4: JOB TITLE	
A5: YEARS OF EXPERIENCE	
A6: YEARS OF EXPERIENCE WITH CLIMATE CHANGE / COMPATIBLE DEVELOPMENT RELATED ISSUES	
A7: NAME OF UNIVERSITY	
A8: COUNTRY	
A9: NAME OF FACULTY	
A10: NAME OF DEPARTMENT	
A 11: NAME OF PROGRAMME/ CENTRE / UNIT / INSTITUTE	
A12: E-MAIL CONTACT	
A13: WEBSITE ADDRESS:	

B: GENERAL VIEWS

B1: Give a short description of **how you understand** 'climate change'

B2: Give a short description of **how you understand** 'climate compatible development' in your context

B3: What, in your view, are the most **critical aspects** to deal with in your country if 'climate compatible development' is to be achieved?

B4: In your view, what is **the role of universities** in contributing to the achievement of climate compatible development?

B5: In your view, what is the **role of university managers** in contributing to achievement of climate compatible development?

C: CAPACITY, KNOWLEDGE AND RESEARCH GAPS

Please indicate if you are answering these questions on behalf of a:

University	
Faculty	
Department	
Programme / Centre / Institute	

	Rate the contributions of your university / faculty / department / programme using 1-5 with 1 being non-existent, and 5 being very active or well developed	1	2	3	4	5
C1	Involvement in research in the area of climate change and/or climate compatible development					
C2	Involvement in **local** climate change and/or climate compatible development research					
C3	Involvement in **national** climate change and/or climate compatible development research					
C4	Involvement in **international** climate change and/or climate compatible development research					
C5	Involvement in single discipline approaches to climate change and/or climate compatible development research					
C6	Involvement in **interdisciplinary** approaches to climate change and/or climate compatible development research					
C7	Involvement in **transdisciplinary** approaches to climate change and/or climate compatible development research					
C8	Involvement of multiple stakeholders in climate change and/or climate compatible development research					
C9	Record of raising funding for climate change and/or climate compatible development research					
C10	Contributions of the research to local climate compatible development pathways					
C11	Contributions of the research to national climate compatible development pathways					

C12: Would you describe your university / faculty / department / programme's research primarily as being focused on:

Climate Change	
Climate Compatible Development	
Other (please specify)	

C13: List major research projects / programmes focusing on climate compatible development in your university / faculty / department / programme:

C 14: List the most active researchers involved in climate change and/or climate compatible development research in your university / faculty / department / programme, and their 'specialist' areas of research and if possible give an email contact address

C 15: List any major practices and research initiatives you or others regard as innovative in your university / faculty / department / programme, and their 'specialist' areas of research, and if possible provide a contact name and email of a person responsible

C16: List any major research or knowledge production networks that you may be involved in that focus on or support knowledge production and / or use that is relevant to climate compatible development in your context? If possible, provide a contact name and email address for the person responsible for the network:

D: CURRICULUM, TEACHING AND LEARNING

Rate the contributions of your university / faculty / department / programme using 1-5 with 1 being non-existent, and 5 being very active or well developed		***1***	***2***	***3***	***4***	***5***
D1	**Specialist courses** offered on climate change / climate compatible development					
D2	Climate change / climate compatible development issues and opportunities **integrated into existing courses**					
D3	**Cross faculty teaching** on climate change / climate compatible development					
D4	**Inter- and/or transdisciplinary teaching approaches** used for climate change / climate compatible development courses					
D5	**Service learning** (accreditation of community engagement as part of formal curriculum) focusing on climate change / climate compatible development concerns					
D6	Courses develop **critical thinking** and **integrated problem solving** skills					
D7	Courses clearly focus on development of **social and/or technical innovation** and **ethical actions**					
D8	Climate change / climate compatible development aspects are included in **assessment and examinations**					
D9	**Staff willingness** to get involved in new issues such as climate change and/or climate compatible development					
D10	**Staff ability** to get involved in new issues such as climate change and/or climate compatible development					

D11: List any main courses in climate change / climate compatible development in your university / faculty / department / programme and indicate if they are undergraduate (1st, 2nd, 3rd year etc.) or postgraduate (Hons, Masters, PhD)

D 12: Give an example of one or two teaching methods that you would use for teaching climate change / climate compatible development in your courses

E: POLICY / COMMUNITY ENGAGEMENT AND STUDENT INVOLVEMENT

Rate the contributions of your university / faculty / department / programme using 1-5 with 1 being non-existent, and 5 being very active or well developed		**1**	**2**	**3**	**4**	**5**
E1	Involvement in climate change / climate compatible development policy outreach / engagement activities					
E2	Involvement in climate change / climate compatible development community outreach / engagement activities					
E3	Student involvement (e.g. through societies, clubs etc.) in climate change / climate compatible development activities on campus and in the surrounding areas					

E4: List any major climate change / climate compatible development **policy** outreach / engagement activities and if possible, the person responsible for the programme:

E5: List any major climate change / climate compatible development **community** outreach / engagement activities and if possible, the person responsible for the programme:

E6: List any major student organisations / activities that are engaged with climate change / climate compatible development activities

F: UNIVERSITY COLLABORATION

What opportunities exist for collaboration towards climate compatible development knowledge co-production?

F1: Inside the university

F2: Between universities in country

F3: With partners

F4: Regionally

F5: Internationally

G: UNIVERSITY POLICY AND CAMPUS MANAGEMENT

G1: Does the university have any policies that are aligned with climate compatible development objectives? If yes, then please list them.

G2: Does the university engage in any campus management activities that are aligned with climate compatible development objectives? If yes, then please list them.

G3: Are there major networks / research groups or programmes that the university is affiliated to that focus on climate compatible development? If yes, please list them.

APPENDIX D: STAKEHOLDER QUESTIONNAIRE

SHORT QUESTIONNAIRE FOR STAKEHOLDERS on CLIMATE COMPATIBLE DEVELOPMENT KNOWLEDGE, RESEARCH AND CAPACITY NEEDS

A: GENERAL INFORMATION

A1: NAME	
A2: GENDER	
A3: HIGHEST QUALIFICATION	
A4: NAME OF ORGANISATION	
A5: NAME OF SECTION / DEPARTMENT IN ORGANISATION	
A6: JOB TITLE	
A7: YEARS OF EXPERIENCE	
A8: YEARS OF EXPERIENCE WITH CLIMATE CHANGE / COMPATIBLE DEVELOPMENT RELATED ISSUES	
A9: COUNTRY	
A10: EMAIL CONTACT DETAILS	
A11: WEBSITE ADDRESS	

B: GENERAL VIEWS

B1: Give a short description of **how you understand** 'climate change'

B2: Give a short description of **how you understand** 'climate compatible development' in your context

B3: What, in your view, are the most **critical aspects** to deal with in your country if 'climate compatible development' is to be achieved?

C: CAPACITY, KNOWLEDGE AND RESEARCH GAPS

C1: What, in your view, are the most critical **knowledge gaps** that need to be addressed for achievement of climate compatible development in your context?

C2: What are your most critical **specific research needs** for achieving climate compatible development in your context?

C3: What, in your view, are the most critical **capacity gaps** (individual skills and institutional capacity) that need to be addressed for achievement of climate compatible development in your context?

C 4: In your view, what is **the role of universities** in contributing to the achievement of climate compatible development?

C5: In your view, how could / should **your organisation** be collaborating with universities to strengthen climate compatible development in your country?

D: INTERESTS, POLICIES, NETWORKS AND CENTRES OF EXCELLENCE OR CENTRES OF EXPERTISE

D1: Briefly describe your organisation's main interest in climate change / climate compatible development

D2: List any major policies and plans that have relevance to climate change / climate compatible development in your country and/or organisational context

D3: Briefly describe any collaboration that you have had with universities and/or research, learning and innovation centres, etc. on mobilising knowledge and capacity for climate change / climate compatible development. List the specific initiative / collaboration, and if possible give details of a person responsible for this.

D4: Are there any national centres of excellence in climate change / climate compatible development research and innovation practices in your country? If yes, please list them and indicate their specialist competence areas.

D5: Is there any specialist expertise in your country / context for climate change / climate compatible development research and learning that you know of? If yes, please list who they are, and indicate their specialist competence areas.

D6: Are there any networks that are engaging with climate change / climate compatible development research and innovation practices in your country? If yes, please list them, and indicate what they focus on. If possible, list a responsible person (with contact details if possible).

APPENDIX E: RESEARCH NEEDS, LINKED TO SPECIFIC KNOWLEDGE NEEDS AND KNOWLEDGE CO-PRODUCTION PARTNERS AS IDENTIFIED IN THE CCS&AP (2012)

Table 16: Research needs, linked to specific knowledge needs

Research needs, linked to specific knowledge needs (as indicated in policy (P), supplemented by workshop (W) and questionnaire data (Q))	Partner organisations for knowledge co-production
Research on the collection and application of data in climate change models at national, regional and local levels, with specific reference to the following knowledge needs: ▪ Strengthening and improvement of meteorological weather data and other relevant field data in various localities to inform CC predictions and impact analysis (P) ▪ Linking up regional climate change models to generate better boundary conditions (P) ▪ Capacity to understanding of climate prediction models at local scale levels (Q) ▪ Up-to-date data on sector scenarios (Q) ▪ Use of space-based technology for predicting impacts of climate change (Q) ▪ Developing and/or validating country and regional specific climate prediction models on a sectoral basis (Q) ▪ Developing of land evaluation models that can project commodity-based performances (Q)	LEAD AGENT: Ministry of Works and Transport (Meteorological Dept) PARTNERS: MoE; Ministry of Fisheries; UNAM; Polytechnic of Namibia; Ministry of Agriculture, Water and Forestry
Research on monitoring of ecosystem and biodiversity changes and their impacts, with specific reference to the following knowledge needs: ▪ Monitoring systems to evaluate changes in ecosystem and biodiversity, especially sensitive ecosystems ▪ Participatory ecosystem monitoring systems involving multiple stakeholders (universities, schools, officials in line ministries, extension workers and communities) ▪ Reporting and assessing implications of changes in ecosystems and biodiversity, including for livelihoods of local people (recommend appropriate adaptation measures) ▪ Study bush encroachment and understand its impact on Namibia's greenhouse gas profile ▪ Ecosystem vulnerability analyses for ecosystem-based adaptation and mitigation	LEAD AGENT: Ministry of Environment and Tourism PARTNERS: MoE; Mines and Energy; Ministries of Forestry, Fisheries, Agriculture; UNAM; Polytechnic; DRFN; Agriculture Unions; Namibian Environmental Observatories Network (NaNEON)
Climate proof research, with specific reference to the following knowledge needs: ▪ Impacts of climate change on crops, livestock, fisheries, forests, pests and diseases (P) ▪ Evolving adverse climate tolerant genotypes and land-use systems ▪ Traditional knowledge for adaptation (P) ▪ Social issues, including but not limited to:- migration and changing household composition, loss of labour due to HIV/AIDS, land tenure security, access to credit and technologies and household activities including water and fuel collection and preparation (P) ▪ Environmental engineering to contribute to sustainable development and growth (Q) ▪ Environment and water resources management (also in urban areas) (Q)	LEAD AGENT: Ministry of Agriculture, Water and Forestry PARTNERS: MoE; Ministries of Fisheries, Environment and Tourism; Directorate of Scientific Services; UNAM; Polytechnic; Private Sector

Research needs, linked to specific knowledge needs (as indicated in policy (P), supplemented by workshop (W) and questionnaire data (Q))	Partner organisations for knowledge co-production
Research on sea level rise, with specific reference to the following knowledge needs: ▪ Monitoring of sea level rise and salinity along the coast of Namibia (using hydro-meteorological data) (P) ▪ Modelling of inundation and salinity impacts of sea level (P) ▪ Modelling and prediction of socio-economic, health and ecosystem impacts of sea level rise (P) ▪ Relocation planning (P) ▪ Effects of increased storm activity at sea (W) ▪ Migration patterns linked to movement to and from the coast (W)	LEAD AGENT: MWT, Department of Meteorology PARTNERS: Ministry of Fisheries; UNAM; Polytechnic; MoE; Government and the Private Sector (coastal mining companies) (W)
Research on, and documentation of traditional / indigenous knowledge and coping practices, with reference to the following knowledge needs: ▪ Best practices, traditional knowledge and alternative practices for coping with climate variability and extreme weather (P) ▪ Dissemination and use of such knowledge in different parts of Namibia (P)	LEAD AGENT: University of Namibia PARTNERS: MoE; Ministry of Environment and Tourism; Polytechnic; Traditional Authorities Council; NGOs (W)
Research on the cost of adaptation and mitigation, with specific reference to the following knowledge needs: ▪ Models that can be used to estimate the cost of adaptation and mitigation broadly, and as these relate to specific adaptation and mitigation practices (P, Q, W) ▪ Financially sustaining approaches to management of land and productive activities (Q)	LEAD AGENT: Ministry of Environment and Tourism PARTNERS: MoE; UNAM; Polytechnic; Ministry of Finance; other research agencies; Private Sector (W)
Research on the macro-economic and sectoral impacts of climate change, with specific reference to the following knowledge needs: ▪ Sectoral analyses using system dynamics models to support national development planning and analysis of medium to long term development issues at national level (P) ▪ Assess costs of not adapting and benefits of early climate change adaptation within sectors (P) ▪ Impact of climate change on the macro-economy of Namibia including impacts on growth, employment, trade etc. (P) ▪ Life-cycle assessments of commodities in major sectors of the economy (Q) ▪ New products development – including better use of existing Namibian climate adjusted plants, NDN Timber Forest products and climate change (Q)	LEAD AGENT: Ministry of Finance PARTNERS: NPC; Statistical Agency Bank of Namibia; Line Ministries; UNAM; Polytechnic; MoE and other research agencies; Private Sector (especially related to specific 'key industries' in Namibia e.g. the coastal mining industry) (W)

Note: Research and knowledge needs with refinements /additions from workshop and questionnaire data.

Table 17: Additional (more detailed) research and knowledge needs alluded to or identified in the CCS&AP (2012)

Aspect A: ADAPTATION	Aspect B: MITIGATION	Aspect C: CROSS-CUTTING ISSUES
Theme 1: Food Security and Sustainable Resource Base ■ Conduct field level trials of climate resilient cropping patterns and associated water management systems ■ Conduct research to develop crop varieties that are climate resistant and resilient (e.g. maize, wheat, pearl millet (Mahangu) etc. ■ Conduct research and select better adapted livestock breeds which are climate resilient ■ Develop rangeland management models that are resilient to climate change ■ Produce GIS maps that show areas vulnerable to drought and flooding in Namibia ■ Document best-practice indigenous food and drought-coping mechanisms ■ Conduct simulation exercises of contingency plans in flood and drought-prone areas ■ Monitor land cover changes in areas covered by forests ■ Monitor and research understanding of climate change impacts on fisheries and aquaculture ■ Establish and monitor the impact of sea level rise on the fishing industry, existing marine culture operations, identified marine culture development sites and infrastructure along the coast ■ Determine and test coping and adaptation mechanisms for rural communities along the perennial rivers (aquaculture may be a suitable adaptation)	*Theme 1: Sustainable Energy and Low Carbon Development* ■ Investigate future energy needs of Namibia and choose the most cost effective energy supply ■ Research and invest in harnessing wind energy, particularly in coastal areas ■ Undertake feasibility studies for tidal and wave energy, geothermal energy, energy from biomass and solar heating technologies for domestic use ■ Collect and monitor accurate data regarding GHG emissions from the agricultural sector ■ Conduct an assessment of investment and financial flows to address climate change adaptation in the Land use, Land-use Change and Forestry (LULUCF) sector ■ Explore the possibility of the development of CDM projects under the LULUCF sector ■ Undertake studies to quantify the amounts of methane produced at waste dump sites in Windhoek and other cities and towns ■ Improve design of rural and urban waste dump sites and assess the potential for effective capturing, storage and use of methane produced at the waste dump sites ■ Support the development of better technologies, innovation and communication amongst all stakeholders in waste management	*Theme 1: Capacity building, training and institutional strengthening* ■ Pilot aspects of the establishment of a Climate Change Agency that will co-ordinate all aspects of climate change issues in Namibia ■ Disseminate / distribute climate change information and research data to interested stakeholders ■ No other research or knowledge needs (e.g. related to the efficacy, approaches, models etc. of capacity building, training and institutional strengthening) identified, only actions for implementation *Theme 2: Research and information needs, including how to use climate change information* *Theme 3: Public awareness, participation and access to information* ■ Involve local farmers and other stakeholders to provide data on how they cope with the effects of climate change ■ No other research or knowledge needs (e.g. On the efficacy or approaches to or models for public awareness, participation and access to information) identified, only actions for implementation *Theme 4: Action plan for disaster reduction and risk management* ■ Undertake vulnerability mapping (using remote

Aspect A: ADAPTATION	Aspect B: MITIGATION	Aspect C: CROSS-CUTTING ISSUES
▪ Pilot test adaptive measures for coastal zone activities (consumptive and non-consumptive use) ▪ Model sea level rise to predict the area size that is likely to be impacted by a higher sea level and explore, develop and pilot adaptation measures ▪ Conduct ecosystem vulnerability assessments ▪ Model and forecast future changes in biodiversity and ecosystems due to climate changes and develop adaptive responses ▪ Document economic benefits of biodiversity and ecosystem services and how these are threatened by climate change and develop adaptive responses ▪ Identify priority species threatened by climate change and undertake focused research and conservation measures *Theme 2: Sustainable Water Resource Base* ▪ Monitor changes in water quality and quantity available for drinking ▪ Model and forecast future water changes due to climate change ▪ Develop and or adopt water efficient technologies ▪ Develop gender-sensitive water management programmes ▪ Develop joint transboundary research as well as poverty-oriented water-related investments *Theme 3: Human Health and Well-being (or Security)* ▪ Identify the implications of climate change on human health and well-being	*Theme 2: Transport* ▪ No research needs identified (e.g. research into more sustainable transportation systems etc.), only actions for implementation	sensing techniques and GIS) to delineate areas prone to disasters such as floods and enable identification of adaptation strategies ▪ Assess the sensitivity of developmental goals and aims of organisations or operations to climate change in order to understand the likely impacts of climate change *Theme 5: Financial resource mobilisation and management* ▪ Research and estimate cost of climate change adaptation and mitigation ▪ No other research or knowledge needs (e.g. Efficacy and alternatives of systems for resourcing climate change adaptation) identified, only actions for implementation. *Theme 6: Action plan for International Co-operation and Networking* ▪ Identify areas of potential North-South and South-South collaborative research in various sectors on climate change adaptation and mitigation ▪ Develop and undertake collaborative research in various sectors on climate change adaptation and mitigation ▪ Take stock of all GHG emissions as required by the UNFCC

Aspect A: ADAPTATION	Aspect B: MITIGATION	Aspect C: CROSS-CUTTING ISSUES
▪ Review outreach programmes to include areas that are vulnerable to climate change related health risks ▪ Assess the impact of floods and other climate change related disasters on the provision of sanitary services ▪ Understanding heat stress and its implications (Q, W) *Theme 4: Infrastructure* ▪ Develop climate change infrastructure risk assessment methodology and conduct climate change risk assessment studies as wall as defining the risk for various infrastructures for each sector ▪ Investigate structural and non-structural causes of water logging in the context of draining capacity of urban areas in major cities and towns (such as Windhoek, Oshakati, Katima Mulilo etc.) ▪ Design improvements in the drainage capacity of flood prone cities / settlements ▪ Estimate and model future flood levels and risks in flood prone areas of Namibia such as north-central and north-east Namibia ▪ Produce a flood vulnerability map based on predicted levels of flooding ▪ Design flood management infrastructures based on models of future flood levels and risks ▪ Improve flood forecasting and warning systems ▪ Design non-structural flood-proofing measures ▪ Conduct a detailed engineering and environmental study to assess options that could be implemented for the protection of coastal infrastructure		*Theme 7: Action plan for Technology Development and Transfer* ▪ Develop technologies that will ensure improved crop yields and livestock production ▪ Develop technologies that will ensure efficient energy use ▪ Expand technology research, development and demonstration and promote technology innovation ▪ Identify and test potential technologies that may be adopted to address adaptation or mitigation in key sectors impacted or likely to be affected by climate change. Assess performance before adoption and assess negative impacts. *Theme 8: Action Plan for Legislative Development* ▪ Review existing legislation / policies to assess the level of relevant climate change content ▪ Identify and prioritise emerging as well as other existing priority issues to address climate change No other research and knowledge needs identified (e.g. comparative studies to inform legislation / policy development), only actions for implementation

APPENDIX F: IDENTIFIED SOURCES OF EXPERTISE FOR CCD IN NAMIBIA

Table 18: Identified sources of expertise for CCD in Namibia

University	Nodes of expertise	Centres of expertise	Centres of excellence	Active Research Networks that could develop CCD expertise links
University of Namibia (UNAM) Polytechnic of Namibia	Nodes of expertise identified at **UNAM** include: *Faculty of Sciences:* Biological Sciences, Geology and NRM inter-disciplinary research *Faculty of Agriculture and Natural Resources:* Agricultural crop diversification research (rice varieties) *Faculty of Humanities:* Research on Gender, community perceptions and CC **Polytechnic of Namibia**, School of Natural Resources and Tourism, Department of Land Management has an Integrated Land Management Institute that conducts research on sustainable land use management, and is now including CCD related issues (soil, NTFPs etc.) into its research portfolio.	***Potentially and Emergent:*** **Multi-Disciplinary Research Centre**, especially its Life Sciences Division which is undertaking risk and vulnerability research, and research linked to CBNRM and an intention to conduct substantive IK research. The other divisions of the MRC appear not to be highly active as yet in CCD research. As noted above, the MRC is a new institution, and requires capacity development and support. Namibia has also recently established a UNU linked Centre of Expertise in Education for Sustainable Development, with links to UNAM's Faculty of Education.	A **SADC Centre of Excellence** in CCD research is located in Gobabeb, Namibia. It is a joint initiative of the MET and the DRFN, a research-led NGO). The Gobabeb Centre conducts research in a wide range of fields that have relevance to CCD including: archaeology and anthropology, biodiversity and climate change and ecology in its broadest sense. It tests, demonstrates and promotes Appropriate Technologies. Currently the Gobabeb CoE is developing a Hybrid Energy System. It works with a range of national and international partners.	▪ Namibian Association of CBNRM Support Organisations (NACSO) ▪ Namibian Environmental Observation Network (NaEON) ▪ Benguela Current Commission ▪ Namibian EE Network ▪ Regional Agricultural Environmental Initiatives Network – Africa (RAEIN-AFRICA) ▪ Africa Monitoring of the Environment for Sustainable Development (AMESD) ▪ Consultancy services such as: Integrated Environmental Consultants Namibia; Consulting Services Africa (CSA), LaquaR Consultancy, Lithon Project Consultants. ▪ Southern Africa Development Community Regional Environmental Education Programme (SADC REEP) ▪ SADC Remote Sensing Centre ▪ SADC Drought Monitoring Centre ▪ SASSCAL Southern African Science Service Centre for Climate Change and Adaptive Land Management

Note: This analysis is based on best available evidence. With further information and evidence, it can be expanded, and also used for monitoring and updating of CCD expertise in Namibia.

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