

# climate change counts

STRENGTHENING UNIVERSITY CONTRIBUTIONS TO CLIMATE COMPATIBLE DEVELOPMENT IN SOUTHERN AFRICA



## Mozambique Country Report



# SARUA CLIMATE CHANGE COUNTS MAPPING STUDY

VOLUME 2 COUNTRY REPORT 5 2014

STRENGTHENING UNIVERSITY CONTRIBUTIONS TO CLIMATE COMPATIBLE DEVELOPMENT IN SOUTHERN AFRICA

## Mozambique Country Report

Series Editor: Piyushi Kotecha

Authors: Heila Lotz-Sisitka and Penny Urquhart

## Note

*This is the Mozambique Country Report of the Southern African Regional Universities Association (SARUA) **Climate Change Counts** mapping study. It brings together background documentation on climate change in Mozambique, 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 Mozambique.*

*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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Southern African Regional Universities Association (SARUA)

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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

ACCRA	Africa Climate Change Resilience Alliance
AICIMO	Investors and Scientist Association of Mozambique
BID	Background Information Document
CCAM	Conformal-cubic atmospheric model
CCD	Climate Compatible Development
CCGC	Coordinating Council for Disaster Management
CDKN	Climate and Development Knowledge Network
CGC	Centro de Gestão de Conhecimento
CGCM	Coupled Global Climate Models
CIGAR	Consultative Group on International Agricultural Research
CLAA	Climate Learning for African Agriculture
CONDES	Sustainable Development Council
CSIR	Council for Scientific and Industrial Research
CSO	Civil Society Organisation
CwDCC	Coping with Drought and Climate Change
DIFD	UK Department of International Development
DNEA	National Directorate of Agrarian Extension
EACC	Economics of Adaptation to Climate Change
FDC	Fundo de Acção para o Desenvolvimento da Comunidade
FEWS	Famine Early Warning System
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIMC	Grupo Interministerial de Mudanças Climáticas
GoM	Government of Mozambique
HEI	Higher Education Institution
HEMA	Higher Education Management Africa consortium
IIAM	Instituto de Investigação Agronómica de Moçambique (Mozambique Institute for Agricultural Research)
INAM	Instituto Nacional de Meteorologia de Moçambique (National Institute of Meteorology)
INDA	Instituto Nacional de Desenvolvimento da Aquacultura
INGC	Instituto Nacional de Gestão de Calamidades (National Institute for Disaster Management)
ISPC	Instituto Superior Politécnico de Chókwe
IPCC	Intergovernmental Panel on Climate Change
MHEST	Ministry for Higher Education, Science and Technology
MICOA	Ministry for the Coordination of Environmental Affairs (Mozambique)
MINAG	Ministry of Agriculture
MOPH	Ministry of Public Works and Habitation
MPD	Ministry of Planning and Development
NAPA	National Adaptation Programme of Action
NGO	Non Governmental Organisation
PPCR	Pilot Programme for Climate Resilience (World Bank)
RNMC	Rede Nacional de Mudanças Climáticas



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
UEM	University Eduardo Mondlane
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

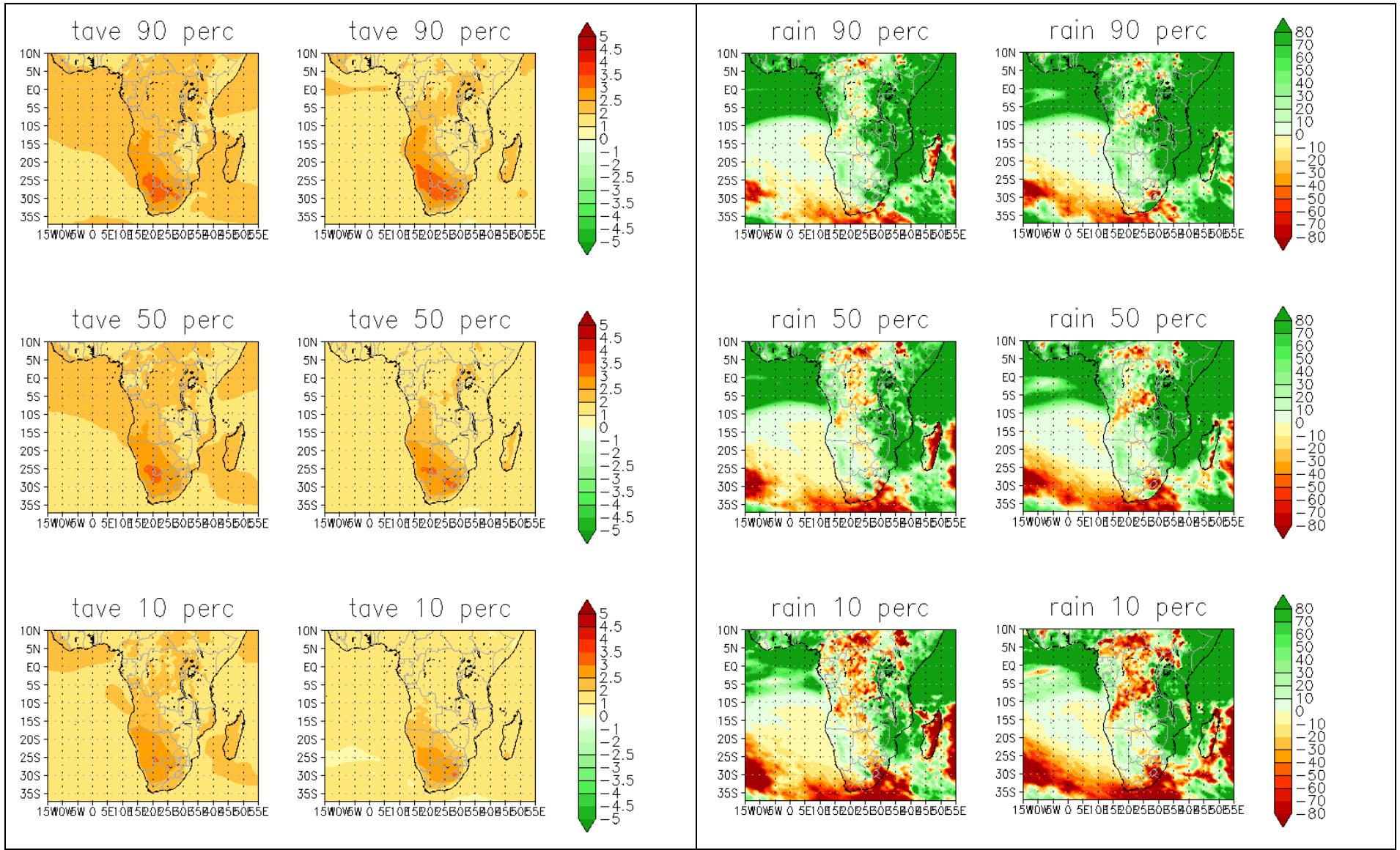
Globally, southern Africa is one of the most vulnerable regions to the impacts of climate change. Current climate variability and vulnerability to extreme events such as floods and droughts is high, and a range of existing stressors, including water availability, land degradation, desertification and 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.

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.<sup>1</sup> 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<sup>2</sup>]. 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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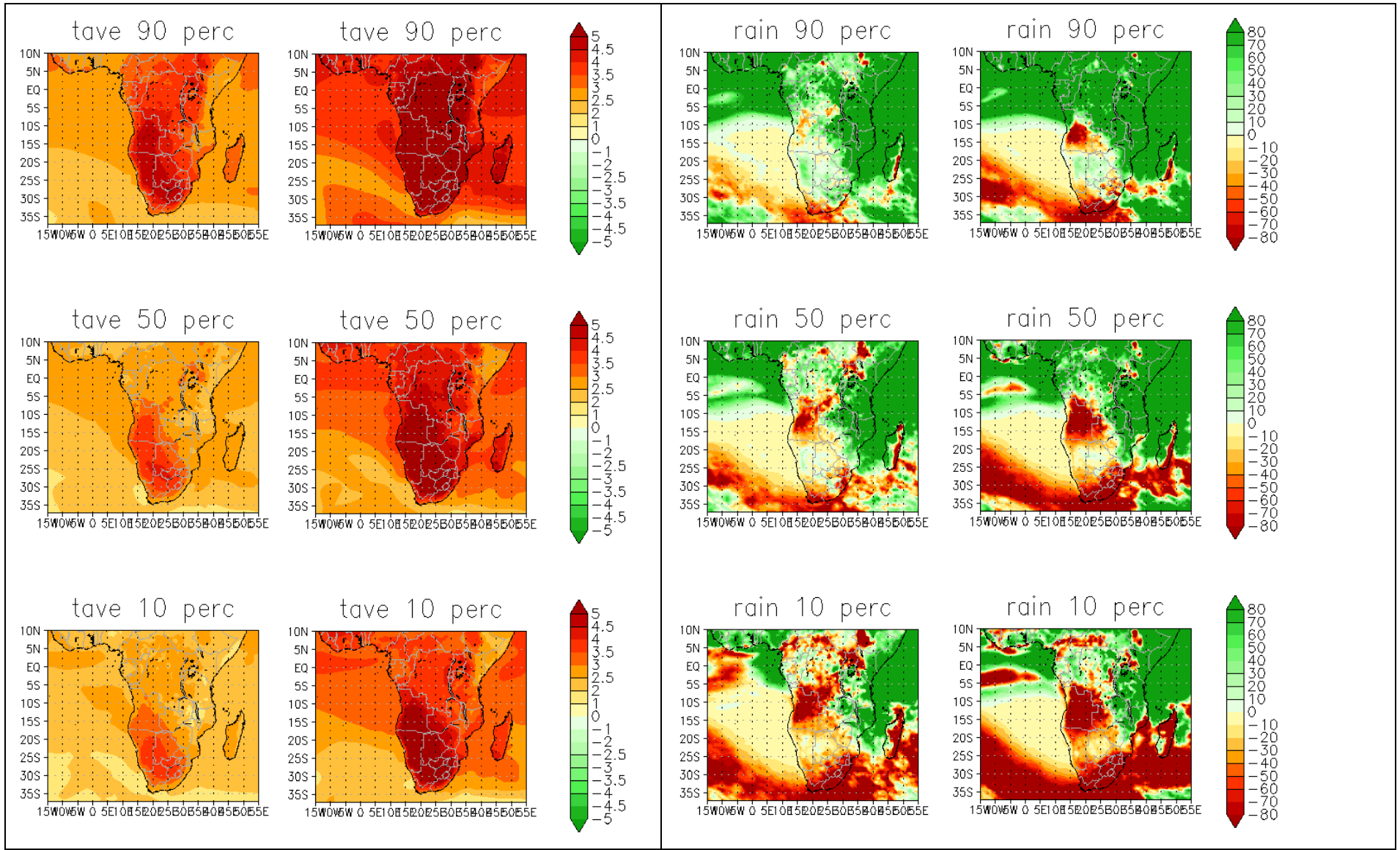
<sup>1</sup> IPCC. 2013. *Impacts, Vulnerability and Adaptation: Africa*. IPCC Fifth Assessment Report, draft for Final Government Review, October 2013, Chapter 22.

<sup>2</sup> 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 climate 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 1970-2009

Figures 1 and 2<sup>3</sup> show 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 CGCM projections are for RCP8.5.

The Initial National Communication to the United Nations Framework Convention on Climate Change for Mozambique (GoM 2003) recognises the country's high levels of vulnerability to climate change, but at the same time recognises the relationship between climate change and development. Climate compatible development (see below) within a framework of climate resilience is provided for in the Strategic Programme for Climate Resilience: Mozambique (GoM 2011).

Shifting perspective from 'development' to 'climate compatible development' requires significant scientific and social innovation. New forms of learning, leadership, planning, policy making 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-sectoral response, which draws on non-climate-related knowledge fields.

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 (SARUA) 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. This programme is highly relevant for Mozambique, given the country's vulnerability to the impacts of climate change (see section 3.3.3 below).

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<sup>3</sup> 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



## 1.2 The SARUA Climate Change initiative: History and objectives

Arising from the 2011 Leadership Dialogue, SARUA designed a five-year programme for Climate Change Capacity Development, to deliver on its mandate of promoting, strengthening

### **Box 1: Mozambique's vulnerability to climate change**

Mozambique is particularly vulnerable to extreme weather events from droughts to cyclones. Mozambique is the third most exposed African country to climate related risks, having experienced 68 natural disasters in 50 years. Mozambique's Initial National Communication to the UNFCCC (2003) notes that the sectors most affected by climate change are agriculture, forests and pastures, livestock, water resources, coastal areas and resources, infrastructure, health and fisheries. In the absence of adaptation, Mozambique could lose up to 4 850 km<sup>2</sup> of land in the 2040s, or up to 0.6 percent of national land area, and 916 000 people could be forced to migrate away from the coast (or 2.3 percent of the 2040s population). The differential vulnerability to climate change of men and women has been highlighted, as well as the greater vulnerability of children under five to environment and climate related diseases such as malaria and diarrhoea, particularly when access to medical facilities is disrupted. Taking into account impacts on agriculture, hydropower, transportation networks and coastal areas, the 2010 World Bank Economics of Adaptation to Climate Change study determines that GDP would fall between 4 percent and 14 percent relative to baseline growth in the 2040–50 decade, if adaptation strategies were not implemented. (See section 3.3.3. for a more detailed picture of Mozambique's vulnerability to climate change.)

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 62 public university members (as at August 2013). 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:

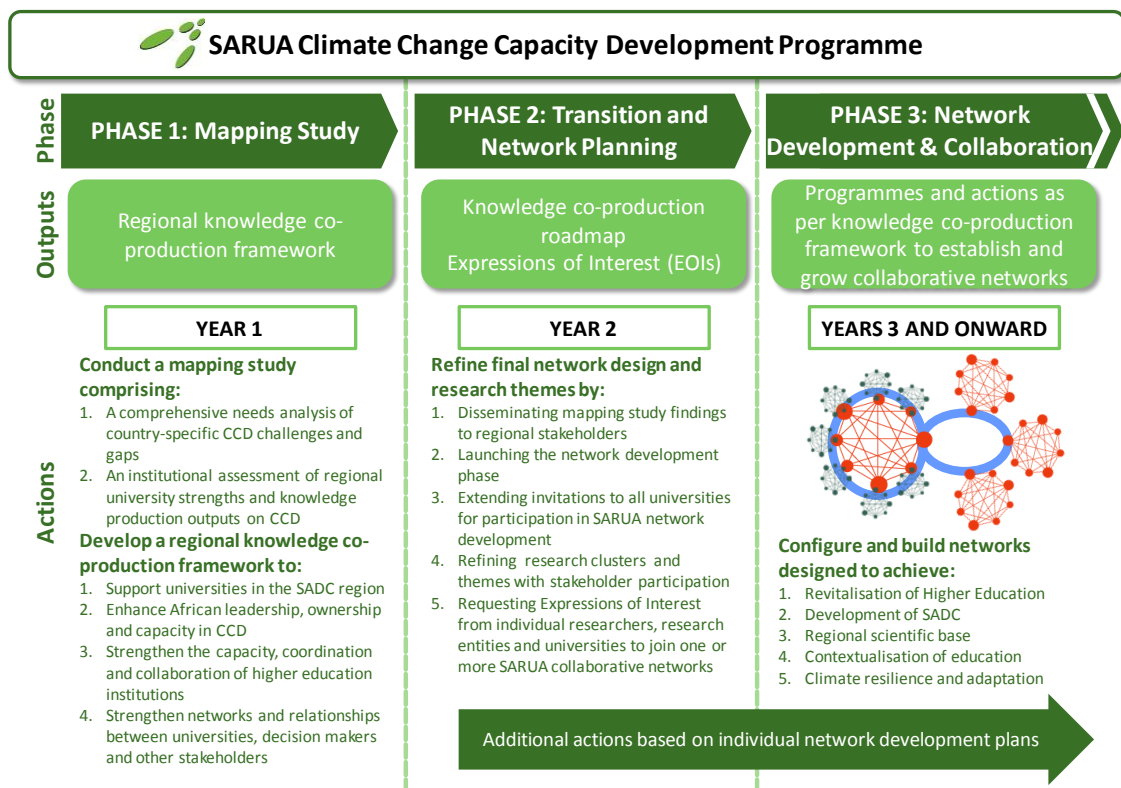
- **Collaborative network development** – Six collaborative networks established, each with a coordinating hub and each with agreement for potential growth hubs.
- **Policy and stakeholder outreach** – Agreement of a knowledge co-production framework with policy makers and community development workers in each country.
- **Research** – Two themed collaborative research networks operational, with 140 PhD students participating by the end of 2016. The PhD training programme offers exchange events and short courses between countries participating in the networks, plus international mentoring for the post-doctorate and senior staff cadres.
- **Teaching and learning** – Climate change issues have been fully mainstreamed across 50 percent of all development-related undergraduate courses run by universities participating in the SARUA network. A regional portfolio of Masters teaching modules

is available, with customised programmes running in 50 percent of member countries, resulting in the graduation of 420 Masters students by the end of 2016.

- **Knowledge management** – A regional database or platform of climate-related research and teaching activities across the SARUA network provides the basis for networking and is updated on a regular basis.
- **Institutional learning and support** – Institutional factors enabling and constraining the development of the programme identified and addressed in development plans of 50 percent of participating universities.<sup>4</sup>

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

The SARUA climate change initiative is diagrammatically illustrated in Figure 3.



**Figure 3: The SARUA Climate Change Initiative**

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

<sup>4</sup> Butler-Adam, J. 2012. *The Southern African Regional Universities Association (SARUA). Seven Years of Regional Higher Education Advancement. 2006-2012.* Johannesburg: SARUA.

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](http://www.sarua.org)).

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

Climate compatible development (CCD) 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.

While the mapping process has used a country-by-country approach, this is 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 Mozambique.

The mapping process was designed to be scientifically informed, participatory and multi-disciplinary. 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; and 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)<sup>5</sup>, “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. Thus climate compatible development opens up new opportunities for interdisciplinary and transdisciplinary research, teaching and engagement with communities, policy makers and practitioners.

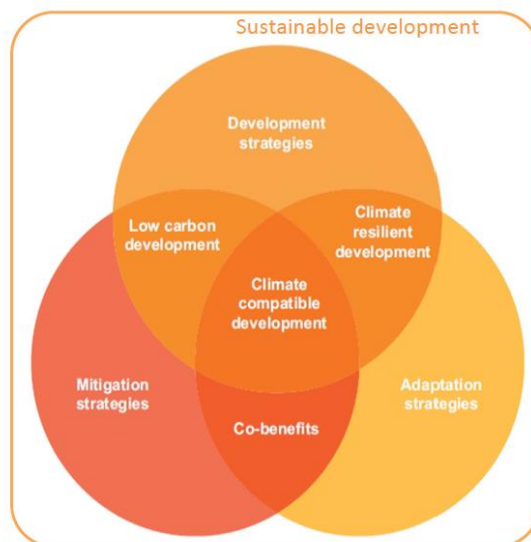


Figure 4: Conceptual framework for Climate Compatible Development (adapted from Mitchell and Maxwell, 2010)

<sup>5</sup> Mitchell, T. and S. Maxwell. 2010. *Defining climate compatible development*. CDKN Policy Brief, November 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***

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The following definition of climate-resilient pathways is taken from the glossary of the Fifth Assessment Report prepared by the IPCC<sup>6</sup>:

*“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.”*

The IPCC highlights the need for a focus on both adaptation and mitigation, as indicated by the following: “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.”<sup>7</sup>

### ***Sustainable Development***

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The most widely accepted definition of sustainable development, as formulated in the Brundtland 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 proposed 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 inter-related, 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

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<sup>6</sup> IPCC. 2013 (currently in draft form). *Fifth Assessment Report: Impacts, Vulnerability and Adaptation*.

<sup>7</sup> IPCC, *Fifth Assessment Report*, Technical Summary.

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.

## 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 Mozambique 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 Mozambique, within an overall interpretive, participatory and consultative and social realist methodology<sup>8</sup>:

#### 2.1.1 Document analysis

A country Background Information Document (BID) was developed to provide 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. The BID was developed for each country and 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 Mozambique mapping study Country Report, the following key policy and programme documents were analysed through rapid desk review:

- Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), 2003;
- Mozambique's National Adaptation Programme of Action (NAPA), 2007;
- Africa Adaptation Programme: Climate Change Adaptation Action and Mainstreaming in Mozambique, 2009;
- World Bank Economics of Adaptation to Climate Change: Mozambique, 2010;
- National Institute for Disaster Management (INGC) report on Responding to Climate Change in Mozambique Phase II (2009-2012), 2012;

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<sup>8</sup> 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.

- Climate Risk Capacity Building in Southern Africa: Summary of Mozambique Needs Assessment, May 2012;
- UNDP Country Climate Change Profile on Mozambique, undated; and
- Strategic Programme for Climate Resilience: Mozambique, June 2011.

The National Climate Change Strategy, developed in 2012 was not included in this study, as it was not available in English at the time. However, workshop participants were asked to include aspects of the strategy in the workshop discussions.

### 2.1.2 Stakeholder and university staff consultations (national workshop)

As part of the SARUA mapping study Initiative *Climate Change Counts*, a country consultation was held in Maputo on 29 and 30 April 2013. The consultations were structured as a 1.5 day programme, with a combined group of participants that included university, government, private sector and NGO 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 three rapporteurs a workshop report was produced, which was circulated to all who participated in the workshop 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 mapping study Country Report, combined with document analysis and questionnaire data.

**Table 1: Workshop programme outline**

Sessions	DAY 1 – 29 APRIL 2013
<b>INTRODUCTION</b>	Welcome and introductory remarks SARUA initiative overview
<b>SESSION 1</b>	Framing Climate Compatible Development
<b>SESSION 2</b>	Mozambique priorities and needs Knowledge and institutional gaps and capacity
<b>SESSION 3</b>	Group discussion (breakaway) Mozambique priorities and needs, knowledge and institutional gaps and capacity Plenary report-backs from group work
<b>SESSION 4</b>	What is the role of the university sector? Identifying other knowledge partners

DAY 2 – 30 APRIL 2013	
<b>INTRODUCTION</b>	Recap day and Agenda for Day 2
<b>SESSION 5</b>	Breakaway groups and plenary Who is doing what, where and why in universities in climate compatible development? (Research, Teaching, Community Engagement) Who is doing what and where amongst stakeholder groups? How does this respond to the identified needs and priorities? What are existing university plans? What are the gaps?
<b>SESSION 6</b>	Plenary discussion Knowledge co-production introduction and example of trans-disciplinary research programme Gaps in enabling environment, and needs for policy and practice support
<b>SESSION 7</b>	Opportunities for collaboration Policy implications for government, universities and donors
<b>SESSION 8</b>	Way forward and closure

### 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 Mozambique, a total of ten questionnaires were answered, which included four stakeholders and six university professionals. Questions covered the following areas:

#### 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 Mozambique, 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 post-workshop 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 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 Country Report therefore presents as a useful 'initial document' and it is hoped that Mozambique, and in particular, Universidade Lurio, Catholic University of Mozambique, Eduardo Mondlane University, Mozambique Technical University, the Pedagogical University of Mozambique and others, as well as national stakeholders especially the Ministry of Higher Education and the Ministry of Environmental Affairs (MICOA), can take this analysis forward in ongoing mapping and planning activities related to CCD research and knowledge co-production, and especially in relation to the plans for establishing a National Knowledge Centre for Climate Change.

## 2.3 Expanding the mapping study

There are numerous ways to expand this study, most notably by administering the questionnaires (included in Appendices B and C) in a manner that would include *every academic at universities and HEIs in Mozambique*, 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 and in the case of Mozambique only a few questionnaires were received, despite them being available in Portuguese.

Similarly, the questionnaire for stakeholders can be administered to additional national and local stakeholders (Appendix C) involved in environment and development initiatives in Mozambique to understand the full scope of climate change and CCD responsiveness in Mozambique, and to further develop the knowledge co-production capacity for CCD in Mozambique. In many ways therefore the SARUA study, as reported in the Country Report, maps out the pathway forward for more detailed and ongoing reflexive analysis of CCD knowledge co-production capacity in Mozambique, 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 Mozambique. Ministries who could take this study forward could include Ministry of Education; Ministry of Science and Technology; Ministry of Tourism; Ministry of Agriculture together with other relevant partners and stakeholders.

## 2.4 Analysis logic

The analysis logic informing this 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 Mozambique, 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 Mozambique, which may also assist Mozambique to **co-operate with other SADC countries in regional CCD knowledge co-production processes.**



## 3 NEEDS ANALYSIS

### 3.1 Introducing the needs analysis

The needs analysis starts with a brief overview of Mozambique's socio-economic context, which provides the baseline for addressing the climate change-related needs and priorities in the country (section 3.2), and a summary of the observed and projected climatic changes for the country (section 3.3). This is followed by an overview of the broader priorities for addressing climate change as identified by policy (section 3.4.1), in workshops (section 3.4.2) and via the questionnaires (section 3.4.3). The needs analysis then moves on to describe more specific priorities and needs, and their associated knowledge, research and capacity gaps (section 3.4). The following differentiation of knowledge, research and capacity gaps is used:

- **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 definitive.

### 3.2 Socio-economic context

Mozambique is situated along the east coast of southern Africa, with an extensive coastline of 2 700 km. The country covers an area of 799 380 km<sup>2</sup>, with more than 60 percent of the population of 23 390 675 (2010 figure) located in the coastal areas. The south of the country has a tropical dry savanna climate, while the centre is dominated by a tropical rainy climate and the north by a moderate humid climate. The generally warm climate has a seasonal variation of 5°C. There are moderate to high risk levels for drought, flooding and cyclones in different parts of the country. Development of the economy since the end of the civil war has resulted in a decreased proportion of the country's population living below the absolute poverty level – from 69 percent in 1997 to 54 percent in 2003. However, poverty remains higher in rural areas, where 80 percent of those living below the poverty line reside and depend on subsistence agriculture. The government's Third Poverty Assessment conducted in 2010 showed that poverty levels were increasing in some urban and rural areas, due partly to the impact of climate change on crops. The most important economic sectors are agriculture (which employs 80 percent of the population), livestock and fisheries. The country's gross per capita income is US\$802, while the life expectancy of its citizens is 47.8 years. Mozambique is currently in a phase of exploration for natural gas, oil and coal, and significant deposits of coal and natural gas have been identified, which will have climate change mitigation implications in future.

### 3.3 Observed and projected climatic changes, impacts and vulnerabilities

**Observed climatic changes:** A warming trend is already well established in Mozambique, although this is not uniform across the country, with mean annual temperatures having increased by 0.6 °C between 1960 and 2006<sup>9</sup>. In the same period, the number of hot days per year has increased by 25 while cold days have decreased by 14; and the number of hot nights has increased while cold nights have decreased. The mean annual rainfall has decreased at an average of 2.5mm per month per decade between 1960 and 2006, with the highest decreases occurring in December, January and February at 6.3 mm per month per decade. This is despite a recorded increase in rainfall in the northern region. Rainfall variability has increased in the southern and central regions since the 1990s, while the number of heavy rainfall events has increased between 1960 and 2006. There are indications of a later start to the rainy season, and an increase in dry spell length.

**Projected climatic changes:** The mean annual temperature is projected to increase by between 1.0 and 2.8°C by 2060, and by between 1.4 and 4.6°C by 2090, with higher rates of warming occurring in the interior compared to areas close to the coast. The INGC 2009 report points out that if global mitigation efforts are insufficient, temperatures could rise by between 2 and 2.5°C by 2050, and by between 5 and 6°C by 2080. An increase in temperature of 1°C will result in a 2.5 percent increase in the evapotranspiration rate in the Zambezi basin. The projected mean annual rainfall is not projected to change significantly, but the dry season rainfall (June to November) is projected to fall by about 15 percent, while the wet season rainfall (December to February) is projected to increase by about 34 percent. The proportion of rainfall that occurs in heavy events is projected to increase by 15 percent by 2090. Across all zones, increases in evaporation will likely be greater than increases in rainfall during the dry season (the JJA and the SON months), indicating that the dry season will become drier everywhere by around 2055 and even more so by 2090 (INGC 2009).

**Impacts and vulnerabilities:** According to the 2009 United Nations Global Disaster Risk Reduction Assessment report, Mozambique is the third most exposed African country to climate related risks, having experienced 68 natural disasters in 50 years. Droughts occur frequently in the southern and central regions, ranging from seven to four every decade. The country has a high level of vulnerability to flooding, sea level rise and increased tropical cyclones, which threaten the livelihoods of the coastal populations. While climate risks differ for the distinct agro-ecological regions, overall it is expected that flood risk in river basins and flood plains will increase notably in the south, whereas the coastal areas of the Central Zone will be heavily impacted by more intense cyclones, sea level rise and associated coastal erosion, posing an immediate threat to existing towns and settlements, and to infrastructure investments. While an increase in disaster risk along the coastline is expected to occur progressively, the consequences of the impacts are expected to increase exponentially.<sup>10</sup>

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<sup>9</sup> UNDP Climate Change Country Profile; INGC, 2009.

<sup>10</sup> INGC. 2012.

Analysis of the interactions between cyclone risk and sea level rise performed for Beira and Maputo illustrate that relatively small levels of sea level rise dramatically increase the probability of severe storm surge events, with associated damages.<sup>11</sup>

Arid and semi-arid areas as well as some coastal regions are likely to lose suitable agricultural land as a result of climate change-induced variations in rainfall. Increased evaporation (largest in the SON months) before the onset of rain, particularly over the Limpopo and Zambezi river valleys, is likely to result in decreased soil moisture before the main cropping season starts, which could affect food production (INGC 2009). Climate change is likely to aggravate food insecurity in Mozambique through a number of different mechanisms. Crop yields will decrease, with an overall projected reduction for maize by 2040 to 2065 of approximately 11 percent of present yield, and up to between 30 and 45 percent decreases in the area around Tete.<sup>12</sup>

Mozambique's Initial National Communication to the UNFCCC (2003) notes that the sectors most affected by climate change are agriculture, forests and pastures, livestock, water resources, coastal areas and resources, infrastructure, health and fisheries. In the absence of adaptation, Mozambique could lose up to 4 850 km<sup>2</sup> of land in the 2040s, or up to 0.6 percent of national land area, and 916 000 people could be forced to migrate away from the coast (or 2.3 percent of the 2040 population)<sup>13</sup>. The differential vulnerability to climate change of men and women has been highlighted, as well as the greater vulnerability of children under five to environment and climate related diseases such as malaria and diarrhoea, particularly when access to medical facilities is disrupted. Taking into account impacts on agriculture, hydropower, transportation networks and coastal areas, the 2010 World Bank Economics of Adaptation to Climate Change study determines that GDP would fall between 4 and 14 percent relative to baseline growth in the 2040–50 decade, if adaptation strategies were not implemented.

### **3.4 Identified needs: Short to medium term national priorities for CCD in Mozambique**

#### **3.4.1 Identified adaptation and mitigation priorities articulated in policy and strategy**

In Mozambique, the greatest impact of climate change in the coming years will be in the form of increasing exposure to natural disasters.<sup>14</sup> To address this, the earlier emphasis on risk reduction and preparedness is now expanding to include a broader focus on longer-term adaptation.

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<sup>11</sup> World Bank. 2010.

<sup>12</sup> INGC. 2012.

<sup>13</sup> World Bank. 2010.

<sup>14</sup> INGC. 2012.

### 3.4.1.1 *Adaptation*

The INGC Phase II report on responding to climate change (2012) identifies five priority areas for adaptation, namely:

- **Coastal protection:** Develop and implement integrated coastal zone management plans; establish and utilise opportunities for private-public sector to co-fund the implementation of expensive hard engineering adaptation options; ensure public participation and disseminate relevant information; disseminate knowledge and information to decision makers; and conduct research on and monitor coastal ecosystems.
- **Preparing cities:** Include climate change adaptation in legally binding documents of cities, put the initial focus on interventions that have low cost-benefit ratios and low capital expenditure, and on the most vulnerable sites; form an Adaptation Planning and Management Unit in each municipality, with the Mayor as the political champion; establish a process for updating the prioritisation of adaptation measures and for monitoring implementation progress.
- **Water resources:** Increase water supply by tapping into groundwater, building reservoirs, community-based approaches to watershed management, and by desalination; and improve water management practices.
- **Agriculture and food security:** Adjust sowing and planting dates; switch to different cultivars that are less sensitive to high temperatures and O<sub>3</sub>; invest in small scale water harvesting infrastructure; develop community-based small scale irrigation systems, improve the existing systems and establish new irrigation systems; conserve and improve soils; conduct agricultural research and practice technology transfer, and establish seed banks; and switch to cold fires.
- **Engaging the private sector in climate change mitigation:** Government to support the introduction of green technology by funding the cost difference between standard technology and improved energy-efficient technology; work with corporate responsible investors as role models; engage the private sector in identifying and utilising commercially viable adaptation measures; and establish a Unique Contact Point to support international investment in climate change adaptation and resilience building programmes.

Many of the recommended adaptation measures require significant investment that surpasses municipality and central-government budgets: for example, Beira would require approximately US\$270 million over five years, mostly for coastal interventions.<sup>15</sup>

### 3.4.1.2 *Mitigation*

Mozambique's INGC (2003) identifies several measures to mitigate emission of GHGs, and these include: combating uncontrolled burning, reforestation, community based management of forests, promotion of the use of renewable energy (solar and wind), rural electrification, use

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<sup>15</sup> INGC, 2012

of gas to replace thermal power, establishment and use of efficient public transport systems, promotion of energy efficient technologies across sectors and implementation of Environmental Impact Assessments.

### 3.4.2 Identified needs associated with CCD articulated in workshop interactions

Participants provided a range of responses during the workshop session dedicated to identifying climate change and CCD-related needs, which indicated a strong level of engagement with the issue. Participants highlighted the following prioritised needs for potential CCD:

A set of needs related CCD specific priorities were identified as:

- Improve **technologies** (assessment of the technological needs);
- Develop **agricultural practices** more resistant to drought and more productive;
- Improve resilience and adaptability of **food production**, and focus on overall **food security** in the country;
- Focus on **soil erosion** and saline intrusion;
- Combat illegal fires;
- Consider species **reforestation** for multiple use and mangrove protection; and
- Rezone **conservation areas** and establish new conservation areas.

Additionally, a set of cross cutting needs were identified:

- **Revision of legislation** for the integration of climate changes aspects in the different sectors (e.g. education, mining, etc.) and development of a national climate change strategy;
- Integration of **knowledge in climate change** in the Government's development programmes; and
- Establishment of opportunities for **exchange programmes** between the sectors and the communities.

### 3.4.3 Identified needs for CCD articulated in questionnaire data

Questionnaire data showed that respondents tended to interpret CCD priority needs from the perspective of their institutional interest / mandate and/or disciplinary interest / mandate (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
<ul style="list-style-type: none"> <li>■ Climate change research themes</li> <li>■ Dissemination of the results</li> <li>■ CCD in the curricula of universities</li> <li>■ Working with communities to protect traditional knowledge</li> </ul>	Office of the Rector /Human resources

Need identified	Institutional interest / mandate and/or disciplinary interest / mandate
<ul style="list-style-type: none"> <li>■ Dissemination of the results of research and reports on climate change and the institutional capacity-building of the private as well as the public sector</li> </ul>	Economics and management / GIS and Regional Planning
<ul style="list-style-type: none"> <li>■ CCD knowledge</li> <li>■ Funding resources for CCD</li> <li>■ Government involvement</li> </ul>	Agronomy / Agrarian Economics & Rural Development
<ul style="list-style-type: none"> <li>■ Economy and influence poverty</li> </ul>	Arts and Social Sciences Faculty / Geography
<ul style="list-style-type: none"> <li>■ Government prioritises CCD</li> <li>■ Developing long-term strategies</li> </ul>	Ministry of Education – Dices, HIV/AIDS Project Manager
<ul style="list-style-type: none"> <li>■ Understanding and awareness-building on the matter of climatic changes</li> <li>■ Preparation of the communities for adaptation to each change, knowledge and technical skill to deal with the issue</li> </ul>	IOPPE/Institute for Development of Small-Scale Fisheries/ Fisheries Technical Expert

Table 2 above shows that stakeholders and university staff observe a wide range of priority needs that require attention for CCD in Mozambique. The diversity of responses shows that different institutions / disciplines and levels of inter-disciplinary management are needed to develop an holistic view of what climate compatible development ‘needs’ are. It is also important to identify and recognise these different perspectives in knowledge co-production processes and approaches, as personal and/or sector or institution specific experience and context can shed light on the specific priority areas that need to be addressed. The diversity of responses from such a varied range of experts shows the inter-disciplinary 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.*

### 3.5 Specific knowledge and capacity needs: CCD research, knowledge and individual and institutional capacity gaps (related to CCD priorities)

A second important part of the Needs Analysis undertaken in the context of the SARUA mapping study involves more detailed analysis of CCD knowledge, research and capacity gaps, with a focus on those identified in key national documents, and as articulated by stakeholders and university staff attending the workshops and completing questionnaires.

#### 3.5.1 Needs analysis: Specific research needs and knowledge gaps

As noted in section 3.3.1 above, all the areas identified for adaptation and mitigation require research and knowledge production. Specifically, and according to the INGC Phase II report on responding to climate change (2012) the following research areas are identified for informing adaptation and mitigation responses:

- **Coastal protection** – Knowledge of coastal risk and vulnerability, infrastructure adaptation, biodiversity and ecosystem services and livelihood options:
  - Undertake risk and vulnerability assessments for coastal zone areas;
  - Establish infrastructure adaptation options and technologies (engineering solutions);
  - Monitor marine and coastal ecosystems and the ecosystem services they provide; and
  - Establish how changes in coastal infrastructure and sea level rise affects livelihoods, and establish viable alternatives.
- **Preparing cities** – Knowledge of adaptation options, alternatives and priorities:
  - Identify adaptation options that have low cost-benefit ratios and low capital expenditure;
  - Identify the most vulnerable sites;
  - Provide information to inform prioritisation of adaptation measures; and
  - Monitor implementation progress.
- **Water resources** – Hydro-meteorology knowledge, and integrated water resources management for adaptation and climate resilient development:
  - Establish appropriate options related to tapping into groundwater, and other strategies such as building of reservoirs etc.;
  - Inform and strengthen community-based approaches to watershed management;
  - Explore desalinisation options; and
  - Develop river basin vulnerability assessments and information to improve water management practices and water system infrastructure resilience.
- **Agriculture and food security** – Adaptation knowledge to improve agricultural productivity and climate resilient agricultural systems, technologies and practices:
  - Conduct risk and vulnerability assessments to inform early warning systems and the adjustment of sowing and planting dates;
  - Identify appropriate cultivars that are less sensitive to high temperatures and O<sub>3</sub>;
  - Inform implementation and use of small scale water harvesting infrastructure and community based irrigation system management;
  - Research conservation and land use management to inform conservation and improvement of soils, improve land use management, and explain how to deal with unplanned territorial zoning; and
  - Provide agro-ecological system innovation and technology transfer.
- **Private sector engagement in climate change mitigation** – Knowledge of appropriate green technology and energy efficient technologies and commercially viable adaptation measures:
  - Provide engineering research into green and energy efficient technologies and renewable energy; and
  - Develop research into viable adaptation measures and their commercial validity and potential.

A set of knowledge gaps and research needs were also identified in the INGC that focus on climate change **observation, monitoring, modelling and risk and vulnerability assessment and analysis**:

- Systematic updates of information in several sectors (manufacturing, construction, agriculture etc.);
- Micro-level studies on the complex interface between population, environment and development in each region;
- Climate vulnerability research to inform decision making;
- Studies of the impact of climate change on the Zambezi river;
- Research on mapping areas of risk to climate change in Mozambique, specifically regarding food security, transport and natural disasters and research;
- Research on coping with drought and climate change (CwDCC), which includes development of early warning systems, improvement in the communication lines to make weather forecast and climate information available to communities;
- Climate Change Risk Analysis, which includes the need for technical studies to inform the climate change risk analysis matrix in an ongoing and systematic process;
- Ongoing modelling of climate change impact on the Zambezi, Limpopo, Pungue basins; and
- INGC adaptation framework programmes for private and equity funding (Clean Energy, Micro and Small Scale Lending, Composting, Agro-Forestry Fund) also need to be extended with ongoing research.

Relating strongly to the National Institute for Disaster Management (INGC 2012) report on Responding to Climate Change in Mozambique Phase II priorities and knowledge and research needs are knowledge and research needs related to the following categories identified in the workshop (shown in more detail in Table 3):

- Agriculture, deforestation, conservation and ecosystem management;
- Efficacy of government policy and legislation;
- Technology development; and
- Education, training, communication and public awareness and participation.



Table 3: Knowledge, research and individual and institutional capacity gaps identified by workshop participants

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Agriculture, Deforestation, Conservation and Ecosystem Management				
Develop agricultural practices more resistant to drought and more productive	<ul style="list-style-type: none"> <li>Inadequate knowledge of resilient seeds, variability and approaches to establish more drought resistant yet productive crop varieties</li> </ul>	<ul style="list-style-type: none"> <li>Research that can establish viable new cultivars and resilient seed varieties, and associated carry through of research information to ensure successful dissemination and implementation of results</li> </ul>	<ul style="list-style-type: none"> <li>Lack of technical and scientific capacity, especially for researching new drought resistant cultivars</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate capacity to mobilise resources</li> <li>Lack of continuity and follow through in research approaches – such research needs dedicated trailing and testing over time</li> </ul>
Food security	<ul style="list-style-type: none"> <li>Lack of technical knowledge on production techniques</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate research into effective implementation of agro-processing techniques</li> </ul>	<ul style="list-style-type: none"> <li>Lack individual skills on agro-processing techniques</li> <li>Inadequate extension service skills</li> </ul>	<ul style="list-style-type: none"> <li>Weak dissemination of agro-processing techniques (e.g. for rural extension officers)</li> </ul>
Soil erosion and saline intrusion	<ul style="list-style-type: none"> <li>Lack of technical knowledge on combating soil erosion and unplanned territorial zoning</li> </ul>	<ul style="list-style-type: none"> <li>Weak dissemination of techniques to combat soil erosion</li> </ul>	<ul style="list-style-type: none"> <li>Lack of skills in the dissemination of techniques to manage and use soils</li> </ul>	<ul style="list-style-type: none"> <li>Weak urban and physical land use planning</li> </ul>
Species reforestation for multiple use and mangrove protection	<ul style="list-style-type: none"> <li>Lack of knowledge on sustainability issues related to forest resources</li> </ul>	<ul style="list-style-type: none"> <li>Research into sustainable approaches to forest resources management and reforestation approaches, especially also for mangrove protection along the coast</li> </ul>	<ul style="list-style-type: none"> <li>Need for forestry specialists and coastal zone botanical scientists / ecologists who have climate change expertise</li> </ul>	<ul style="list-style-type: none"> <li>Weak law enforcement</li> </ul>
Rezoning of conservation areas and establishment of new conservation areas	<ul style="list-style-type: none"> <li>Weak knowledge of the ecology of migratory species and of traditional migratory routes</li> </ul>	<ul style="list-style-type: none"> <li>Research into biodiversity / conservation management</li> </ul>	<ul style="list-style-type: none"> <li>Lack of specific training in biodiversity / conservation management</li> </ul>	<ul style="list-style-type: none"> <li>This issue is dealt with by two different institutions with lack of resource mobilisation skills</li> <li>Weak information dissemination and use of the existing biodiversity research projects</li> </ul>

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Combating illegal fires	<ul style="list-style-type: none"> <li>Lack of quantified knowledge on the effects of illegal fires</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient anthropological and sociological data related to illegal fires</li> </ul>	<ul style="list-style-type: none"> <li>Lack of ecological scientists and anthropologists that specialise in fire</li> </ul>	<ul style="list-style-type: none"> <li>Weak law enforcement and lack of information compilation on the effects of illegal fires</li> </ul>
<b>Efficacy of Government Policy and Legislation</b>				
Integrate climate resilience into mainstream development investment – in agriculture, natural resource management (including water), coastal infrastructure development, roads, and private sector investment	<ul style="list-style-type: none"> <li>Knowledge of risk and vulnerability and alternatives for adaptation and mitigation to inform mainstreaming of climate resilience into development planning and investment (includes knowledge of financial implications)</li> </ul>	<ul style="list-style-type: none"> <li>Inter-sectoral research on climate resilience for policy making</li> <li>Risk and vulnerability assessments per sector and overall</li> <li>Infrastructure planning research</li> </ul>	<ul style="list-style-type: none"> <li>Lack of motivation</li> <li>Lack of inter-disciplinary specialists that can facilitate inter-sectoral co-operation</li> <li>Lack of specialists for climate resilience research across sectors</li> </ul>	<ul style="list-style-type: none"> <li>Lack of integration for micro-projects</li> <li>Lack of definition of appropriate labour time for research activities</li> <li>Lack of legislation to manage the implementation of sectoral programmes</li> </ul>

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Revision of legislation for the integration of climate change aspects in the different sectors (e.g. education, mining, etc.) and development of a national climate change strategy	<ul style="list-style-type: none"> <li>■ Inadequate integrated policy framework on climate change</li> <li>■ Lack of ongoing monitoring and assessment</li> </ul>	<ul style="list-style-type: none"> <li>■ Research into cross sector integration that is based on the dynamics of climate change and implications for different sectors</li> <li>■ Inadequate knowledge of vulnerabilities associated with different sectors</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of skills and knowledge on the dynamics of climate change (resulting in the need for staff training and capacity development)</li> <li>■ Lack of capacity to assess national policies</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of financial motivation (low salaries)</li> <li>■ Research centres lack credibility</li> <li>■ Lack of training needs analysis</li> <li>■ Staffing is inadequate and staff lack specific CC expertise</li> <li>■ Weak legislation dissemination and law enforcement by the different sectors</li> <li>■ Research policies and incentives are inadequate</li> <li>■ Policy harmonisation and cross sectoral coordination is weak</li> <li>■ Lack of strategies on national investments</li> </ul>
<b>Technology Development</b>				
Improved technologies (assessment of the technological needs)	<ul style="list-style-type: none"> <li>■ Lack of sufficient knowledge and implementation of technological development plans</li> </ul>	<ul style="list-style-type: none"> <li>■ Research to establish technological needs and alternative technological development pathways in different sectors (e.g. agriculture, mining, coastal zone management, infrastructure development)</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of qualified staff (e.g. for genetic improvement of seeds, management and information and for cleaner production / clean technology development)</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of research funding and equipment</li> <li>■ Lack of information dissemination</li> <li>■ Insufficient legislation on technologies</li> <li>■ Strict customs and tax regulation hindering the acquisition of research equipment</li> </ul>

Prioritised needs for CCD	Knowledge gaps	Research gaps	Individual capacity gaps	Institutional capacity gaps
Education, Training, Communication and Public Awareness and Participation				
Establish opportunities for exchange programmes between the sectors and the communities	<ul style="list-style-type: none"> <li>■ Lack of contextualisation of the school curricula and knowledge of how to effectively contextualise curricula to include CC issues</li> <li>■ Community-based environmental awareness and knowledge for new challenges of CC</li> </ul>	<ul style="list-style-type: none"> <li>■ Research to model approaches to curriculum contextualisation</li> <li>■ Research to inform community-based adaptation</li> <li>■ Community-based vulnerability assessments to inform awareness programmes</li> </ul>	<ul style="list-style-type: none"> <li>■ Environmental education curriculum specialists with knowledge of how to contextualise curricula</li> <li>■ Community-based extension officers with knowledge of climate change vulnerabilities and adaptation strategies</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of definition of strategies at structural level in the education system to deal with climate change activities and curriculum contextualisation</li> <li>■ Lack of awareness programmes for communities and inadequate extension services</li> </ul>
Promote research projects on climate change terminology and its effects on people’s lives and country’s economy	<ul style="list-style-type: none"> <li>■ Lack of integration of climate change agenda in the school curricula and in higher education</li> <li>■ Lack of understanding of climate change terminology and concepts</li> </ul>	<ul style="list-style-type: none"> <li>■ Environmental education research to inform curriculum development</li> <li>■ Research appropriate dissemination strategies for effective communication of research information and climate change concepts and knowledge in accessible formats</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of individual motivation</li> <li>■ Environmental education / Education for Sustainable Development specialists</li> <li>■ Climate change communication specialists</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of research funding</li> <li>■ Lack of professional careers associated to climate change and environmental education</li> <li>■ Lack of dissemination of research data and information with the communities</li> </ul>
Promote professional internships related to climate change (across different sectors, institutions and disciplines)	<ul style="list-style-type: none"> <li>■ Knowledge of the range and scope of potential internships and where placements can be made</li> </ul>	<ul style="list-style-type: none"> <li>■ Research into knowledge exchange strategies and potential host institutions to inform internship programme development</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of individual engagement in climate change projects and activities</li> </ul>	<ul style="list-style-type: none"> <li>■ Lack of professional internships</li> <li>■ Lack of appropriate research and training institutions to host interns</li> </ul>

As shown in Table 3, these research and knowledge needs as discussed in the workshops, are more nuanced than those identified via policy. They also include **knowledge gaps** not mentioned elsewhere such as the need for knowledge on how to integrate climate change and CCD related knowledge in school and higher education curricula; and knowledge of how to improve communications and understanding of climate change terminology and concepts. A commonly cited concern related to knowledge is the inefficacy of existing knowledge transfer processes in Mozambique.

Prioritised **research gaps** show that there is a need for vulnerability assessment research to inform various sectors, including agriculture, forestry, coastal zone management, and conservation services; and that this research is also necessary to inform communication and education programmes and processes as well as disaster risk reduction and the various priorities that have been identified for longer term adaptation and mitigation. It is interesting also to note that knowledge and research needs related to **health** and in particular climate change and its effect of disease (e.g. malaria) were not identified anywhere in policy or in workshop or questionnaire data, despite this being a key vulnerability in Mozambique that would no doubt require research to inform appropriate responses and planning.

The priorities for CCD relating to education, curriculum development, participant and knowledge transfer should not only help with expanding community awareness of climate change risks and responses, and the wider societal transition towards CCD, but should also 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.

### 3.5.2 Needs analysis: Individual capacity gaps

The INGC (2012) notes that key capacity gaps exist in enabling individuals to participate in **systematic observation** of parameters of climate change. Other key fields requiring capacity support include: climate change modelling; atmospheric chemistry; risk assessment and management; marine pollution; environmental auditing; Information and Communication Technology (ICT); Geographic Information Systems; Physics; disaster risk planning and urban planning. The capacity to **process existing climate change data** for application and implementation is needed, along with capacity to **conduct vulnerability assessments** and **develop adaptation options**. Participating in **international negotiations** on climate change and **evaluating technological needs** of the country are also desperately needed according to the policy documents assessed. There are also key individual capacity gaps in **project management** and **international fundraising** for climate change and CCD related projects.

Key considerations for individual capacity development expressed by the workshop participants involved an **overall lack of technical and scientific capacity**, due to insufficient specialised training. This in turn leads to scarcity of available qualified staff in climate change related and CCD fields. Another area of concern raised in the workshops was the noticeable **lack of motivation**, particularly from government, to participate in climate change and CCD. Particular skills needed focused mainly on **agriculture and food security**, such as agro-

processing techniques, including techniques to manage and use soils. The lack of **conservation and technology development** training, **environmental education curriculum development and extension services**, were also mentioned. Generally participants felt there could be improvements to enable capacities for information dissemination and co-production capacities across priority areas.

### 3.5.3 Needs analysis: Institutional capacity gaps

The policy review revealed the following specific institutional capacity gaps, which were mainly sourced from the INGC (2012):

- Inadequate observation systems and information management systems;
- Conditions not conducive to the development of research activities at national level;
- Inadequate waste management in urban areas;
- Inadequate funds for conducting research activities;
- Lack of staff competencies needed to deliver institutional mandates;
- Lack of enforcement/implementation of existing policies and strategies;
- Lack of inter-institutional cooperation;
- Inadequate linkages between the new research areas and curricula;
- Decentralised decision-making and early recovery capacity; and
- Inadequate linkage between knowledge generation and use.

The Mozambique workshop and questionnaire identified the need for institutional capacity building in a range of key areas. Inadequate capacity to mobilise resources and fundraising was noted, and linked to this was the lack of incentives for professionals to get involved in CCD research as salaries and research budgets are low. Another capacity gap raised was the noticeable lack of information sharing at institutional level, as well as with the general public and other communities. On this note, one participant raised the issue that there is a noticeable lack of clearly defined climate change mandates leading to each sector potentially duplicating efforts. Workshop participants felt that institutions need to improve their capacities for offering professional careers associated to climate change, which also includes providing professional internships for recent graduates. Area-specific institutional capacity gaps raised by participants included urban and physical planning, law enforcement, dissemination of agro-processing techniques (e.g. through agricultural extension) and low levels of capacity for monitoring, observation, modelling and risk and vulnerability assessment due in part also to insufficient investment in these research areas, and also due to lack of adequate research facilities.

## 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 Mozambique, and identifies some of key stakeholders that could form part of a Mozambique's CCD knowledge co-production framework.

Following that, 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 Mozambique<sup>16</sup>

Estudos Gerais Universitarios was the first higher education institution established in Mozambique (in 1962). In 1968 this university became known as the University of Lourenço Marques. By 1974 the university offered 17 degree programmes across diverse academic and professional disciplines (Chilundo 2010). At that time the university was mainly reserved for students of Portuguese colonials, and only a small number of Mozambicans gained access to the university (Higher Education in Mozambique Patrol n.d.). After independence the University of Lourenço Marques became Eduardo Mondlane University. Eduardo Mondlane University is considered the first real Mozambican university and had the aim of expanding access to higher education for large numbers of Mozambicans. In 1985 the Pedagogic University was established, making it the second public university in Mozambique. The main purpose of this university was to train teachers for the national education system. A few years

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<sup>16</sup> This short summary is derived from a SARUA country profile compiled by Nteboheng Mahlaha in 2011 (Chapter 9: Mozambique in *A profile of Higher Education in Southern Africa, Volume 2* – [www.sarua.org](http://www.sarua.org)).

later a third public university was established, the Instituto Superior de Relacoes Internacionais (ISRI), whose mission is to train people in diplomacy studies. The Universidade Lúrio was established in Nampula in 2006 and now also has campuses in Pemba and Lichinga. In 2007 the University of Zambezi was established. Located in Beira, this new university began admitting students from 2009. Private higher education was only officially permitted in 1993 through a new higher education policy which provided for the approval of private higher education. In the first three years after the policy came into being, three private institutions were established (Knight and Teferra 2008) and there has been a tremendous growth in the number of higher education institutions since then. Today there are a total of 13 private higher education institutions and 13 public higher education institutions (including universities).

In 1995 the first National Education Policy and Strategies for Implementation was approved. This document aimed to improve the economy by increasing the literacy rate in the country (Kotecha 2008). The Education Sector Strategic Plan 1999–2003 was launched in 1998 and its main focus was to improve access of education for all, especially for women; improve the quality of education; and strengthen the financial and administrative infrastructure of institutions to ensure effective and sustainable delivery of education. At the end of this 1999–2003 strategic plan cycle, a number of gaps and possible improvements were identified in the higher education sector and a new higher education law was passed in 2003. Through this plan (covering the period 2005–2009), the Ministry for Higher Education, Science and Technology (MHEST) sought to achieve the following objectives: 1) enhance research at cultural and technical levels via training to address relevant problems facing society and business towards national development and human heritage; 2) develop a highly skilled core of technical and research staff through training; 3) encourage the third mission of the university through extension services, mainly through knowledge dissemination and exchange; and 4) enhance human capital production to the training of graduates of high quality. It included many of the same initiatives as the first, but in addition focused on the development of vocational education and higher education (GoM 2005). This policy document advocates for an increase in higher education access through vocational and other tertiary forms of education and the production of human capital with the skills relevant for the recovering economy.

Originally, the higher education sector in Mozambique was governed as an integral part of the Ministry of Education, and no particular emphasis was placed on higher education as a separate section. However, between 2000 and 2004 the need to improve the capacity for human capital formation as well as research and innovation lead to the creation of the Ministry of Higher Education, Science and Technology. Together with MHEST, two councils were established: the Higher Education Council, and the National Council on Higher Education, Science and Technology, composed of rectors from both public and private higher education institutions (Bailey et al. 2011). These two councils were set up to advise MHEST as part of its decision-making process.

#### **4.2.2 Policy context for climate change**

The 2004 Constitution of Mozambique provides for a sustainable development policy orientation while Agenda 2025 (GoM 2003) also provides for climate change as a cross-cutting issue. Mozambique's proactive response to climate change has resulted in the development of



the National Climate Change Strategy, which was passed by the Council of Ministers in November 2012 and constitutes a framework for enhancing the country's resilience to climate change; and the national strategy on Disaster Risk Reduction and Climate Change Adaptation. Climate concerns are integrated into various policies and programmes, including the Master Plan for Prevention and Mitigation of Natural Disasters (2006), Environmental Strategy for the Sustainable Development of Mozambique (2007) and National Water Resources Management Strategy (2006).

Key achievements of the INGC Phase II study (2009–2012) include detailed vulnerability risk analysis and no-regret adaptation options for 11 high-risk coastal cities and towns; city adaptation strategies for 2010 to 2015 for Maputo, Beira and Quelimane; a business plan for **Climate Change Knowledge Centre** (discussed below in more detail); early-warning mapping of changes in inundation and risk areas resulting from climate change for the Zambezi, Limpopo and Pungwe rivers; development of four commercially viable adaptation programmes in partnership with the private sector, each worth US\$50 million to US\$100 million of private-sector investment over a five-year time-span; and a National Strategy on Disaster Risk Reduction.

#### 4.2.3 Institutional arrangements for climate change

The existing institutional arrangements for climate change are shared between two councils leading to parallel decision-making – the Sustainable Development Council (CONDES), which is responsible for climate change and the environment; and the Coordinating Council for Disaster Management (CCGC), which is responsible for climate change and disaster risk. The Ministry for the Coordination of Environmental Affairs (MICOA) is the designated national authority for climate change in Mozambique. It has the responsibility to oversee the country's involvement in the UNFCCC – providing institutional leadership on mitigation and low carbon development. The National Disaster Management Institute (Instituto Nacional de Gestão de Calamidades – INGC), under the Ministry of State Administration, provides institutional leadership on disaster risk and vulnerability reduction, as well as research into the potential effects of climate change. The Ministry of Planning and Development (MPD) is responsible for mainstreaming climate change into the planning policies of the country, providing institutional leadership on adaptation across sectors. The Inter-Institutional Group on Climate Change (GIIMC) provides a mechanism for line ministries to debate climate change matters, while the Environment Working Group Coordinates donor activities on environment, including climate change. The coordinated response has resulted in the Mozambique Climate Change and Development (CCD) Combined Work Programme.

According to the SARVA report (2012), Mozambique has a multi-stakeholder forum on climate change that includes NGOs such as CARE, World Vision and Save the Children. Mozambique's United Nations Human Settlements Programme's (UN-HABITAT) Cities and Climate Change

Initiative also provides for the participation of NGOs and community based organisations and associations on climate change in urban areas.<sup>17</sup>

### 4.3 Research and development institutions

Mozambique's INGC (2003) highlighted four major institutions responsible for research concerned with climate change: the National Meteorological Institute, the National Institute for Agronomic Investigation, the University of Eduardo Mondlane, and the Universidade Pedagógica; and noted the absence of a framework to facilitate inter-institutional linkages. Under theme seven of INGC's second phase, a **Climate Change Knowledge Centre** will be established that will build the country's knowledge base and information management capacity on climate change through research, education, awareness building and provision of advisory services. Information packages, from research findings, will be targeted at management, administrative and technical staff at both provincial and district levels. Multidisciplinary research projects will be employed to generate solutions to adaptation and mitigation as per nationally defined priorities.

### 4.4 Some current CCD initiatives and programmes

There are a number of CCD initiatives and programmes active in Mozambique. This institutional analysis was only able to identify *some* of these (Table 4). More comprehensive national analysis would be able to expand the insights into existing active programmes.

**Table 4: Some CCE initiatives and programmes in Mozambique**

Programme / initiative	Driving agency / department	Focus and timeframe	Status / additional comments
UN Joint Programme in Environmental Mainstreaming and Adaptation to Climate Change	Implemented by Ministry of Agriculture, INGC, INAM and MICOA; with six United Nations agencies Funded by Spain MDG Fund	2008 – 2010 Adaptation to climate change at policy and practice levels in Gaza Province along the Limpopo River Basin. Includes enhanced community coping and adaptation measures	
Adaptation in the Coastal Zones of Mozambique	Ministry of Environment (MICOA), UNDP Funded by GEF-LDCF	2012 – 2016: Integrate coastal CC risks into key decision making processes; enhance adaptive capacity of coastal communities.	Document and disseminate best practices Replication plan for successful coastal adaptation pilots Awareness campaign

<sup>17</sup> UN-Habitat. 2009. *Climate change in urban areas of Mozambique: A pilot initiative in Maputo City – preliminary assessment and proposed implementation strategy*. Maputo: MICOA & Maputo Municipality Council.

Programme / initiative	Driving agency / department	Focus and timeframe	Status / additional comments
Africa Adaptation Programme	INGC, MICOA UNDP Funded by Government of Japan	2009–2012: Strengthen dynamic long term planning mechanisms; harmonise institutional frameworks; strengthen leadership; implement policies; expand financing options for adaptation; generate and share knowledge on adjusting national development processes to incorporate CC risks	Technical studies included developing a Climate Change Risk Analysis Matrix and modelling climate change impact on the Zambezi, Limpopo, Pungue basins. INGC adaptation framework programmes for private and equity funding (Clean Energy, Micro and Small Scale Lending, Composting, Agro-Forestry Fund)
Economics of Adaptation to Climate Change (EACC)	World Bank	Completed 2010: Explored impact on economy & costs of adaptation in agriculture, transport, energy & coastal zone	Economic assessments carried out
Coping with Drought and Climate Change (CwDCC)	Implemented by MICOA with UNDP support, funded by GEF SCCF	2009 – 2014: Reduce drought vulnerability in farming and pastoral communities by guaranteeing water supply and through training local communities to grow drought-resistant crops, like sweet potato, cassava or sorghum	Early warning systems; improve the communication lines to make weather forecast and climate information available to communities
Pilot Programme for Climate Resilience	Ministry of Environment (MICOA), MPD, World Bank	Ongoing: Integrate climate resilience into mainstream development investment – in agriculture, natural resource management (including water), coastal infrastructure development, roads, and private sector investment	Enhanced National Water Information System to support climate-resilience water-enabled economic growth
Climate Learning for African Agriculture (CLAA) project – Mozambique country study	Financed by CDKN, implemented in partnership by the Natural Resources Institute of the University of Greenwich (NRI), the Forum for Agricultural Research in Africa (FARA) and the African Forum for Agricultural Advisory Services (AFAAS)	2012–2013: Aimed to assess the extent to which climate change and CCD are addressed by agricultural research, extension and development activities and programmes. Also facilitated stakeholder learning about CC and climate compatible agricultural development	Report produced and learning engagements completed

**Note:** The list in Table 4 is not comprehensive but is illustrative of how some of the issues identified above are already being addressed.

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

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

At present, climate change issues are addressed in some sectors as specific climate mitigation and adaptation policies such as the National Institute for Disaster Management (INGC) report on Responding to Climate Change in Mozambique Phase II (2009-2012), the Summary of Mozambique Needs Assessment for Climate Risk Capacity Building in Southern Africa (2012), and the Strategic Programme for Climate Resilience: Mozambique, June 2011. Even with these policies, there is a need to develop a common understanding of the core issues of Climate Compatible Development (CCD) necessary for knowledge co-production in Mozambique. Discussion on the meaning of climate compatible development in the workshop in Maputo 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.

Amongst the stakeholders involved in CCD related policy and knowledge mediation activities, different understandings of CCD exist, as shown by these extracts from the questionnaire data:

- “CCD is the reduction of emissions by use renewable energy”;
- “CCD is something related to the mitigation, adaptation and development strategy”;
- and
- “CCD is the promotion or implementation of development activities, adjusting them to the new context or changing trends in the climatic situation. The perspective is to anticipate negative effects on the climate and mitigate climatic impacts on socioeconomic and productive activities”.

Within the universities across Mozambique, there were somewhat different understandings of CCD, as shown by these extracts from the questionnaire data obtained from nine university respondents:

- “CCD is the involvement of the community in all aspects; sharing and dissemination of the results obtained. It involves research that feeds into the definition of government policies on flooding, slash and burn activities, and devastation of fauna and flora (biodiversity loss)”;
- “CCD refers to a new development approach that we must always take into consideration with regard to current climate changes”; and

- “CCD is development that takes in account the environment and reduces the emission of GHG, and increases the capacity of carbon sinks; enhances green economy and the use of alternative and clean energy sources”.

From this it is possible to see that although understandings of CCD differ amongst and between stakeholders and university staff involved in 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. **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

An assessment of what research is needed for CCD in Mozambique and a detailed database search of all research published on climate change / sustainable development research in Mozambique would provide substantive detail on what research is already being conducted in Mozambique. 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 Mozambique.

The INGC (2003) shows that in Mozambique various institutions conduct research activities in areas inherent to climate change, each one dealing with the components relevant to its area of specialisation. From these institutions, the following can be noted:

- The National Meteorological Institute is responsible for studying agro-climatology, climate and human comfort and climatic conditions;
- The Mozambique Institute for Agricultural Research (IIAM) is responsible for research related to the study and improvement of agricultural varieties, and for addressing dry-land agriculture and water conservation issues, and agro-forestry research, as well as climate related agro-ecological research (although this is not the only research they do);
- The Eduardo Mondlane University conducts academic research relevant to climate studies;
- The Universidade Pedagógica is concerned with simulation and adaptation studies, as well as environmental education;
- The Catholic University of Mozambique (recently established private university) is also beginning to undertake climate related research in a number of its faculties; and
- The Higher School of Rural Development (ESUDER) operated jointly with UEM (recently opened in Inhambane Province) is also beginning to undertake climate related research.

An examination of Mozambique policy documents reveals some interesting recent climate change research, and shows that Mozambiquan researchers are contributing knowledge to policy and strategy for CCD in Mozambique:

- E.R.M. Archer van Garder, *Institutional Arrangements for Responding to Climate Change in Mozambique*. Report prepared for INGC and UNDP, May 2012.
- T. Avellan, J. Guillemot and S. Llosa, *The User Interface Platform (UIP) of the Global Platform for Climate Services Health and Disaster Risk Reduction within the Global Framework for Climate Services*. Consultation Report, 14-16 November 2011, Geneva: WHO.
- INAM (Instituto Nacional de Meteorologia), *Monitoria e Atualização da época chuvosa 2001-2012*, Maputo, 2012.
- INGC, Main report: INGC Climate Change Report: Study on the Impact of Climate Change on Disaster Risk in Mozambique, in K. Asante, G. Brundrit, P. Epstein, A. Fernandes, M.R. Marques, A. Mavume, M. Metzger, A. Patt, A. Queface, R. Sanchez del Valle, M. Tadross and R. Brito (eds.), INGC, Mozambique, 2009.
- O. Monteiro, A. Calengo and A. Mavume, *Respondendo as mudanças climáticas em Moçambique (Responding to Climate Change in Mozambique): Tema 9: Proposta de estratégia nacional para a redução do risco de desastres e de adaptação às mudanças climáticas (Proposal for a national strategy for disaster risk reduction and adaptation to climatic changes)*, (ENARC) INGC, Maputo, 2012.

A rapid review of published research available on Google Scholar (first ten articles listed with 'climate change Mozambique' in the search) shows the following research conducted on climate change in Mozambique.

**Table 5: First ten articles listed with 'Climate change' and 'Mozambique' in the search and the national origin of the first author**

Article	Origin of first author
Arndt, C., K. Strzepeck, F. Tarp, J. Thurlow, C. Fant IV and L. Wright. 2011. "Adapting to climate change: an integrated biophysical and economic assessment for Mozambique," <i>Sustainability Science</i> 6(1): 7-20.	Denmark
Artur, L. and D. Hilhorst. 2012. "Everyday realities of climate change adaptation in Mozambique," <i>Global Environmental Change</i> 22(2): 529-536.	Netherlands
Ribeiro, N. and A. Chaúque. 2010. <i>Gender and climate change: Mozambique case study</i> . Cape Town: Heinrich Böll Stiftung Southern Africa.	South Africa and Mozambique
Barbir, J. and W. Leal. 2012. "Socio-Environmental Evaluation of Drip Irrigation System Implementation as a Climate Change Adaptation Measure Within the N'hambita Community Carbon Project Area, Mozambique," in <i>Climate Change and the Sustainable Use of Water Resources</i> , 663-684. Berlin Heidelberg: Springer.	Spain
Hahn, M.B, A.M. Riederer and S.O. Foster. 2009. "The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change – A case study in Mozambique," <i>Global Environmental Change</i> 19(1): 74-88.	USA
Strzepek, K., C. Arndt, P. Chinowsky, A. Kuriakose, J. Neumann, R. Nicholls and L. Wright. 2010. <i>Economics of Adaptation to Climate Change: Mozambique</i> Washington DC: World Bank.	USA
Arndt, C., P. Chinowsky, K. Strzepek and J. Thurlow. 2012. "Climate change, growth and infrastructure investment: the case of Mozambique," <i>Review of Development Economics</i> 16(3): 463-475.	Denmark

Article	Origin of first author
Ziervogel, G. and A. Taylor. 2011. "Integrating Climate Change Information within Development and Disaster Management Planning: Lessons from Malawi, Mozambique and Zambia" in <i>Climate Change Adaptation and International Development</i> , 129-151. London: Earthscan.	South Africa
Gething, P.W., D.L. Smith, A.P. Patil, A.J. Tatem, R.W. Snow and S.I. Hay. 2010. "Climate change and the global malaria recession" <i>Nature</i> 465(7296): 342-345.	UK
Levine, S., E. Ludi and L. Jones. 2011. "Rethinking Support for Adaptive Capacity to Climate Change. The Role of Development Interventions. Findings from Mozambique, Uganda and Ethiopia".	Unknown

It is encouraging to see that there are a variety of different research publications available regarding climate change in Mozambique. Even more encouraging is to see that six of the first ten publications with the title including "climate change" and "Mozambique" were published within the last two years. Despite this promising finding none of the internationally listed publications were primarily authored by researchers from Mozambique, showing that there is a little to no research presence regarding climate change in Mozambique in the international arena, despite the growing climate change policy environment and the increase of donor funded programmes on CCD in Mozambique. The majority of the articles/chapters focus on adaption, and disaster management (infrastructure, vulnerability, gender, food security and health).

#### 4.5.2.2 University-based research

The Mozambique questionnaire and workshop data shows a diversity of universities, university faculties and department involvement in climate change and CCD related research, as shown in Table 6 below.

**Table 6: Diversity of universities, university faculties and departments involvement in CC and CCD related research**

Faculty / School / Centre	Department	Programmes / Institutes
UNIVERSIDADE LURÍO, Faculty of Agrarian Sciences	Agriculture	Science days dedicated to with themes related to climate effects/changes and/or climate change and its effects
CATHOLIC UNIVERSITY OF MOZAMBIQUE, Faculty of Economics and Management	GIS and Regional Planning, SÉRGIO NIQUISSE sniquisse@gmail.com	Programme to study the impact of climate change on the Zambezi River
CATHOLIC UNIVERSITY OF MOZAMBIQUE, School of Marine and Coastal Sciences (ESCMC)	Coastal vulnerability and adaptation research	Working with INGC on coastal adaptation and vulnerabilities research



Faculty / School / Centre	Department	Programmes / Institutes
CATHOLIC UNIVERSITY OF MOZAMBIQUE, Faculty of Agriculture	Agriculture adaptation studies	
EDUARDO MONDLANE UNIVERSITY, Faculty of Agronomy and Forestry Engineering	Agrarian Economics & Rural Development LUIS ARTUR lartur@uem.mz	Disaster risk reduction research focussing particularly on Forestry, Agriculture and Rural Development
EDUARDO MONDLANE UNIVERSITY, Faculty of Veterinary Sciences		Climate related livestock agriculture adaptation research
EDUARDO MONDLANE UNIVERSITY, Faculty of Art and Social Sciences	Geography BALOI ARISTIDES aristides.baloi@gmail.com	Mapping areas at Risk to Climate change; Social learning and communal irrigation system management
EDUARDO MONDLANE UNIVERSITY, Faculty of Education	Education AGUIAR BAGUETTE	Education for Sustainable Development Programme
UNIVERSIDADE PEDAGOGICA, Department of Science Education	Education ARMINDO MONDLANE	Environmental Education / Education for Sustainable Development
MOZAMBIQUE TECHNICAL UNIVERSITY	Geography RUI MAIA BRITO AV. www.udm.ac.mz	Disaster Risk Reduction research linked to Pan African university network on DDR
THE HIGHER SCHOOL OF RURAL DEVELOPMENT (operated jointly with UEM)		Rural risk and vulnerability and adaptation research

**Note:** Table may not be complete, and is therefore indicative rather than definitive

Table 6 above shows faculty-based diversity and departmental level diversity of participation in climate change related research and teaching at Eduardo Mondlane University, Catholic University of Mozambique and Universidade Lurio as well as the Universidade Pedagogica and the Mozambique Technical University.

The table also shows that between the universities most of these have some form of climate change related research programme. Very little of this work is showing as recent publications in the international arena, and it may be necessary to investigate what is inhibiting the publication of this research.

Workshop and questionnaire data showed that there is some research taking place on topics that are related to CCD, including (but not limited to) those outlined below:

Associated with these research programmes and other smaller scale research initiatives are a number of active researchers, who were mentioned in workshop and questionnaire data (these are listed in Table 6, with further information in Appendix B).



*Gender and PhD profile:* Of those lecturers responding to the questionnaire all were male, however one of the stakeholders involved in gender and climate change research was female, showing some participation of women scientists in climate related questions in Mozambique, although the research environment seems to be somewhat male dominated. Most of those responding to the questionnaire had 5 or more years' experience in their disciplines. Only one of the respondents had a PhD, showing the need for improved institutional and academic support for developing more PhD scholars, particularly in climate change and CCD related fields.

#### **4.5.2.3 Centres of Excellence, Centres of Expertise 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 post-graduate 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.

#### ***Centres of Excellence***

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No CCD related Centres of Excellence were identified for CCD research in Mozambique. However, the plans for the **Climate Change Knowledge Centre** in Mozambique, being established under MICOA and the INGC out of the Africa Adaptation Programme promises to become a national Centre of Excellence for CCD related research and knowledge co-production. This centre is, however, only currently being established.

#### ***Centres and nodes of expertise***

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It was not possible to identify specific centres of expertise at universities other than UEM due to the limitations associated with this mapping study, besides those 'nodes' of research expertise identified in Table 6 above.

It is possible, however to identify the University Eduardo Mondlane's Faculties of Agronomy and Forestry Engineering and Faculty of Veterinary Sciences as a Centre of Expertise for **climate compatible agricultural development research**. Each of these two faculties employed 17 researchers (full time equivalent) in 2008, and they are actively engaged in climate related research, although it is not their only research focus (Parkinson 2013<sup>18</sup>). UEM collaborates with the National Agricultural Research Institute (IIAM) on climate change adaptation research projects, and a variety of collaborative projects are implemented with centres of the Consultative Group on International Agricultural Research (CIGAR). UEM also collaborates with several European universities on climate related research. Most of these projects use climate models to understand climate change and predict future trends of several climate scenarios, land use, production systems and crop yield predictions. UEM also works closely with INGC and the Famine Early Warning System (FEWS) on disaster forecasting and preparedness and with INAM in collecting, processing and disseminating climate data.

A number of broader centres of expertise and research networks / programmes in climate compatible research in Mozambique (not located within the university system, but which worked with researchers from the university system) were identified as being:

- National Institute for Disaster Management (INGC);
- National Institute of Meteorology (INAM);
- Mozambique's Climate Change and Development (CCD) Combined Work Programme;
- Livaningo: Mozambican CSO that focuses on environmental education (António Reina – Reina@virconn.com);
- Mozambique Institute for Agricultural Research (IIAM): Soils and Crops Department
- ABODES: CSO specialising in organic agriculture research: Lina da Silva – linaevaristo@gmail.com);
- Centro Terra Viva: CSO specialising in natural resources management (www.ctv.org.mz Director General Alda Salomão); and
- United Nations University linked Regional Centre of Expertise in Education for Sustainable Development for Mozambique (linked to the Geography and Education Faculties at EMU, and the Pedagogical University of Mozambique, as well as other stakeholders).

Other Mozambique Research Networks that are relevant to CCD research were identified as:

- Fewsnets (MIND) Famine Early Warning System Network (Mozambique Country Office Mozambique@fewsnets.net)
- PPCR – World Bank Pilot Programme for Climate Resilience

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<sup>18</sup> Parkinson, V. 2013. "Climate Learning for African Agriculture: The Case of Mozambique," in *Climate Learning for African Agriculture*. Working Paper No. 6. AGEMA Consultoria, Maputo, Mozambique (www.cdkn.org).

Regional environmental research and knowledge networks that Mozambican researchers are linked to:

- SADC REEP (Southern African Development Community Regional Environmental Education Programme);
- SADC: SADC Drought Monitoring Centre;
- SADC: SADC Meteorological Services;
- SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management); and
- ACCRA (Africa Climate Change Resilience Alliance).

#### 4.5.3 Curriculum innovations and teaching for CCD

All the university respondents who responded to the questionnaires indicated that there is some existing work taking place with regard to CCD curriculum innovation in their departments. Questionnaire responses indicate that all the participants from the various universities showed a willingness to get involved in new issues such as climate change and/or climate compatible development with regard to their curriculum innovation and teaching, and the questionnaire data showed that staff ability to get involved was good. Eduardo Mondlane University showed the greatest incidence of CCD issues and opportunities incorporated into their current curriculum.

All the respondents showed little to no experience with regard to inter- and/or transdisciplinary teaching approaches to CCD. Universidade Lurio had some courses that clearly focus on development of social and/or technical innovation and ethical actions. The other two universities are also implementing pedagogical innovations for Education for Sustainable Development, and this is being led by the Pedagogical Director of the University, and is supported by the Vice Chancellor.

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. The following specific courses were identified as being on offer (cited in the workshop discussions and questionnaire data) (see Table 7).

**Table 7: Courses oriented towards climate compatible development**

University / Faculty	Courses being run	Who is involved	Type and level of course
UNIVERSIDADE LURIO: in the Faculty of Agrarian Sciences and Faculty of Natural Sciences	Degree in Rural Development, Degree in Forestry Engineering Degree in Biology These degrees include aspects of CCD.	ISAUNA D.C. ZACARIAS MÁQUINA	Undergraduate and post-graduate (MSc)

University / Faculty	Courses being run	Who is involved	Type and level of course
CATHOLIC UNIVERSITY OF MOZAMBIQUE: Inter-disciplinary partnership between the Faculty of Agriculture and the Faculty of Economics and Management	A curriculum is currently being developed on Climate Change and Sustainable Development.	SÉRGIO NIQUISSÉ	Undergraduate
EDUARDO MONDLANE UNIVERSITY: Faculty of Agronomy and Forest Engineering	Courses that focus on Disaster risk resolution Masters in Rural Development and Climate Change Masters in Environmental Science Other courses are currently being reviewed to include CCD.	LUIS ARTUR	Post-graduate: Masters
EDUARDO MONDLANE UNIVERSITY: Faculty of Art and Social Sciences	Geography course, that incorporates Climate Change and CCD	ARISTIDES BALOI	Undergraduate
EDUARDO MONDLANE UNIVERSITY: Faculty of Science	Masters in Integrated Water Management, Soil and Waste (at UEM in partnership with United Nations University)	Unknown	Post-graduate
EDUARDO MONDLANE UNIVERSITY: Physics Department	Provides an optional subject of renewable energies. The programme fosters research, training and community development. It responds to CCD priorities in the content of the curriculum.	Unknown	Undergraduate
EDUARDO MONDLANE UNIVERSITY: Faculty of Education	Developed a Bachelor in Environmental Education which has, as part of its curricula, climate change related topics which foster CCD. An inter-disciplinary Masters degree in Climate Change is currently being planned.	AGUAIR BAGUETTE	Undergraduate  Post-graduate, inter-disciplinary

**Note:** This list is not exhaustive; it can be updated and extended.

There appears to be a link between those lecturers involved in climate change 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 7 Eduardo Mondlane University has dedicated CC / CCD courses at post-graduate level. For all the universities and for the faculties at EMU that are including CCD, especially at undergraduate level, the dominant pattern of practice appears to be to integrate aspects of 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, as such integration is not only taking place in one faculty. The university-based questionnaire (especially Section C) in Appendix B 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 in the questionnaire as being potentially effective for CCD in courses beyond traditional teaching approaches included:

- Climate themed educational games;
- Simulations, scenario building and role play;
- Participatory teaching methods; and
- First hand experience in fieldwork situations.

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

#### 4.5.4 Community and policy outreach

Questionnaire data did not show any specific incidences of university staff contributing to the policy processes, although it was noted in the workshop that academics were involved in the drafting of the national Climate Change Strategy. There was one example mentioned at the UEM of a programme that had been developed with students to provide community awareness programmes regarding uncontrolled slash and burn activities. Part of the process involved designing joint policies with communities to respond with new approaches to agriculture and food production.

The Universidade Lurio has an innovative community engagement approach: students at the university are involved in a programme called 'one student one family' in which each student is responsible for sharing knowledge gained in their faculties with families in the university community. This programme is currently being reviewed for the extent to which it includes sustainable development knowledge and practice that can be shared with communities.

Besides these examples mentioned, in general the workshop and questionnaire data showed a low level of community outreach or engagement amongst university staff.

#### 4.5.5 Student involvement

The only student organisation cited as having potential for engaging more with CCD issues was the Student Association of Eduardo Mondlane University, however no detail was provided.

#### 4.5.6 University collaboration and networking

Researchers responding to the questionnaire and discussions in the workshop felt that opportunities for collaboration lay in the development and implementation of a national strategy for climate change in Mozambique. University staff were either involved in, or recognised that they could become more involved in the following **research networks** listed below:

- CARE Moçambique;
- CGC: Centro de Gestão de Conhecimento;
- GIMC: Grupo Interministerial de Mudanças Climáticas;
- FDC: Fundo de Acção para o Desenvolvimento da Comunidade;
- IIAM: Instituto de Investigação Agronómica de Moçambique;
- INAM: Instituto Nacional de Meteorologia de Moçambique;
- INDA: Instituto Nacional de Desenvolvimento da Aquacultura;
- INGC: Instituto Nacional de Gestão de Calamidades;
- ISPC: Instituto Superior Politécnico de Chókwe; and
- RNMC: Rede Nacional de Mudanças Climáticas.

##### 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 (Table 8), and some knowledge partners exist for CCD knowledge co-production in Mozambique. Table 8 shows these 'mapped' out, with ascribed roles (as per workshop discussions).

**Table 8: CCD knowledge co-production partners (potential, with some already actualised)**

Research organisations	Civil society organisations	Private sector	Government	Regional organisations	International organisations
<ul style="list-style-type: none"> <li>■ University Eduardo Mondlane – Faculty of Agronomy and Forestry Engineering</li> <li>■ University Eduardo Mondlane – Department of Physics</li> <li>■ University Eduardo Mondlane – Faculty of Geographic Engineering</li> <li>■ University Eduardo Mondlane – Faculty of Education</li> <li>■ University UNILÚRIO</li> <li>■ Technical University of Mozambique – UDM</li> <li>■ Pedagogical University of Mozambique</li> </ul>	<ul style="list-style-type: none"> <li>■ Livangingo: Mozambican CSO that focuses on environmental education</li> <li>■ ABODES: CSO specialising in organic agriculture research</li> <li>■ Terra Viva: CSO specialising in natural resources management</li> <li>■ MUGEDE: National Women, Gender and Development NGO (with some specialisation in CCD and gender issues)</li> </ul>	<ul style="list-style-type: none"> <li>■ Coal and gas companies that are speculating</li> </ul>	<ul style="list-style-type: none"> <li>■ Ministry of Education</li> <li>■ Ministry of Higher Education, Science and Technology</li> <li>■ Ministry of Tourism</li> <li>■ Ministry of Agriculture (MINAG)</li> <li>■ Ministry for the Co-ordination of Environmental Affairs (MICOA)</li> <li>■ National Institute for Disaster Management (INGC)</li> <li>■ Ministry of Public Works and Habitation (MOPH)</li> <li>■ Ministry of Planning and Development (MPD)</li> <li>■ Mozambique Institute for Agricultural Research (IIAM)</li> <li>■ National Directorate of Agrarian Extension (DNEA)</li> </ul>	<ul style="list-style-type: none"> <li>■ Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCCAL)</li> <li>■ INDA</li> <li>■ INAM</li> <li>■ SADC Regional Environmental Education Programme</li> <li>■ CIGAR</li> </ul>	<ul style="list-style-type: none"> <li>■ World Bank (Pilot Programme for Climate Resilience)</li> <li>■ UNDP</li> <li>■ GIMC</li> <li>■ DFID Programme: Mainstreaming Climate Change into Development</li> <li>■ UNU (United Nations University)</li> <li>■ CDKN</li> </ul>

Different roles were ascribed to different partners involved in the knowledge co-production process.

*Universities:* It was said that **universities** should develop new philosophies and approaches to climate change research, and that universities and other HEIs in Mozambique should work collaboratively to strengthen their weaknesses. Universities should also develop stronger synergies between their programmes and community based organisations and make efforts to disseminate knowledge related to climate change. They should also promote CCD research that is relevant to the country's context and improve curricula and training programmes. They should be active in participating collaboratively in co-generation and dissemination of knowledge on climate change issues as well as in supporting policy development. They should further take an active role in stimulating and promoting CCD-related work, and develop awareness raising activities based on the results of scientific research.

*Private sector:* There was an appeal for more involvement of the private sector in awareness campaigns for communities, and for the private sector to provide funds for mitigation and adaptation measures with a view to reducing risks. It was also said that the private sector should implement legislation and policies on CCD, particularly by implementing clean technologies and that they should orient their Corporate Social Responsibility programmes to support local communities and to strengthen partnerships with education institutions on CCD research projects. Overall there was a feeling that the private sector needed to show better ownership of the CCD concept leading to attitude change towards environmental issues.

*Donors:* It was said that donors should develop better support strategies avoiding the top-down approach; strengthening partnerships and establishing relationships of trust and that they should actively seek to work in partnership with the Mozambican government and universities in the implementation, dissemination and research of CCD related issues. They should also align funding on climate change based on the priorities established by government and help to identify national priorities vis-à-vis international recommendations on adaptation and mitigation.

*Government:* It was said that government should better understand the impact of its decisions on mitigation and adaptation to climate change, and develop and improve existent climate change policies and legislation through harmonisation of policies from different sectors. It was also said that government should strengthen cross-sectoral coordination and institutions on CCD-related issues; and adjust the structure of local institutions to better deal with climate change issues. Government also needed to develop more contextualised and robust CCD measures, and support the development of national capacities and skills for the development and implementation of climate change policies. CDD should be integrated into all development and strategic plans, and law enforcement should be improved, particularly with regard to impact assessment legislation. There was also a need for government to adopt integrated mechanisms in development plans and programmes dealing with climate change, within a medium and long-term framework. They should also mobilise funding for CCD projects, and maximise sectoral efforts to avoid duplication of work and optimise resource use. This needed to be done through establishment of multidisciplinary task forces that could encourage climate change research and information dissemination.



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) revealed the following status quo, also outlining possibilities of how such collaboration can be enhanced. The insights are captured in Table 9.

**Table 9: Perspectives on university collaboration from partner organisations**

Knowledge partners:	How they can work with the university sector:
Research Institutions and Documentation Centres (e.g. Fisheries Research Institute – Instituto de Investigação Pesqueira; USTM; IIAM – Mozambican Agrarian Research Institute)	<ul style="list-style-type: none"> <li>■ Undertaking scientific research and sharing the findings and results</li> <li>■ Implementing CCD projects and supporting research with partner organisations</li> <li>■ Developing and implementing professional development programmes and internships on climate change</li> </ul>
Government institutions (e.g. Ministries, Centres for Sustainable Development, Natural Disaster Management Institute) and political parties	<ul style="list-style-type: none"> <li>■ Developing and approving adequate legislation and policies, focusing on mitigation and adaptation strategies</li> <li>■ Working with higher education institutions to develop research projects focusing on CCD</li> </ul>
Non-Governmental Organisations and Civil Society Organisations (e.g. Christian Network for Climate Change, AICIMO – Investors and Scientist Association of Mozambique)	<ul style="list-style-type: none"> <li>■ Implementing CCD projects and supporting research projects at community level</li> <li>■ Developing and implementing training courses for civil society organisations</li> </ul>
Private sector, donor organisations (e.g. Danida, Sida) and consultancy companies	<ul style="list-style-type: none"> <li>■ Provide funding for CCD projects and research activities</li> <li>■ Promoting knowledge transfer through workshops and seminars</li> </ul>
Rural communities	<ul style="list-style-type: none"> <li>■ Providing indigenous knowledge to help shaping climate change research</li> </ul>
Higher education and research centres (e.g. public – UEM and private universities)	<ul style="list-style-type: none"> <li>■ Promoting climate change scientific research and identifying CCD related thesis</li> <li>■ Offering bursaries and internships on climate change subjects</li> <li>■ Undertaking teaching and learning activities and adapting curricula to include CCD topics</li> </ul>

#### 4.5.7 University policy and campus management

The participants from the different universities did not have any known policies aligned with CCD, and did not mention any campus based activities that are aligned with CCD objectives.

### 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 reflections on the status quo, and what could be done differently. These show that Mozambique 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. What can be seen from the outcomes of the workshop and questionnaires is that there are several different key areas that require attention. These areas are not loyal to a particular research discipline, or institution, but rather affect various different fields and institutional mandates and interests. This shows that responding to the current situation in Mozambique 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 and donors).

#### 4.6.2 Co-ordination, collaboration and improved partnership building

There is generally a need to improve internal co-operation, collaboration and improved partnership building in Mozambique. Overall poor communication, knowledge transfer and coordination were inhibiting the development of sound integrated climate change and CCD related research. Improved motivation and interest from government departments, and their willingness to collaborate with research institutions were cited as a key area of concern. The data shows that universities in Mozambique are already providing climate change and CCD related curricula, or are in the process of establishing these; what is needed is for the private sector and government to participate in this growing research community, to further prepare their own systems and strategies to accommodate a growing individual capacity for climate change and CCD in Mozambique.

#### 4.6.3 Strengthen and expand understandings of CCD

As shown in section 4 above, CCD is a relatively new concept to some stakeholders and university researchers, yet it is being integrated slowly into research and teaching. From the workshop and questionnaire data it can be seen that the concept of CCD also has different meanings, and lends itself to a diversity of contextual interpretations. It is also multi-disciplinary, and multi-faceted and has diverse research and capacity building implications. This was further explored in the workshop which brought in regional perspectives, stressing that there is need for alternative development options that are continually responsive to changing climate change and emerging global and regional development paradigms related to climate which take into account what is happening in the region in and around Mozambique. Further discussion revealed a need to see CCD not as a static concept, but rather as an emergent and evolving research area that needs to include indigenous forms of mitigation and adaptation.

Linked to this need to strengthen and expansion of understandings of CCD, workshop participants stressed the importance of integrating this into Mozambique's education system, including public education and grass roots community programmes. Curriculum contextualisation, curriculum development and community awareness and training were continuously cited in the workshop and questionnaires, and this is a key area of concern for further educational development into the future.

#### 4.6.4 Capacity building for CCD and staffing

There was a strong call for capacity building, particularly for undertaking research but as mentioned above, also for integrating CCD into curriculum and teaching. As this is a multi-disciplinary issue, such capacity building should take both a specialist (to develop specialist research capacity) and a multi-disciplinary approach that allows for knowledge exchange and the development of collaboration. There currently seems to be little experience in multi-disciplinary research and capacity development for enabling these capacities in Mozambique should be considered a key priority moving forward.

#### 4.6.5 Curriculum development and curriculum innovation

As shown in the institutional analysis above, CCD is currently mainly being 'integrated' into existing courses, although there is some experience of offering CCD related teaching at post-graduate level, particularly in the Faculty of Agronomy and Forestry Engineering. The Faculty of Education is also exploring a Masters degree in this area, but it is still under development. There seem to be some strong areas of expertise in CCD adaptation research and subsequent curriculum development around rural development, disaster risk management and mapping which overall seem to outweigh mitigation research, with limited mitigation focused courses.

#### 4.6.6 Research

There were a number of institutional issues identified that affect research, and the capacity to undertake CCD research. These include a lack of research funding, and associated resources and equipment needed to undertake climate change related and CCD research. In addition to this, strict customs and tax regulation are said to hinder the acquisition of research equipment, which points to the commonly raised concern for improved research. The issue of research incentives was also raised for providing more open channels for CCD related research. Another set of key inhibiting factors include the lack of continued long term research, information dissemination and cross-sector integration reducing the potential for dynamic collaborative research communities. One participant felt there was a noticeable lack of credible research centres in Mozambique.

Many recommendations were made on how research for CCD could be improved in Mozambique's university and between other stakeholders. Key amongst these was to improve the CCD research culture in the universities, and research partners, especially local and national government, who are responsible for creating an overarching CCD policy and action plan. This would require integrated coordination and collaboration of universities with government, and other partners. The dissemination of knowledge for all spheres of society (government, communities, academia and civil society organisations) was highlighted, and climate change research was seen to not simply include geographical and environmental sciences but a range of different disciplines.

There was also discussion in the workshop that research institutions need to take ownership of scientific CCD research and promote CCD in their curricula. This, it was said, would in turn provide a wider range of training of more highly qualified professionals to feed the different government sectors, and to further the research agenda in Mozambique. It was also said that

researchers should feed their research into government policy development, which was of particular concern for building the country's overall climate resilience.

Particular research programmes with a focus on climate change and CCD were suggested to include research that focuses on (but is not limited to): sustainable agriculture, water resource management, sea-level rise and coastal protection, infrastructure development and urban planning, as well as biodiversity and natural resource management. Research priorities also included the development of simple but effective methods for information dissemination that improve not only how knowledge is generated (for example, forms of participatory research) but also how knowledge is expanded and shared in its essential production. It was further noted that knowledge production should be used to support communities affected by climate change; in this way part of the research agenda requires an inherent emancipatory sensibility. There was also a recommendation that the primary responsibility of the research community in Mozambique was to identify new climate change-related research lines of enquiry that were contextual and specific to the conditions in Mozambique.

#### **4.6.7 The role of university leaders**

The role that university leaders play in supporting CCD research and development mostly focused on policy development which would require university wide infrastructure (legislative, financial and capacity) to promote CCD related research across all departments and disciplines and across all universities. In connection to this it was agreed that managers and leadership have a responsibility to develop incentives for developing new study fields with regard to CCD, which further motivates a growing research culture in this direction. This includes fundraising and supporting funding applications by university staff. University leaders have a role to play in promoting collaborative research and creating opportunities in which human resources skills development and capacity development are accessible.

## 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.<sup>19</sup> 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.<sup>20</sup>

### Scales of problem and approach

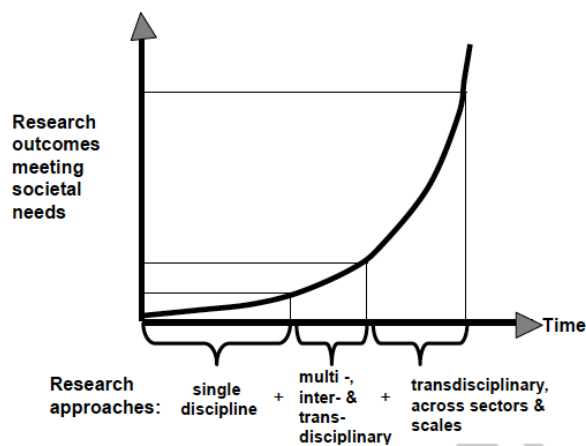


Figure 5: Research approaches

<sup>19</sup> This is because universities are organised and established around a disciplinary knowledge production structure.

<sup>20</sup> 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.<sup>21</sup> These emerging approaches to research are clarified below.

### ***Multidisciplinarity***

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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***

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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***

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This entails using strategies from inter-disciplinary 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<sup>22</sup>; 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 deeper into developing new and more complex ways of understanding and engagement in contexts where new forms of theory and practice come together<sup>23</sup> across sectors and at different scales.

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<sup>21</sup> 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.

<sup>22</sup> 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.

<sup>23</sup> 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.<sup>24</sup> 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***

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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; and 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.<sup>25</sup> 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**

The current status of multi-, inter- and transdisciplinary approaches are not readily observable considering the findings of the workshop and questionnaires. While there are some interdisciplinary exchanges between the Agronomy and Physics departments at Eduardo Mondlane University, there is still a wide gap in trans-disciplinary expertise in Mozambique. There is however optimism that with growing government interest in establishing strategies and action plans, there will be further opportunities for multi-, inter- and transdisciplinary approaches to research and knowledge production. During the compilation of the report, however, one good example of a research and learning programme was identified that focuses on CCD, and that involves multiple stakeholders, including university researchers. It also has an interest in strengthening university capacity for undertaking CCD research. The programme involved some researchers from universities, and also involved universities in the post-programme learning and knowledge sharing (Box 2 that follows summarises the project). The case studies reported on via this CDKN case study work, can serve as an example of how transdisciplinary approaches to knowledge (co) production take place.

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<sup>24</sup> Max Neef 2005.

<sup>25</sup> Adapted from the Akili Complexity Forum draft proposal, NRF South Africa (March 2010).



### **Box 2: *Climate Learning for African Agriculture (CLAA): Mozambique Case Study (Parkinson 2013)***

This project was funded by the Climate Development Knowledge Network (CDKN), and led by the Natural Resources Institute (NRI) of the University of Greenwich, the African Forum for Agricultural Advisory Services (AFAAS) and the Forum for Agricultural Research in Africa (FARA). The project aims to produce knowledge and practices that respond to the need for adaptation to climate change in the agricultural sector, and to strengthen extension services' roles in climate adaptation. The project reviewed a number of case studies, each briefly summarised below.

#### ***Case Study 1 – Chicualacuala District (project implemented by UNDP and MICOA, with Spanish MDG funding)***

This was a joint programme involving a number of partners and ten villages and involved setting up pilot activities to support farmers in adapting to the effects of climate change. The following inter-disciplinary activities were undertaken: production of a risk map for the District, to produce district development profiles; installation of meteorological equipment for monitoring, analysing and interpreting climate data (community leaders and local government staff received training to do this). Solar and bio-gas renewable energy technologies were tested, including two solar water-pumping systems. Field-based demonstrations and training in conservation agriculture, livestock nutrition, dairy hygiene, cheese-making and forest-nursery management were provided. Animal health workers were also trained. An inventory of strategies and coping mechanisms was also taken. Agro-forestry demonstrations were set up using fruit or fodder trees. Outcomes were monitored, and lessons learned were captured and shared.

#### ***Case Study 2 – Guija District (implemented by UNDP and MICOA with GEF funding)***

The project sought to develop and pilot test a range of coping mechanisms for reducing vulnerability of farmers and pastoralists to future climate shocks. The project sought to build capacity for continuous review of the sustainability of land management systems, and to adapt them as climate changes alter the underlying drivers of productivity. One of the planned activities was to address problems of water supply (linked to availability and quality). A hydro-geological survey was undertaken in the district. Socio-economic studies were also conducted in the district. Extension activities were reviewed to provide insight into the role of extension in drought management. These studies were undertaken to inform decision making related to water-supply infrastructure development and management. Additional studies were needed to map the current situation regarding quantity and quality of potable water points in their district and their functionality in the community, and to establish a baseline of community activities, water use patterns, and their understandings and attitudes with regard to early-warning systems and climate change. People's perceptions, levels of awareness, knowledge, attitudes and practices related to climate change were also assessed. This informed pilot testing of optimal crop varieties, enhanced the use of early warning systems for agricultural purposes, and vulnerability to water scarcity (drought mitigation) was enhanced through access to quality water resources via construction of concrete water harvesting and storing systems. Outcomes were monitored and lessons learned shared with stakeholders.

#### ***Case Study 3 – District of Angoche (implemented by CARE and AENA – the Nampula Association of Extensionists)***

The project seeks to develop agricultural climate change adaptations in the form of production practices such as conservation agriculture, reduced tillage, maintenance of soil cover and crop rotation, and promoting other adaptation technologies including improved seeds tolerant to drought and flood, conservation agriculture using mulching and control of forest fires. It also uses an Adaptable Programme Lending (APL) component for micro-financing. The programme collaborates with research institutions – IIAM on seed improvement, and UEM on communication and extension. This project is still ongoing, and outcomes along the way are being monitored and shared with stakeholders to facilitate ongoing co-learning.

#### **REFLECTIONS ON THE CASES ABOVE:**

What is interesting to note from the examples above, is that the action oriented objectives of the programmes were research-informed, and that the research required was obtained from multi-disciplinary perspectives, and included: agricultural studies on seed varieties, field-piloting of varieties and alternative livelihood options, hydro-ecological studies, meteorological studies (conducted on-site by community members working with research support), socio-economic and social practice surveys, and education, communication and extension research. Research was determined by contextual need, and proposed outcomes, and helped to create a reflexive project implementation context, which ultimately had the benefit of enhancing community resilience and adaptation options, and which also contributed to improved livelihoods. Also important to note is that not all interventions were successful or sustained, hence the need for ongoing monitoring research, and for co-learning forums where theory and practice can come together.



### 5.1.3 Possibilities

As can be seen from policy, workshop and questionnaire data, and from the example outlined above, there is clearly a need for such research in Mozambique to facilitate CCD. As shown above, 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. There is a need to develop capacity for such approaches to research, and to develop incentive and funding structures for universities to participate in such research, and also to recognise the research outcomes that result (which are both theory and practice based). Currently university research incentive systems do not reward such approaches to research, despite the fact that they are clearly important for society.

## 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

A warming trend is already well established in Mozambique, although this is not uniform across the country, with mean annual temperatures having increased by 0.6°C between 1960 and 2006.<sup>26</sup> In the same period, the number of hot days per year has increased by 25 while cold days have decreased by 14; and the number of hot nights has increased while cold nights have decreased. The mean annual rainfall has decreased at an average of 2.5mm per month per decade between 1960 and 2006. Rainfall variability has increased in the southern and central regions since the 1990s, while the number of heavy rainfall events has increased between 1960 and 2006. There are indications of a later start to the rainy season, and an increase in dry spell length. The mean annual temperature is projected to increase by between 1.0 and 2.8°C by 2060, and by between 1.4 and 4.6°C by 2090, with higher rates of warming occurring in the interior compared to areas close to the coast. The INGC 2009 report points out that if global mitigation efforts are insufficient, temperatures could rise by between 2 and 2.5°C by 2050, and by between 5 and 6°C by 2080. Mozambique is particularly prone to an increase in natural disasters, and to the impacts of sea level rise on coastal communities.

Within this context, the mapping study needs analysis for Mozambique revealed that while some 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 and for the significant development challenges that Mozambique faces as a result of its high vulnerability to climate change. A major priority that cuts across all of Mozambique's climate change policies and planning is to develop capacity for risk reduction and preparedness, within a broader framework of longer-term adaptation and climate resilience.

Consistent with the socio-economic context and Mozambique's post-conflict status, overarching barriers to adaptation indicated in all three data sources include poor quality information and knowledge of the nature of climate change risks and appropriate adaptation, mitigation and CCD responses; limited research engagement with these issues; low levels of technical capacity; and insufficient financial resources to address climate change adaptation and mitigation challenges. One important aspect identified is the need to engage the private sector in climate change mitigation, especially related to green / clean technology and investments in the national climate change adaptation and resilience building strategy, especially given the current expansion of investments in oil, natural gas and coal extraction. The workshop and questionnaire responses identified a range of cross-cutting needs for

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<sup>26</sup> UNDP Climate Change Country Profile; INGC 2009.

responding better to CCD, amongst which are capacity development and knowledge exchange (including dissemination of climate information to communities), revision of legislation to include CCD in all sectors, and integration of CCD knowledge into development programmes and projects and government priorities, and the need for increased opportunities for understanding and awareness building, and knowledge exchange programmes between universities, sectors, and communities. There was also a concern with community preparedness for adaptation to predicted changes and the knowledge needs of communities. The issue of providing climate related information in Portuguese was raised, as most climate information is being produced in English.

### 6.1.2 Broad adaptation and mitigation needs

There is broad agreement amongst the data sources used to compile this mapping study report on the *broad priority focus areas for adaptation and climate resilience building* – namely, coastal protection, preparing cities and local governments, water resources management, agriculture and food security, including soil erosion management, biodiversity and forest management, human health, and human settlements. Core to all these is the need for improved meteorological data and capacity. These reflect the climate vulnerabilities of Mozambique, especially for its majority rural populations. The data sources also agree on *broad mitigation priorities and needs*, which encompass measures related to improved energy management and use of renewable energy resources, rural electrification and forestry to reduce deforestation and establishment of clean energy production systems and sustainable transport systems. Mozambique, as noted above, has identified significant natural gas and coal resources, and workshop participants identified the need for assessment of technology needs, and clean technology development as a key mitigation need, a need that is also articulated in policy. Policy also suggests the need to seek ways of developing renewable energy technologies, and to develop natural gas technologies for national energy supply needs.

### 6.1.3 Specific knowledge and research gaps

Workshop participants felt that there were still significant policy and implementation gaps that were linked to inadequate knowledge and research. Analysis of all data sources showed that there were key knowledge and research gaps related to adaptation which include: agriculture and food security (including soil conservation, need for more resilient cultivars, and improved land use management), coastal zone management and protection (including protection of mangroves and studies on ecosystem vulnerability and sea level rise implications); preparing cities; and, water resources management. These were the most regularly cited areas requiring specific research and knowledge development related to adaptation. Mitigation knowledge and research needs focused primarily on renewable energy and clean technology research, transport and forestry research and development. Private sector engagement in climate change mitigation research, especially engineering research into green and energy efficient technologies, was identified as being important in Mozambique. Underpinning these adaptation and mitigation research and knowledge needs are additionally critical research and knowledge gaps. These include: systematic observation, monitoring, modelling and risk and vulnerability assessments. This involves assessing vulnerability (especially local level vulnerability mapping); providing more accurate and expansive meteorological information

and projections (observational data to underpin climate assessments and vulnerability on water resources, agriculture, biodiversity, sea level rise and infrastructure planning). Technology development was also repeatedly emphasised in workshop and questionnaire data. Accessing and drawing on community knowledge were identified as an important adaptation and CCD priority, given the high dependence on subsistence production in rural areas, and the high levels of poverty experienced in these areas.

#### 6.1.4 Cross-cutting needs

Key cross-cutting needs emphasised in Mozambique amongst workshop participants include the need for improved co-ordination across sectors within government and implementation partners, improved awareness raising and capacity development, and production of climate knowledge in accessible languages and forms (Portuguese knowledge resources were emphasised a number of times as was concept clarification and understanding of climate change concepts and responses). Cross-cutting educational concerns involved the lack of curriculum contextualisation and curriculum development for climate change in schools and universities. Low levels of research capacity for CCD related issues also reflect a need for research capacity development.

*Individual capacity needs* were identified in policy documents and in workshop discussions. A strong need was identified for professionals with the skills to participate in **systematic observation** of parameters of climate change, process climate change data for application and implementation, and to conduct vulnerability evaluations and assess adaptation options. Other key fields requiring capacity support include: climate change modelling; atmospheric chemistry; risk assessment and management; marine pollution; environmental auditing; Information and Communication Technology (ICT); Geographic Information Systems; Physics; disaster risk planning and urban planning. Technology development related scarce skills were identified in the following areas: Clean Technology and Engineering. From a social change perspective, the following scarce skills were identified: Sociology and environmental education, extension and communication specialists, curriculum innovation and community based communication competences. Consultations revealed an overall lack of technical and scientific capacity, due to insufficient specialised training.

#### 6.1.5 Institutional capacity gaps

Specific institutional capacity gaps emerging from documentation and the workshops show an overall lack of institutional capacity on climate change issues, which is not surprising given the scope of climate vulnerabilities in Mozambique and post-conflict development context, and socio-economic realities. There is consensus across the data that there is a need to substantively strengthen capacity for information and research development for CCD. The lack of research funding and incentives will require attention to expand climate change research capacity in Mozambique. There was also a need identified for improved political and institutional capacity for enabling technical cooperation between different sectors; and for integrating climate change into the country's legislation and development plans. There are socio-cultural barriers and capacity gaps, especially related to communications and education. Financial barriers and capacity gaps as well as insufficient financial resourcing were also

identified as a key institutional capacity gaps. Workshop participants felt that institutions need to improve their capacities for offering professional careers associated to climate change, which also includes providing professional internships for recent graduates.

Co-production of knowledge and its reliance on improved cross-sectorial institutional capacities can be seen as a significant area of concern for Mozambique. How knowledge is shared, and how research is responded to and used by decision makers, was of particular concern among workshop participants. More and more credible research facilities are also needed for the production of *systematic* knowledge of climate change and climate compatible development pathways.

## 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. Mozambique's INGC (2003) highlighted four major institutions responsible for research concerned with climate change: the National Meteorological Institute, the National Institute for Agronomic Investigation, the University of Eduardo Mondlane, and the Universidade Pedagógica; and noted the absence of a framework to facilitate inter-institutional linkages. Under theme seven of INGC's second phase, a **Climate Change Centre of Knowledge** will be established that will build the country's knowledge base and information management capacity on climate change through research, education, awareness building and provision of advisory services. Information packages, from research findings, will be targeted at management, administrative and technical staff at both provincial and district levels. Multidisciplinary research projects will be employed to generate solutions to adaptation.

Of greatest significance is the obvious lack of 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 very new area of research and development in Mozambique. There is, however, some research emerging in the UEM, Universidad ú, the Catholic University of Mozambique and the Pedagogical University. CCD related research is strongest in the UEM, especially in the Faculties of Agronomy and Forestry Engineering, Veterinary Sciences, Humanities and Arts (Geography) and the Education Faculty. However, the university still lacks a 'critical mass' of researchers in this area. The institutional analysis shows not many Mozambican university professionals appear to be engaging in CCD research, and fewer still are publishing this research in international arenas. Most local research is used to inform policy and government information needs, and the government, especially via IIAM and INGC are leading CCD related research. As such, government – supported by various donor organisations – is playing an important role in initiating and also conducting CCD related knowledge, but this is not 'carrying through' into HEI research programmes or curriculum innovations with great strength as yet. The general comment from the workshop was that very little was being done in terms of research for CCD and those projects that were being undertaken are not well funded, disseminated or shared, and the number of scientific reports and publications are very limited. There was also acknowledgement that CCD research requires an epistemological shift towards more community-engaged research.

The institutional assessment revealed that there were a few courses focusing on CCD in teaching programmes, mostly integrated into existing programmes at undergraduate level. There were however, some CCD related Masters degrees on offer at UEM in the Faculty of Agronomy and Forestry Engineering focusing mainly on disaster risk reduction and adaptation. This appears to be a research strength in Mozambique. The Education Faculty are also preparing a Masters degree in Climate Change and Education for Sustainable Development, but this is at the planning stage. The need for curriculum development capacity building was noted. A number of research programmes (mostly government or donor organisation based) were identified and some research networks that could facilitate CCD related knowledge co-production.

The Mozambican institutional assessment also revealed that there are *new institutions and programmes emerging* that can potentially provide strong platforms for CCD knowledge co-production in future. These are the soon to be established Climate Change Knowledge Centre (linked to MICOA and INGC), and the already existing IIAM which works closely in partnership with the Faculty of Agronomy and Forest Engineering and Faculty of Veterinary Sciences in the area of agricultural CCD. However, these research institutions, along with smaller emerging nodes of research expertise (e.g. in the Geography Department at UEM) require capacity building, as indicated by research participants who commented on the lack of resources, capacity and research planning.

The table in Appendix E lists sources of expertise for CCD in Mozambique.

No active student based centres with potential for enhancing knowledge and awareness of climate change and CCD were identified in Mozambique.

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 also showed that amongst the university community no examples of transdisciplinary research could be identified. However, at a broader level one example of transdisciplinary research was identified but these were being spearheaded by international organisations and national NGOs (UNDP and CARE) and were being documented by CDKN. A key finding of the institutional analysis was that there was a need for knowledge exchange platforms between universities and such programmes. Workshop participants recognised the potential role of regional organisations such as SASSCAL and SADC centres for providing capacity building support in Mozambique, and in some cases Mozambique researchers are drawing on these international research networks such as CIGAR and ACCRA.

The institutional assessment has shown that there is an urgent need for capacity building in CCD related matters amongst the Mozambican research community. There is a strong and clearly articulated need for support in this area, both from within policy which emphasises the need for research, and amongst stakeholders and practitioners and university professionals. There is a need for disciplinary capacity development for CCD research, as well as for transdisciplinary research and teaching.

The institutional assessment has also highlighted that it is extremely important for universities in Mozambique to become more strongly engaged with issues of CCD knowledge co-

production concerns, so that they can be located within key climate change dialogues, and so that they are able to better support and inform policy and CCD practice. Key areas identified for Mozambique include curriculum development and innovation, research institution capacity development, individual professional development and research competence development, knowledge sharing and epistemological change, research incentives, and community and policy outreach.

### 6.3 A broad map of Mozambique CCD knowledge co-production pathways

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 Mozambique. **One example** is offered here (Table 10). More examples associated with CCD priorities can be further developed based on the identified CCD needs in this mapping study and in national policy.

**Table 10: CCD Knowledge, Research, Capacity Building and Institutional Capacity Gap Analysis: Develop agricultural practices more resistant to drought and improve food security**

CCD PRIORITY	Knowledge and research gaps (research agenda)	Individual capacity gaps (education and training agenda)	Institutional capacity gaps (institutional development agenda)
ADAPTATION: Develop agricultural practices more resistant to drought and improve food security	<ul style="list-style-type: none"> <li>■ Resilient seeds variability and approaches</li> <li>■ Technical knowledge on production techniques that are climate compatible and resilient to climate impacts</li> <li>■ Technical knowledge on combating soil erosion</li> <li>■ Research on current practices, and understandings of CCD amongst communities</li> <li>■ Sustained, systematic research, information dissemination and implementation in localised sites</li> <li>■ Pilot testing of implementation of agro-processing techniques</li> <li>■ Systematic field testing and monitoring of outcomes and adoption of new practices</li> </ul>	<p>Research scientists:</p> <ul style="list-style-type: none"> <li>■ Agro-ecological and agro-biodiversity scientific capacity</li> <li>■ Agro-processing knowledge and skills</li> <li>■ Agro-meteorological skills</li> <li>■ Hydro-meteorological skills</li> <li>■ <i>Extension and Social learning expertise</i></li> <li>■ Skilled extension services with CCD knowledge and expertise</li> <li>■ Social change and social learning experts (sociology and education competence)</li> </ul>	<p>Resourcing and resource mobilisation:</p> <ul style="list-style-type: none"> <li>■ Inadequate capacity to mobilise resources</li> <li>■ Micro-financing management and support is inadequate and not sustained / carried through over time</li> </ul> <p>System development:</p> <ul style="list-style-type: none"> <li>■ Weak urban and physical planning</li> <li>■ Weak extension services system</li> </ul> <p>Knowledge management and dissemination:</p> <ul style="list-style-type: none"> <li>■ Weak dissemination of agro-processing techniques (e.g. for rural officers)</li> </ul>

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.

Mozambican researchers are beginning to engage with CCD, and most research is funded and initiated and supported by government (there is very little evidence of independent research). New institutions are forming for this purpose, and stakeholders and researchers participating in this mapping study have identified the possibilities that lie in the proposed Climate Change Knowledge Centre. The strongest influence in CCD research in Mozambique at present – other than government research – appears to be donor funded initiatives, especially those supported by UNDP, GEF and international NGOs. A key finding of this mapping study is that the existing expertise base needs to be significantly expanded and supported in more strategic ways – also in ways that can strengthen participation of higher education institutions in CCD research – since the knowledge co-production challenges for CCD are vast and complex, and the responding capacity for research is clearly inadequate at present.



Various recommendations were made for strengthening capacity for research and knowledge co-production in this mapping study that can be useful for charting a way forward, including aspects such as improving access to information in Portuguese, improving communication and co-operation, obtaining adequate funds for research including scholarships and internships for students, and other aspects related to knowledge sharing and transfer.

Critical issues to be addressed if Mozambique 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 11), to guide further action at country level.
- Support and expand the capacity of the new Climate Change Knowledge Centre 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 the future into 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 Mozambique, especially to build research capacity, and curriculum innovation capacity, and to link up various CCD research initiatives that are occurring under the auspices of government and development programmes with university research and research capacity building.
- Improve co-operation, communication and shared access to data at all levels and maximise potential knowledge exchange and co-operative research opportunities with national and regional research organisations that are focusing on CCD.
- Develop motivation and incentives for researchers, especially for engaging in multi-, inter- and transdisciplinary research approaches. Support capacity development of researchers in these areas and create mechanisms that allow existing researchers to learn from new approaches to inter- and transdisciplinary research as modelled in national development case studies (e.g. the CLAA linked UNDP and CARE programmes).
- Strengthen research partnerships and research infrastructure, including research funding and incentives for students.
- Support curriculum development capacity, and curriculum innovation to mainstream CCD into existing courses and programmes, and support existing initiatives for curriculum innovation and the development of Masters degrees that are currently in the pipeline through regional co-operation where possible.
- 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.

The large scale research and development programmes being undertaken with support from UNDP, GEF, DIFD, the World Bank and other major donors in partnership with various ministries and development organisations potentially provide a significant platform for

enhancing knowledge of CCD related issues, and knowledge co-production processes, as the research being undertaken within these large scale projects is inter-disciplinary, and is also tied to application and implementation programmes and processes. However, platforms will need to be explicitly created for such knowledge sharing to take place. The major institution that is set to strengthen university and other institutional capacity for CCD research is still in its infancy e.g. the Climate Change Knowledge Centre. This, however, provides an important opportunity for CCD capacity building in future.

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

Climate Change and CCD research and teaching in Mozambique seems to be dominated by adaptation expertise, however it may also be due to the strong drought disaster relief incentive of the government since 1996, which focused heavily on drought relief that involved a variety of adaptive and some mitigation forms of research. There are also some interesting mitigation and cross-cutting climate change related knowledge production niches in Mozambique. Particular areas of strength identified in Mozambique include:

- **Climate change adaptation research:** Disaster Risk Management in Agriculture and Rural Development contexts;
- **Climate change mitigation research:** not specified (some expertise in renewable energy in rural areas);
- **Cross-cutting issues research:** Sustainable Rural Livelihoods research;
- **Systems of social change research:** Environmental education and education for sustainable development; and
- **Teaching and curriculum innovation:** Masters programme in climate disaster risk reduction in rural agricultural contexts – in the Faculty of Agronomy and Forest Engineering at UEM (it could provide a model for other similar programmes).

**APPENDIX A: WORKSHOP ATTENDANCE LIST****List of confirmed participants at the Mozambique workshop, 29-30 April 2013****RADISSION-BLUE HOTEL, MAPUTO**

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	Name/s	Surname	Organisation	Phone	Email
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45	Federico	Vignati	SNV	+258 (21) 48 67 90 / 1	fvignati@snvworld.org

## APPENDIX B: ACTIVE RESEARCHERS IDENTIFIED WHO ARE CONTRIBUTING TO CC /CCD RELATED RESEARCH ACTIVITIES

**Table 11: Active researchers who are contributing to CC /CCD related research activities**

Name and qualification	Department / area of expertise	Years of experience: Years of experience in CC research	Contact details
Farizana Omar (Masters)	HIV Aids And Climate Change	7 years: 5 years	Farzanajulaia@Gmail.Com Farzana.Omar@Minec.Gov.Mz Ministry Of Education – Dices, Institutional Development Fund
Sérgio Niquisse (Masters)	GIS And Regional Planning	7 years: 5 years	Sniquisse@gmail.com Catholic University Of Mozambique, Economics And Management
Luis Artur (PhD – Professor)	Disaster Studies- Agronomy	12 years: 7 years	Lartur@Uem.Mz Eduardo Mondlane University, Agronomy
Aristides Baloi (Masters)	Geography	10 years: 10 years	Aristides.Baloi@gmail.com Eduardo Mondlane University, Geography
Boaventura Cuambe (PhD – Professor)			Eduardo Mondlane University
Antonio Queface (PhD)			Eduardo Mondlane University and National Disaster Management Institute (INGC)
Almeida Siteo			almeidasitoe@gmail.com

**Note:** This list is based on information provided in the country workshop and from completed questionnaires, and is therefore indicative rather than definitive.

**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
<b>C1</b>	Involvement in research in the area of climate change and/or climate compatible development					
<b>C2</b>	Involvement in <b>local</b> climate change and/or climate compatible development research					
<b>C3</b>	Involvement in <b>national</b> climate change and/or climate compatible development research					
<b>C4</b>	Involvement in <b>international</b> climate change and/or climate compatible development research					
<b>C5</b>	Involvement in single discipline approaches to climate change and/or climate compatible development research					
<b>C6</b>	Involvement in <b>inter-disciplinary</b> approaches to climate change and/or climate compatible development research					
<b>C7</b>	Involvement in <b>transdisciplinary</b> approaches to climate change and/or climate compatible development research					
<b>C8</b>	Involvement of multiple stakeholders in climate change and/or climate compatible development research					
<b>C9</b>	Record of raising funding for climate change and/or climate compatible development research					
<b>C10</b>	Contributions of the research to local climate compatible development pathways					
<b>C11</b>	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
<b>D1</b>	<b>Specialist courses</b> offered on climate change / climate compatible development					
<b>D2</b>	Climate change / climate compatible development issues and opportunities <b>integrated into existing courses</b>					
<b>D3</b>	<b>Cross faculty teaching</b> on climate change / climate compatible development					
<b>D4</b>	<b>Inter- and/or transdisciplinary teaching approaches</b> used for climate change / climate compatible development courses					
<b>D5</b>	<b>Service learning</b> (accreditation of community engagement as part of formal curriculum) focusing on climate change / climate compatible development concerns					
<b>D6</b>	Courses develop <b>critical thinking</b> and <b>integrated problem solving</b> skills					
<b>D7</b>	Courses clearly focus on development of <b>social and/or technical innovation</b> and <b>ethical actions</b>					
<b>D8</b>	Climate change / climate compatible development aspects are included in <b>assessment and examinations</b>					
<b>D9</b>	<b>Staff willingness</b> to get involved in new issues such as climate change and/or climate compatible development					
<b>D10</b>	<b>Staff ability</b> 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 (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> year etc.) or post-graduate (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
<b>E1</b>	Involvement in climate change / climate compatible development policy outreach / engagement activities					
<b>E2</b>	Involvement in climate change / climate compatible development community outreach / engagement activities					
<b>E3</b>	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: IDENTIFIED SOURCES OF EXPERTISE FOR CCD IN MOZAMBIQUE

Table 12: Identified sources of expertise for CCD in Mozambique

University	Nodes of expertise	Centres of expertise	Centres of excellence	Active research networks that could develop CCD expertise links
<ul style="list-style-type: none"> <li>■ University of Eduardo Mondlane</li> <li>■ Pedagogical University of Mozambique</li> <li>■ Catholic University of Mozambique</li> <li>■ Universidad Lurio</li> </ul>	<p>Catholic University of Mozambique:</p> <ul style="list-style-type: none"> <li>■ Undertaking CCD research and curriculum development in at least three faculties (Marine Sciences, Agriculture, Economics and Management)</li> </ul> <p>University Eduardo Mondlane:</p> <ul style="list-style-type: none"> <li>■ Department of Physics</li> </ul> <p>University Eduardo Mondlane:</p> <ul style="list-style-type: none"> <li>■ Faculty of Humanities and Arts: Geography Department</li> </ul> <p>Technical University of Mozambique:</p> <ul style="list-style-type: none"> <li>■ UDM</li> </ul>	<ul style="list-style-type: none"> <li>■ Agronomy oriented disaster and risk reduction research expertise (at UEM's Faculties of Agronomy and Forest Engineering and Veterinary Sciences) and linked to CIGAR, IIAM and other regional and international agricultural research CCD partners</li> <li>■ Environmental education / ESD research in UEM and in the Pedagogical University as well as in Universidad Lurio (UEM and PU are linked via the UNU and SADC REEP Regional Centre of Expertise in Education for Sustainable Development (also linked to MICOA and other stakeholders engaged in ESD)</li> </ul>	<ul style="list-style-type: none"> <li>■ Potential exists for the soon to be established Climate Change Knowledge Centre to serve as a Centre of Excellence for CCD knowledge co-production</li> </ul>	<ul style="list-style-type: none"> <li>■ CGC: Centro de Gestão de Conhecimento</li> <li>■ GIMC: Grupo Interministerial de Mudanças Climáticas</li> <li>■ FDC: Fundo de Acção para o Desenvolvimento da Comunidade</li> <li>■ IIAM: Instituto de Investigação Agronómica de Moçambique</li> <li>■ INAM: Instituto Nacional de Meteorologia de Moçambique</li> <li>■ INDA: Instituto Nacional de Desenvolvimento da Aquacultura</li> <li>■ INGC: Instituto Nacional de Gestão de Calamidades</li> <li>■ ISPC: Instituto Superior Politécnico de Chókwe</li> <li>■ MICOA: Ministério para a Coordenação da Acção Ambiental</li> <li>■ RNMC: Rede Nacional de Mudanças Climáticas</li> </ul>

**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 Mozambique.

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