Climate Change Adaptation in Africa

UNDP Synthesis of Experiences and Recommendations

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Rajdamnern Nok Avenue, Bangkok, 10200, Thailand
www.adaptation-undp.org

Authors: The report preparation was led by Jessica Troni with contributions from Caroline Petersen, Henry Rene Diouf, Janine Twyman Mills, Jennifer Baumwoll, Lance W. Garmer, Leonard Unganai, Mame Dagou Diop, Marjolaine Cote, and Mark Tadross. The report was reviewed by Alice Ruhweza, Margarita Arguelles, Pradeep Kurukulasuriya, Greg Benchwick, Muyeye Chambwera and Daisy Mukarakate.

Cover photo: Malian Boy
Credit: Imen Meliane
Graphic Design: Doungjun Roongruang, Janine Twyman Mills and Greg Benchwick
Copy Editing: Laura Hammett

Dedicated to Mame, with sincere gratitude.

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FOREWORD

Supporting bold, innovative approaches in Africa for low-carbon climate-resilient development

Africa has achieved impressive economic, political and social growth in recent decades. Yet, there are still high disparities between the rich and poor. Poverty, while reduced, remains a serious issue in many countries. And climate change, droughts, floods, changing rainfall patterns and conflict have the potential to unravel efforts to reduce hunger and achieve the goals outlined in the Paris Agreement and 2030 Agenda for Sustainable Development.

Africa has vast resources and talents that can be activated to reach these goals. Given the real and present threat that climate change poses, the time is now to support bold, innovative approaches to foster low-carbon climate-resilient development across sub-Saharan Africa and the rest of the continent.

Make no doubt about it, climate change is one of the largest risk multipliers for the people, environment and stability of the continent. Temperatures in Africa are projected to rise faster than the global average during the 21st century. By 2050, temperature extremes are expected to breach today's levels by 2 °C. In tropical western Africa and the Sahel, this projection raises to 4 to 6 °C by the end of the 21st century.

Predicted changes to rainfall regimes indicate that southern African will become drier, and eastern and western Africa will become wetter, with more intense rain and increased risk of floods. Some projections indicate that 250 million Africans could face water shortages by 2020 if nothing is done – and done quickly. One need only look to the recent water crisis in South Africa or the food crisis in the Sahel to see that this is a serious threat, not only for the region but also for our global economy as a whole.

The trickle-down impacts of such climatic changes are wide-ranging. At a fundamental level, climate change will interact with baseline stresses that, in many cases, are the primary drivers of vulnerability and poverty. Water resources will be subject to much larger pressures due to population growth, urbanization, agricultural growth and land-use change.

Africa's food production systems are currently among the world's most vulnerable. Six out of ten people rely on agriculture for their livelihoods. With international food prices expected to rise due to climate change and somewhere around 9 billion mouths to feed by 2050, the time to transform agriculture in Africa is now.

Understanding the impacts of climate change on development priorities in Africa – and adapting economies, societies, natural resource management practices, energy investments, budgets and policies to its expected and uncertain consequences – is essential in the pursuit of sustainable development and improved climate governance.

In many ways, this work is already underway. With funding from donors such as the Global Environment Facility Least Developed Countries Fund, Adaptation Fund and bilateral sources, African nations have made important strides in piloting climate-resilience initiatives. This works means diversified incomes on the farm, and greater access to irrigation and climate-resilient seeds and planting techniques. It means better climate information and early warning systems that will save lives and protect productive assets, and it means stronger institutions with the training, tools and technology they need to succeed in the monumental task of transforming a continent and rising to the significant risks posed by a changing climate.

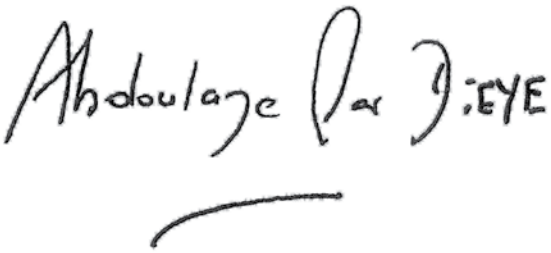
As nations across the region take steps to fulfil

their Nationally Determined Contributions to the Paris Agreement, and reach bold goals for poverty reduction, food security, gender equality and more, it will be essential to mainstream and accelerate these pilot initiatives while at the same time providing the policy support needed to ensure the sustainability of these investments.

The support from the Global Environment Facility Least Developed Countries Fund (GEF-LDCF) has been essential in laying the foundation for countries across the region to successfully incubate climate resilience initiatives and build a long-term vision for climate-resilient economies, societies and ecosystems. Many of these countries are now attracting climate finance from other financial resources, such as the Green Climate Fund (GCF), to allow for the effective scaling up of climate resilience efforts across the continent.

This mainstreaming and acceleration of climate resilience initiatives works in alignment with UNDP's new strategic plan, notable efforts to foster collaboration across the United Nations Development System, and support to countries throughout sub-Saharan Africa to access new climate finance from GCF. Equally as important, through this support, countries in Africa are also finding new innovative ways to activate the private sector and co-financing agreements. This work will support the scaling-up of climate services in Malawi, resilient agriculture in Zambia, wetlands preservation in Uganda, and the low-carbon transformation of Mauritius's economy.

This report provides an overview of several successful initiatives on climate change adaptation that UNDP supported in sub-Saharan Africa from 2000 to 2015. These signposts lay the groundwork needed to tap Africa's vast resources and human talents to transform the continent and ensure a brighter future for generations to come.



Abdoulaye Mar Dieye
Assistant Administrator and Director
Bureau for Policy and Programme Support
UNDP

Ahunna Eziakonwa
Assistant Administrator and Director
Regional Bureau of Africa
UNDP

Photo: UNDP Benin

Photo: Clotilde Goeman/UNDP

At the forefront of resilience to climate change

As a designated financial mechanism of the United Nations Framework Convention on Climate Change, the Global Environment Facility (GEF) continues to be at the forefront of international efforts to strengthen developing countries' resilience to climate change.

Adaptation to the adverse impacts of climate change is urgent and indispensable to safeguard development gains and to address the needs of the poor and the vulnerable. Healthy systems that are resilient to disruptions, shocks, and stressors are critical in achieving not only environmental benefits but also serve as a foundation for economic and human development. Climate resilience is a key component of any healthy system, particularly in vulnerable countries that depend heavily on climate sensitive natural resources and traditional agricultural practices for subsistence and livelihoods.

Least developed countries in Africa are among the most vulnerable to climate change, yet the least able to adapt. In many cases, they lack the technical, financial and institutional capacity to identify the best ways to build resilience. With around US$1.3 billion of voluntary contributions from donors, the Global Environment Facility Least Developed Countries Fund (GEF-LDCF) holds the largest portfolio of adaptation projects in the Least Developed Countries. With a renewed focus on implementation, the LDCF builds on its track record of leaving no one behind.

But environmental and climate threats are growing on a global scale. There is a significant overlap of countries which are characterized as fragile, or conflict affected, and those categorized as LDCs. Given this, addressing fragility is especially important to the LDCF, which has provided and will continue to provide financing for the urgent and long-term adaptation needs of these countries. Going forward, the GEF will fulfil the mandate it was given by the Paris Agreement by continuing to demonstrate leadership with emerging issues in adaptation, help developing countries to mainstream climate considerations and resilience into relevant policies, plans and associated processes, and by supporting a reduction of the vulnerability of people, livelihoods, physical assets and natural systems to the adverse effects of climate change, toward maintaining a safe operating space for humanity.

Africa is home to over 50 nations, with more than 1 billion people, and is rising as a global powerhouse. For over 20 years, the GEF and its partners have implemented projects that have contributed to shifting Africa's future towards more sustainable development. The GEF is therefore delighted to co-publish this important synthesis report together with UNDP, highlighting some of the results of the GEF Adaptation Programme in Africa. I am looking forward to our continued collaboration to support the most vulnerable countries to cope with the impacts of climate change and reach their development priorities in a sustainable, resilient and environmentally sound fashion.

Gustavo Fonseca
Director of Programs
Global Environment Facility

Adriana Dinu
Deputy Director
Bureau for Policy and Programme Support
UNDP

EXECUTIVE SUMMARY

Africa is at a tipping point. While efforts to achieve the goals outlined in the 2030 Agenda for Sustainable Development and Paris Agreement could drive positive changes following nearly a decade of economic growth across Africa, climate change threatens to derail these gains. Given that temperatures in Africa are rising, and are set to rise faster than the global average during the 21st Century, it is time to mainstream, scale-up and accelerate support for climate change adaptation across the continent. Recent studies indicate it is likely that the true costs of adaptation will be substantially higher than originally projected and will require creative financial mechanisms and substantial engagement with the private sector to meet. While initial climate change adaptation initiatives show good potential for economic viability, livelihood enhancement and vulnerability reduction, long-term sustainability will depend on the prevailing levels of poverty, the wider context of policies and regulations, access to markets and financial services, as well as government capacity to provide continuous technical support to communities. This indicates that baseline development is still required to reach targets for poverty reduction and climate action in Africa. Building on the lessons learned from over a decade pioneering adaptation in Africa, a new generation of climate change adaptation initiatives are coming on board. To be successful, these projects will need to enhance adaptive capacity, improved decision making, access to markets, policy mainstreaming and evidence-based decision making.

The time for action is now

Real steps need to be taken to empower the nations of Africa to build their resilience to the threats that climate change brings. Left unchecked, these threats will erode long-term opportunities for human development, undermining human productivity and capability. They have the potential to create new famines and undermine global efforts to achieve "No Hunger and No Poverty" by 2030. In turn, high levels of poverty and low levels of human development limit the capacity of poor people to manage climate risks, placing further stress on already overstretched coping mechanisms that will perpetuate poverty traps. Taken together, this means the potential for an increase in eco-migrants, disease outbreaks such as the Ebola outbreak in West Africa from 2014 to 2016, and increased instability.

Perhaps most importantly, climate change is putting the lives of millions of people at risk in Africa. For the first time in over a decade, world hunger is on the rise, affecting 11 percent of the global population, according to recent estimates from the Food and Agriculture Organization of the United Nations (FAO). Conflict and climate are the main drivers for this spike in hunger. In Africa, crop destruction from the fall army worm, strong droughts induced by an abnormally strong El Nino cycle, and a rise in conflict in places such as Nigeria, Somalia and South Sudan, were the chief culprits in a serious rise in food insecurity in 2017. At the peak of the El Niño crisis from 2014 to 2016, some 40 million people in Africa required emergency assistance. This number dropped to around 26 million in 2017. Taking reactive approaches to food security and disaster recovery costs the people of Africa billions of dollars in lost GDP, and syphons off government resources that should be dedicated to education, social programmes, healthcare, business development and employment.

Taken on a human level, while the people of Africa have much to lose from climate impacts, they contributed very little to climate change. The collective agreement to protect our people and our planet signed on by 195 parties in Paris in 2015 provides a global compromise to support the nations of Africa in promoting low-carbon development, while at the same time looking toward continued economic and social development, and a long-term vision for stability, peace and prosperity across the continent.

Reaching the goals for a more peaceful and prosperous Africa will require concerted efforts from the global community, vertical and bilateral funds, the private sector, local governments and other actors to play an increasingly important role in creating sustainable climate actions.

On a global level, "the costs of adaptation are likely to be two-to-three times higher than current global estimates by 2030, and potentially four-to-five times higher by 2050," according to the 2016 UN Environment Adaptation Gap Finance Report.[1] "Previous global estimates of the costs of adaptation in developing countries have been placed at between US$70 billion and US$100 billion a year for the period 2010-2050. However, the national and sector literature surveyed in this

1 UN Environment, 2016, The Adaptation Gap Finance Report, http://web.unep.org/adaptationgapreport/sites/unep.org.adaptationgapreport/files/documents/agr2016.pdf

report indicates that the costs of adaptation could range from US$140 billion to US$300 billion by 2030, and between US$280 billion and US$500 billion by 2050." According to the report, sub-Saharan Africa will bear the highest costs per unit of Gross Domestic Product (GDP).

A roadmap to resilience

Addressing the myriad underlying drivers of climate change and poverty in Africa and the rest of the world is a priority of UNDP's new strategic plan for 2018-2021. Anchored in the 2030 Agenda for Sustainable Development and committed to the principles of universality, equality and leaving no one behind, the UNDP vision for the Strategic Plan for the next four years is to help countries achieve sustainable development by eradicating poverty in all its forms and dimensions. This work will be achieved by accelerating structural transformations for sustainable development and building resilience to crises and shocks.

Under this vision, UNDP is working as a broker to connect the United Nations Development System to improve baseline resilience to current climate variability. This will require transformational system-wide changes across the UN system, governments, the private sector and society as a whole, as well as concerted evidence-based investments in human, social, physical, natural resources management, enabling capabilities and adaptive capacities. Policy and institutional strengthening is necessary for the mainstreaming and acceleration of successful adaptation approaches as well as the promotion of innovation.

It is impossible to reduce risk to zero. Disasters will continue to cost the people of Africa millions every year. Helping communities bear the costs of residual losses will be critical to protecting development gains and helping recovery. As severe weather, extreme weather events such as droughts or floods, and temperature rises continue to increase, 'tipping points' will be reached where established economic systems will cease to be productive. This means that the costs of residual risks are bound to become a bigger part of overall adaptation efforts.

Lessons learned 2000-2015

The lessons learned from these interventions, dating from 2000 to 2015, make up the case studies in this publication. They provide valuable insights into global efforts to mainstream and accelerate climate actions in Africa and across the globe.

First generation adaptation projects in Africa were small-scale and largely focused on investing and diversifying assets largely through agricultural technologies and practices with a mixed level of support for adaptive decision-making. Recent programming efforts have focused on larger and more programmatic efforts that address multiple sectoral entry points and make better use of partnerships. Most UNDP-supported projects during this time period focused on livelihoods diversification and have been designed to reduce sensitivities to climate change. Some projects are also focused on reducing exposure to climate change, ecosystem-based adaptation efforts, as well as National Adaptation Plans projects designed to improve climate governance. Just a handful of projects address the residual risk of climate change – unavoidable losses for which there is no feasible response options.

There have been a number of noteworthy successes in climate change adaptation in Africa over the past decade. UNDP-supported projects improved food security in places like Benin, Mali, Niger and Sudan, and farmers across the continent are acquiring climate resilient seeds and farming techniques to improve productivity and protect against changing climate conditions. With the support of UNDP and funding from vertical funds such as the GEF, national governments also improved climate information and early warning systems across the continent, protected communities from wildfires,

Photo: UNDP

sea-level rise and other natural disasters, empowered women to be more effective agents of climate actions, and created new opportunities to find jobs on and off the farm. Governments have also created unique measures to foster the enabling environments needed to achieve their Nationally Determined Contributions to the Paris Agreement.

Now is the time to take these measures to scale. New projects funded by the Green Climate Fund in Africa and a new-generation of GEF and Adaptation Fund-financed initiatives hold great promise in mainstreaming and accelerating earlier initiatives. GCF-financed climate change adaptation projects supported through the UNDP are now underway in the sub-Saharan African region in Malawi, Uganda and Zambia. GCF-financed National Adaptation Plans projects were recently approved for the Democratic Republic of the Congo, Liberia, and Niger.

Based on the experiences outlined in this report, some important factors have emerged to guide and inform future project design and implementation across the continent. These will be critical to empowering climate actions to achieve the goals outlined in the 2030 Agenda for Sustainable Development. They will also provide the critical support needed to connect countries with the finance, tools, training and technology they need to reach Nationally Determined Contributions to the Paris Agreement and build a vision for low-carbon, climate-resilient development. These main factors fall into a simple acronym, ADAPT, that provides a holistic framework for the nations of Africa to adapt to climate change.

Adaptive capacity is essential for the sustainability, mainstreaming and acceleration of climate change adaptation initiatives. Our climate system is inherently variable and because it is impossible to predict the weather with certainty, it requires analytical skills and technical information for iterative climate change planning and policy making.

Decision-making that is shared across governments, and with communities and other stakeholder groups on the 'what' and the 'how' of adaptation projects, is critical to the success and sustainability of such initiatives.

Access to markets to enable scale-up, encompassing market linkages, value chain development and business planning is critical to enable and sustain adaptation benefits. Similarly, a transformation within the private sector is required to fund adaptation initiatives and protect business and various economic sectors from the impacts of climate change.

Policy mainstreaming is necessary to embed climate change adaptation considerations into policy and institutional frameworks, and facilitate its acceleration. Pilot projects should be set up along with robust monitoring frameworks so that evidence of what works and why – the causal pathways between the investment and the result – is fed into policy processes. In this way countries can begin to build up a knowledge bank of the costs of adaptation, the transferability of experience and the factors that would enable successful adaptation.

Technical information to support evidence-based decision-making is important for policy making and planning. This includes economic information on the returns from investments in hard and soft adaptation options, and the performance of adaptation investments over time.

Photo: UNDP

Signature Solutions of the UNDP Strategic Plan (2018-2021)

Under the leadership of Administrator Achim Steiner, UNDP has a new four-year strategic plan for 2018 to 2021. UNDP's adaptation efforts align with this plan and provide continued support to achieving the goals outlined in the 2030 Agenda, Sendai Framework, Paris Agreement and other global accords.

Signature solution 1: Keeping people out of poverty. This signature solution will target the barriers and vulnerabilities that keep people in poverty or that push them back into poverty, including when shocks and crises occur. In rural areas that are largely dependent on agriculture and natural resources, this signature solution will be closely related to issues of food security and the resilience of agricultural systems.

Signature solution 2: Strengthen effective, inclusive and accountable governance. Inclusive and accountable governance systems and processes are recognized as crucial to sustainable development and human security. The work of joint programmes like the FAO-UNDP Integrating Agriculture into National Adaptation Plans Programme (NAP-Ag) and the joint UNDP-UN Environment National Adaptation Plans Global Support Programme (NAP-GSP) fit well into this solution of the UNDP Strategic Plan by bolstering nationa adaptation planning processes worldwide.

Signature solution 3: Enhance national prevention and recovery capacities for resilient societies. Building resilience to the impact of disasters and emergency situations (whether from socioeconomic or natural causes) requires efforts to minimize the drivers of risk ingrained within development processes and to strengthen human security.

Signature solution 4: Promote nature-based solutions for a sustainable planet. Biodiversity and terrestrial and marine ecosystems provide the foundation for human societies and a safety net of resources and ecosystem services for billions of people. UNDP will apply integrated actions developed in partnership with FAO, UN Environment and others to address biodiversity loss by tackling market, policy and governance failures that lead to ecosystem degradation.

Signature solution 5: Close the energy gap. Access to clean and affordable energy is a critical enabler for sustainable development whether it be for nutrition, transport, education or economic opportunity, among others.

Signature solution 6: Strengthen gender equality and the empowerment of women and girls. Significant gender inequalities persist in every region of the world, manifested as the unequal distribution of care work, lack of equitable access to decision-making and unequal access to basic services, assets and finance.

ACRONYMS

AAP	Africa Adaptation Programme
AEDD	Agency for Sustainable Development (Mali)
AF	Adaptation Fund
ALAD	Association de Lutte pour l'Autosuffisance et Développement
BERCA Baara	Bureau d'Études de Réalisation et de Conseil Agricoles (Guinea)
CAR	Central African Republic
CBO	Community Based Organization
CEEPA	Centre for Environmental Economics and Policy in Africa
CI / EWS	Climate Information / Early Warning Systems
CNSF	National Centre for Seeds Research
COP	Conference of the Parties
CPEIR	Climate Public Expenditure and Institutional Review
CSO	Civil Society Organization
DA	Development Agent
DDD	Direction of Sustainable Development (Congo)
DNM	Directorate of National Meteorology
DRC	Democratic Republic of Congo
ECCA	Economics of Climate Change Adaptation
EIP	l'École Instrument de Paix
EMA	Environmental Management Agency
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
FCFA	West African Franc
GAGE	Groupe Africain pour la Gestation de l'Environment (Guinea)
GBH	Grain Business Hub
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWP	Global Water Partnership
HIV / AIDS	Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome
I&FF	Investment and Financial Flows
ICIPE	The International Centre of Insect Physiology and Ecology
IFAD	International Fund for Agricultural Development
IGEBU	Institute of Geography of Burundi
IOD	Indian Ocean Diapole
INC	Initial National Communication
INRAN	National Institute of Agronomic Research of Niger
IPM	Integrated Pest Management

IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KACCAL	Kenya Adaptation to Climate Change in Arid Lands
KARI	Kenya Agricultural Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
KIRDI	Kenya Industrial Research and Development Institute
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LEG	Least Developed Countries Expert Group
MAWF	Ministry of Agriculture, Water and Forestry
MEDD	Ministère de l'Environnement et du Développement Durable (Senegal)
MoARD	Ministry of Agriculture and Rural Development (Ethiopia)
MICOA	Ministry of the Coordination of Environmental Affairs
MPAT / DC	Ministry of Planning, Urban and Land Use Planning and Community Development
NAP	National Adaptation Plan
NAPA	National Adaptation Programmes of Action
NAP-GSP	National Adaptation Plan-Global Support Programme
NAP-Ag	Integrating Agriculture in National Adaptation Plans Programme
NCSP	National Communications Support Programme
NDEF	National Directorate of Environment and Forestry
NEMA	National Environmental Management Authority (Kenya)
NGO	Non-governmental Organization
ODB	Organisation pour un Développement à la Base
PROVIA	Programme of Research on Climate Change Vulnerability, Impacts and Adaptation
RAB	Rwanda Agricultural Board
REMA	Rwanda Environmental Management Authority
SCCF	Special Climate Change Fund
SGP	Small Grants Programme
SHG	Self Help Group
SNC	Second National Communication
T21	Kenya Threshold 21
TNC	Third National Communication
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNDP-GEF	United Nations Development Programme-Global Environment Finance
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
UNITAR	United Nations Institute for Training and Research
US$	United States Dollar
V&A	Vulnerability and Adaptation
VIA	Vulnerability Impact Assessment
WHO	World Health Organization

Glossary of Commonly Used Terms*

Adaptation
The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Adaptive capacity
The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Coping
The use of available skills, resources, and opportunities to address, manage, and overcome adverse conditions, with the aim of achieving basic functioning of people, institutions, organizations, and systems in the short to medium term.

Disaster
Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster Risk Reduction (DRR)
Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.

Exposure
The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Mainstreaming
The informed inclusion of relevant environmental concerns into the decisions of institutions that drive national, local and sectoral development policy, rules, plans, investment and action.

Resilience
The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.

* Except where specifically stated, all definitions are based on IPCC Fifth Assessment Report (https://unfccc.int/files/adaptation/groups_committees/ldc_expert_group/application/pdf/undp.pdf)

Risk
The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term "risk" is used primarily to refer to the risks of climate-change impacts.

Sensitivity
The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

Sustainable development
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987).


Photo: UNDP Sierra Leone

Photo: UNDP

Africa is rising. Across the continent we are seeing promising achievements in economic and social growth, inclusion, innovation, environmental protection and overall poverty reduction. Women are more empowered than ever before. Strong economic growth has been matched by an increase in education. Disrupting factors threaten to unravel this positive growth, however, and derail the continent's development aspirations. Taken together with multiplying risk factors such as migration, conflict and disaster, climate change poses one of the most serious threats to peace and prosperity in Africa today. Left unchecked, climate change could create major impacts on the continent's economy, society, culture and environment. In order to address the pressing needs brought on by climate change, the world needs to come together to support transformative and scalable climate actions across the continent. These will support Africa – and the rest of our planet – in realizing the lofty goals outlined in the 2030 Agenda for Sustainable Development and the Paris Agreement. The requisite human elements are already coming into place. In order to mainstream and accelerate this support, the United Nations Development System, donors, civil society, the private sector and national governments will need to come together to build capacity, policies, enabling environments and collaborative approaches that will ensure the sustainability of climate change programming in Africa.

INTRODUCTION

Photo: Imen Meliane/UNDP

1. INTRODUCTION

1.1 Adaptation in Africa

Africa is at a tipping point. With projected temperature rises higher than the rest of the world – and an increase in the occurrence of droughts, floods and other natural disasters – the people, economy and ecosystems of Africa are especially vulnerable to the effects of climate change. Early pilot initiatives for climate change adaptation have provided important lessons, data and insights to inform the design, implementation, and monitoring and evaluation of future climate change adaptation programming across the continent. Taking these pilot initiatives to scale will require increased capacity and collaborative management approaches, improved engagement with the private sector, empowering actions that engage women and youth, capacity development to improve climate governance, and a holistic approach that looks at climate change not as a series of linear challenges, but as a systematic challenge that requires transformational shifts, innovative thinking and bold action.

Addressing climate drivers in Africa requires a continued focus on human development. As we take steps to mainstream and accelerate a new generation of climate change adaptation and mitigation projects designed to address both baseline needs as well as long-term targets for environmental protection and economic and social development, these projects need to connect climate drivers with community development, community development with zero-carbon growth, and zero-carbon growth with a climate-resilient future.

People are at the center of the climate change equation. They are the common denominator that connects adaptation with mitigation, and the common driver of human-induced climate change. Adaptation may take the form of improving farm production to leave no one behind in our goals of ending hunger and poverty by 2030, strengthening effective, inclusive and accountable climate governance and natural resource management practices, enhancing national prevention and recovery capacities for resilient societies, promoting nature-based solutions for a sustainable planet and closing the energy gap. It will also involve reducing risks and informing evidence-based decision making through the introduction of climate information and early warning systems, strengthening gender equality and the empowerment of women and girls, and other bespoke approaches designed from the ground up to help people, society and economies transform the way they do business in a new climate reality.

In a world where every economic sector - be it farming or aviation - will need to rethink the way it does business, the human power, intellect and innovative spark of the people of Africa will be the essential driving force behind climate change adaptation on the continent. Human-driven design, connected with evidence-based decision-making will be key in ensuring the sustainability of investments in climate actions in Africa. For developing countries in Africa, this innovative human-based design will require continuous supports from the United Nations Development System, civil society, the private sector and donor funds. The cost of inaction – or poorly executed action – is simply too high to ignore the problem at hand. The real question is, how will the world rise to the challenge and support the people of Africa in building a resilient future?

1.2 The evidence for action

Human-induced climate change is real and is affecting development progress today. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report noted that atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years, with carbon dioxide concentrations rising by 40 percent since pre-industrial times from 278 parts per million (ppm) to 391 ppm in 2012, primarily from fossil fuel emissions and secondarily from net land use change emissions. It also reported that global average temperatures increased about 0.8°C from 1901 to 2010. Human influence has been detected in ocean warming, ocean acidification, the global water cycle, reductions in snow and ice, global mean sea level rise and some climate extremes.[1] A new IPCC report is due in 2018, with early drafts of the report indicating that global warming is on track to break the toughest limit set by the Paris Agreement of 1.5 degrees by the middle of this century unless governments and businesses make significant moves to change the way they do business, use fossil fuels and invest in the long-term sustainability of our planet.

The link between human-induced climate change and rainfall patterns in Africa is uncertain. Changes in rainfall trends - such as the onset, duration, dry spell frequencies and rainfall intensity - have been detected in eastern Africa, southern Africa and the Horn of Africa. East Africa has experienced intense rainfall and drought more frequently in recent decades during the spring and summer seasons, and southern Africa is experiencing more droughts.

In Africa and parts of the Middle East, droughts and conflicts in 2017 created famines and food insecurity, and propelled a global spike in malnutrition – the first time in over a decade that we have fallen back on targets to end hunger by 2030. Globally, hunger affects more than 1 out of 10 people, with the estimated number of undernourished people increasing from 777 million in 2015 to 815 million in 2016.

The link between climate and conflict in Africa and across the globe is cause for concern. According to recent estimates from Food and Agriculture Organization of the United Nations (FAO), of the 815 million chronically food-insecure and

1 IPCC 2012. In 2018, the Mauna Loa Observatory reported CO2 levels topping 410ppm.

malnourished people in the world, the vast majority – 489 million – live in countries affected by conflict. The proportion is even more pronounced for undernourished children. Almost 122 million, or 75 percent, of stunted children under age five live in countries affected by conflict, with the difference in average prevalence between conflict and non-conflict affected countries at nine percentage points. Climate change is also contributing to human migration, which can trigger conflict over scarce resources such as lands and water.

> "We find strong causal evidence linking climatic events to human conflict across a range of spatial and temporal scales and across all major regions of the world. The magnitude of climate's influence is substantial: for each 1 standard deviation (1σ) change in climate toward warmer temperatures or more extreme rainfall, median estimates indicate that the frequency of interpersonal violence rises 4 percent and the frequency of intergroup conflict rises 14 percent. Because locations throughout the inhabited world are expected to warm 2 to 4°C s by 2050, amplified rates of human conflict could represent a large and critical impact of anthropogenic climate change."[2]

The wide-reaching impacts of climate change threaten development progress in Africa. Temperatures in Africa are projected to rise faster than the global average during the 21st Century, with temperature extremes breaching levels experienced today by 2°C by 2050 and 4° - 6°C by the end of the 21st Century in tropical western Africa and the Sahel. Changes to rainfall regimes are more uncertain, but indications from global climate modelling exercises are that southern African will become drier and eastern and western Africa will become wetter, with rain falling more intensely and bringing an increase in the risk of floods. These broad directional changes mask variability on a smaller scale; for example, modelling results in Ethiopia indicate a wide range of rainfall pattern changes. Other modelling results suggest drying over most parts of Kenya, South Sudan and Uganda in August and September by the end of the 21st Century.

A drought primarily driven by an unusually strong El Niño event in 2017 increased malnutrition rates among rural children and drove up food prices in east and southern Africa. It also resulted in livestock deaths and asset loss for pastoralists. The water crisis in South Africa and near famine conditions in Somalia – where 6.2 million people, over half the population, faced food insecurity - underscored the disruptive impacts that climate change can bring and made international headlines.

Downstream impacts on African economies could be wide-ranging. Africa's food production systems are among the world's most vulnerable because of their extensive reliance on rain-fed crop production, high intra- and inter-seasonal climate variability, recurrent droughts and floods that affect both crops and livestock, and persistent poverty that limits the capacity to adapt. For example, farming systems in at least half of the cropping area of most African countries may have to deal with climate conditions that are beyond current norms by 2050, which will have an overall negative effect on yields of major cereal crops across Africa. Projections estimate yield losses of maize from 18 percent for southern Africa to 22 percent aggregated across sub-Saharan Africa, with yield losses for South Africa and Zimbabwe in excess of 30 percent. Other modelling results for sub-Saharan Africa suggest drops in cereal crop production in Africa ranging from 2 percent for sorghum to 35 percent for wheat by 2050.

Other projections based on continued high emissions levels suggest a decrease of up to 40 percent in fishery yields in the tropics by 2055 and reductions in fish production in Lakes Kariba, Kivu, Tanganyika, Victoria and Malawi, where small variations in climate are already causing nutrient dispersion; changes in terrestrial ecosystems throughout Africa, with additional warming posing high risks for the survival of some species; reductions in ground water for low rainfall areas, including the Sahel, the Horn of Africa and southern Africa; and sea level rise leading to aquifer salinization, with salinity potentially reaching very high levels.

International food price rises due to climate change are very likely by 2050; if these come to pass, they will reinforce poverty through reduced consumption of food, while non-food sectors such as health and education will be overstretched. To further complicate the issue, food production will need to grow by 50 percent by 2050 in order to feed our growing population, according to estimates from FAO.

A fundamental point is that climate change will interact with and exacerbate baseline stresses that, in many cases, are the primary drivers of vulnerability and poverty. For example, water resources will be subject to much larger pressures such as population growth, urbanization, agricultural growth and land use change. Health outcomes are significantly challenged by deficient human and financial resources, inadequate public health and health care systems, insufficient access to safe water and improved sanitation, food insecurity and poor governance.

1.3 Building momentum for action

In 2015 world leaders finalized an historic agreement in Paris at the 21st Conference of the Parties (COP21) that will provide a pathway to protect our people and our planet from the severe impacts climate change will have on our society.

> "The Paris Agreement's central aim is to strengthen the global response to the threat of climate

2 Hsiang, Solomon M., Marshall Burke, and Edward, Miguel. 2013. "Quantifying the Influence of Climate on Human Conflict." Science. 2013.

change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework."[3]

Many governments and organizations have been using this threshold to plan for and adapt to potential impacts since the 2010 COP16 in Cancun, Mexico. However, limiting temperature increase to 2°C is recognized as increasingly unrealistic, as illustrated both by draft reports from the Sixth IPCC report and the World Bank's 2012 publication 'Turn Down the Heat.' The World Bank report argues that, without further commitments and action to reduce greenhouse gases, the world is likely to warm by more than 3°C and that, with current mitigation pledges, there is roughly a 20 percent likelihood of still exceeding 4°C of warming as early as 2069.[4]

Adapting to a 4°C increase in temperature is not simply a linear extrapolation of adaptation to 2°C. It would be a more substantial, continuous and transformative process because the responses of the Earth's systems to climate change are non-linear and complex. A world average increase of 3°C compared to pre-industrial temperatures over the coming decades could result in some local increases up to 6°C. Indeed, an average global temperature increase of 4°C could result in an increase of as much as 10°C in some areas of the world[5] and prevent country systems from achieving planned adaptation.

As of October 2017, 54 African nations had signed the Paris Agreement, with 43 countries (78 percent) ratifying Nationally Determined Contributions (NDCs).

"All African Intended Nationally Determined Contributions (INDCs) have incorporated two targets: an unconditional target that will be met by African countries with their own resources (about 15 percent), and a conditional target, subject to financial support from the international community (about 85 percent). However, in mapping current commitments, there is no distinction between these targets. Without making this distinction and mobilizing the resources to enable African countries achieve both targets, we stand the

3 UNFCCC, https://unfccc.int/process/the-paris-agreement/the-paris-agreement

4 The World Bank, Turn down the heat: Why a 4 C world must be avoided, November 2012. Washington. http://climatechange.worldbank.org/sites/default/files/Turn_Down_the_heat_Why_a_4_degree_centrigrade_warmer_world_must_be_avoided.pdf

5 World Bank, 2012; UNDP, 2007

Photo: Imen Meliane/UNDP

Photo: Imen Meliane/UNDP

risk of not achieving the global goal. In addition, African countries have consistently emphasized the importance of adaptation considering their high vulnerability to the adverse impacts of climate change. Although the Paris Agreement has established a global goal on adaptation with a view to contributing to sustainable development, current efforts at implementing NDCs, including those in Africa, have not attached much importance to adaptation and resilience building. Efforts also need to be made to develop bankable projects that contribute to the NDCs in African countries and that will attract private sector investors." [6]

1.4 The costs of adaptation

Estimates of the costs of climate change and adaptation vary in global studies, depending on the sub-sectors covered, the assumptions made, and the level of climate change modelled (often under 3°C). Many do not account for tipping points – unpredictable and non-linear events in the earth's biophysical systems – and large-scale change.

The Fifth Assessment Report by the Intergovernmental Panel on Climate Change reported global estimates of the costs of adaptation in developing countries of between US$70 billion and US$100 billion per year until 2050. Economist Nicholas Stern in 2006 estimated that mean business as usual damages in 2100 would reach 2.2 percent of global GDP. Other studies during that time period on the costs of adaptation have estimated a range from US$4 billion to US$109 billion a year.

The most recent estimates say these early estimates were too low. On a global level, "the costs of adaptation are likely to be two-to-three times higher than current global estimates by 2030, and potentially four-to-five times higher by 2050," according the 2016 UN Environment Adaptation Gap Finance Report.[7] "Previous global estimates of the costs of adaptation in developing countries have been placed at between US$70 billion and US$100 billion a year for the period 2010-2050. However, the national and sector literature surveyed in this report indicates that the costs of adaptation could range from US$140 billion to US$300 billion by 2030, and between US$280 billion and US$500 billion by 2050." According to the report, sub-Saharan Africa will bear the highest costs per unit of Gross Domestic Product (GDP). The Africa Development Bank Group estimates required financing for NDCs in Africa at US$4 trillion by 2030.

In the end, the final number for adaptation will be high, but it is intrinsically difficult to determine and assign exact financial value, given that droughts, extreme weather events, tropical storms and sea level rises will have a disproportionately large effect on the poorest people and given the potentially catastrophic effects of 'tipping points.' Climate shocks such as droughts, floods and storms erode long-term opportunities for human development, undermining human productivity and capability. High levels of poverty and low levels of human development limit the capacity of poor people to manage climate risks, place further stress on already overstretched coping mechanisms and perpetuate poverty traps.[8] This is paired with the fact that climate impacts are heavily concentrated in poor countries. Often, these impacts can drive greater levels of inequality, given the limited abilities to cope, and threaten to erode freedoms and choice.

The economics of adaptation is a key consideration in making improved investments in climate change adaptation in Africa. In a world with competing demands for limited technical and financial resources, critical questions need to be asked to form the most efficient policy response. Questions such as what is the magnitude of climate change impact on a sector like agriculture? To what extent will households that rely on agriculture be affected? Where are these changes expected? What kinds of interventions will have the highest return in terms of social welfare improvements? It is also key to address concerns over where and when adaptation investments should be made (recognizing that if one adapts too soon, resources may be wasted, and conversely that adapting too late will at the very least increase vulnerability for at-risk populations and perpetuate poverty traps, and may mean much greater costs).

The valuation of disaster risk reduction, climate information and early warnings provides an important example on the relative return-on-investment for climate change adaptation.

> "These valuation systems are not uniformly applied, nor do they use consistent metrics in all cases, making it hard at times to track the true impact of these investments. An example in UNDP's portfolio comes from a recently approved GCF-funded project in Malawi. Estimates suggested that an investment of approximately US$16 million—for the expansion of the hydromet observation networks and capacity strengthening within the National HydroMeteorological Service (NHMS) to gather, analyze and package relevant information for local districts, villages and communities— would result in a net benefit of about 1.5 times the cost of the project. Assuming a 10-year useful life of the early warning system and a 10 percent discount rate, the internal rate of return was estimated to be 31 percent, which exceeds 10 percent, the economic opportunity cost of capital."[9]

According to Rogers and Tsirkunov (2013), "upgrading all hydrological information production and early-warning capacity in developing countries would save an average of 23,000 lives annually and would provide between US$3 billion and US$30 billion per year in additional economic benefits

6 Africa NDC Hub, Africa Development Bank Group.
7 UN Environment, 2016, The Adaptation Gap Finance Report
8 UNDP,, 2007
9 Snow, John T.; 'A New Vision for Weather and Climate Services in Africa', UNDP, New York, USA, 2016..

related to disaster risk reduction." These estimates have been taken into account in UNDP-supported planning for Climate Information and Early Warning Systems (CI/EWS) projects. In Uganda, for example, the cost-benefit ratio on investment for CI/EWS is said to be between five- and ten-fold.

1.5 UNDP's position on climate change

Supporting the people and nations of Africa to adapt to climate change aligns directly with UNDP's vision to help countries achieve sustainable development by eradicating poverty in all its forms and dimensions, accelerating structural transformations for sustainable development and building resilience to crises and shocks.

Tackling the dual threats of climate change and disasters (SDG Goal 13) is essential for achievement of all the other Sustainable Development Goals (SDGs) outlined in the 2030 Agenda, in particular Goal 1 (poverty eradication) and Goal 10 (reducing inequalities). By building resilience and ensuring that all development is risk-informed, countries and communities can protect against losses and simultaneously boost economic growth, create jobs and livelihoods, strengthen access to health and education, and ensure that no one is left behind.

UNDP's support to countries on climate change and disaster resilience is shaped by three important global agreements: the Paris Agreement on Climate Change, the Sendai Framework on Disaster Risk Reduction, and the 2030 Agenda for Sustainable Development. UNDP works with countries to help them reduce greenhouse gases and advance a long-term goal of zero-carbon development. At the same time, UNDP works together with partners across the UN Development System to adapt to the impacts of climate change, enhance access to clean and renewable energy, reduce the risk of disasters and, where needed, support resilient disaster recovery.

For UNDP, adaptation means climate-resilient economic development and sustainable livelihoods, especially for vulnerable populations – the poor, women, youth and indigenous peoples. These communities are often the most vulnerable to climate change and are at greater risk to its impacts. A single shock – a storm or drought – or slow onset impact – such as sea level rise – can exacerbate existing vulnerabilities and increase the likelihood of locking communities already at risk into cycles of poverty.

UNDP supports climate change resilience and risk management at the local, regional and global levels in the context of climate-resilient agriculture and food security, promoting sustainable water resource management, ensuring sustainable coastal zone development, addressing climate-related extreme events and risks, providing access to early warning systems and climate information for enhanced planning, and pursuing ecosystem-based adaptation approaches. It also includes support for improved climate governance through National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPAs).

All approaches are also gender-responsive, meaning that they address the unique needs and priorities of both women and men, while also empowering women as important adaptation leaders and agents of change.

Under the leadership of Administrator Achim Steiner, UNDP approved a new strategic four-year strategic plan (2018-2021). UNDP's adaptation efforts align with this plan and provide continued support to achieving the goals outlined in the 2030 Agenda, Sendai Framework, Paris Agreement and other global accords. These signature solutions (see box Executive Summary) are designed to keep people out of poverty, strengthen effective, inclusive and accountable governance, enhance national prevention and recovery capacities for resilient societies, promote nature-based solutions for a sustainable planet, close the energy gap, and strengthen gender equality and the empowerment of women and girls.

1.6 UNDP engagement on climate change adaptation in Africa

UNDP is working to help African countries address the challenges of climate change and remains the largest service provider in the UN system globally on climate change adaptation and mitigation. UNDP's value added as Implementing Agency is threefold:

- **Technical support at three levels of quality assurance** - Country Office supported by regional technical unit, supported by headquarters technical advisers - to ensure that projects are mobilizing successful approaches for addressing climate change.
- **Programming advice** that reflects the core principles of capacity development, sustainable human development, gender equity and participation.
- **Technical and financial quality control** benefiting from UNDP's established project management procedures and processes. This is all firmly in support of country leadership of the project that is important for ownership of effective adaptation approaches.

1.7 Results from UNDP-supported projects 2000-2015

UNDP-supported climate change adaptation projects are developing methodologies and approaches for reducing vulnerability to climate change and contributing to stronger human development outcomes. The results contained in this publication reflect pilot initiatives undertaken between 2000 and

2015. The lessons learned give solid ground to inform new climate actions across the continent. The adaptation measures that have been tested through UNDP-supported projects show good potential for profitability, livelihood enhancement and reduced vulnerability to climate shocks. However, project sustainability is generally weak and dependent on the prevailing levels of poverty, the wider context of regulation, access to markets and financial services, as well as government capacity to provide continuous technical support to communities.

For example, in a recent project in Ethiopia, of the 2,822 households participating in the project and receiving cash and food transfer support, 16 percent graduated out of safety net support (474 households with a total population of 1804), reducing their food deficit from four to two months.[10] In Zimbabwe, a project increased food security and income diversification and levels for project beneficiaries, thereby improving resilience to climate change in Chiredzi district project areas.[11] In addition, innovations in developing seasonal weather forecasts under another project offer great promise for Zimbabwe, where use rates of the current weather forecasts among farmers and confidence in the information provided are low. The project represents a notable contribution toward more functional and reliable forecasting methods in Africa. Adaptation projects have wider benefits in terms of promoting citizen voices and participation, which contribute to stronger systems of democratic governance. They also promote inclusive and sustainable growth and development.

1.8 Scaling-up and mainstreaming adaptation

First generation adaptation projects in Africa were small-scale and largely focused on investing and diversifying assets largely through agricultural technologies and practices with a mixed level of support for adaptive decision-making. Recent programming efforts have focused on larger and more programmatic efforts that address multiple sectoral entry points and make better use of partnerships. UNDP's practical experience in supporting governments to design adaptation projects shows that policy makers and communities want adaptation interventions to reduce vulnerability and to deliver growth in the context of a changing climate. In this sense, resilience to climate change is necessary, but not sufficient. Returning or recovering to the baseline is not good enough; adaptation should be a means to achieving a net gain. Therefore, building assets rather than simply protecting current baselines, as well as policy action to improve the vulnerability context, have been and continue to be important aims of adaptation projects.

10 Ferguson, 2013

11 Ibid

While not covered in the case studies outlined in this publication, many of these first-generation climate projects have now closed. With funding from the Green Climate Fund (GCF), the Global Environment Facility and other vertical funds, a new generation of climate adaptation projects are coming online across the continent, building on, replicating and scaling-up tried and tested climate actions.

New GCF-financed adaptation projects in Africa include a growing cadre of National Adaptation Plans (NAPs) projects with average funding around US$3 million (currently approved for the Democratic Republic of the Congo, Liberia and Niger). NAPs projects facilitate the mainstreaming of adaptation at planning level, creating the framework for integrated approaches that leverage the innovations from projects and planning processes. In addition to the NAPs, further large-scale GCF-financed projects to scale-up adaptation initiatives have been approved in Malawi, Uganda and Zambia.

The **"Building Resilient Communities, Wetland Ecosystems and Associated Catchments in Uganda"** project will support the Government of Uganda in the management of critical wetlands that are being affected by a changing climate. The project will restore wetlands and their eco-system services, based on the wise-use principles and guidelines outlined by the Ramsar Convention on Wetlands. It also supports sustainable land management practices and reforestation, resilient agricultural practices and alternative livelihoods for communities living in these areas. This support will reduce the pressures on the wetlands. Finally, the project seeks to strengthen the climate information and early warning systems to support these communities to make climate-resilient decisions. The impact of climate change, coupled with other human and environmental stressors, is increasing degradation of wetlands and their associated ecosystem services in Uganda. This is negatively affecting the livelihoods of the people living in and around the wetlands – around 4 million people. In fact, over 80% of the people living adjacent to wetland areas in Uganda directly use wetland resources for their household food security needs. Given that wetlands are highly vulnerable to changes in the quantity and quality of their water supply, climate change will most likely substantially alter ecologically important attributes of wetlands and will exacerbate the impacts from human activity. On the other hand, the loss of wetlands could exacerbate the impacts of climate change in as they provide fundamental services that contribute to mitigation of such impacts.

The **"Saving Lives and Protecting Agriculture Based Livelihoods in Malawi: Scaling Up the Use of Modernized Climate Information and Early Warning Systems" (M-Climes)** project will support the Government of Malawi to take important steps to save lives and enhance livelihoods at risk from climate-related disasters, reaching an estimated

3 million people. The project focuses on Malawi's technical and financial capacity, as well as access barriers related to weather and climate information. These barriers will be addressed by investing in enhancing hydro-meteorological early warnings and forecasting systems; developing and disseminating tailored products for different actors (including smallholder farmers and fishers); and strengthening capacities of communities to respond to climate-related disasters.

The **"Strengthening climate resilience of agricultural livelihoods in Agro-Ecological Regions I and II in Zambia"** project supports the Government of Zambia to strengthen the capacity of farmers to plan for climate risks that threaten to derail development gains, promote climate resilient agricultural production and diversification practices to improve food security and income generation, improve access to markets, and foster the commercialization of climate-resilient agricultural commodities. The project will support the Government of Zambia in building climate-resilient food security and poverty reduction measures for approximately 940,000 people.

1.9 A vision for climate resilience in Africa

A range of experiences in adaptation programming shows that the process of designing and implementing adaptation projects is no different than the process of designing and implementing good development projects. A key component of success in both is to incorporate a participatory approach for design and implementation that reflects the fact that the vulnerability in the countries that we serve is often a symptom of poverty and political and economic marginalization. The use of technologies and practices that anticipate and plan for climate change is what distinguishes these interventions as specific to climate change. The adaptation measures that are applied would fall into the realm of asset-building and capacity development for livelihoods improvement, because a household's prosperity in the context of today's climate is what ultimately matters for people. Households often know the solutions, but those solutions face high barriers to adoption in the absence of technical, financial and institutional support.

Based on UNDP's experience, we suggest that there are three main factors leading to achievable and sustained adaptation benefits that are the basis for devising a set of principles for the design and implementation of adaptation interventions:

1. **Collaborative management approaches,** horizontally and vertically, within government and between government and non-state actors, that meaningfully put the affected people at the centre of the innovation process.
2. **Sustainability-led programming** that addresses the barriers to replication and scaling up of promising adaptation innovations.
3. **Capacity development for policy design,** programming, implementation, and monitoring and evaluation among all stakeholders within and outside government.

These principles reinforce good governance in two ways: i) by promoting shared decision-making in how best to adapt to climate change; and ii) the development of evidence-based policy leading to cost-effective, equitable and transparent use of public resources. Much of the effort will be in the strengthening of policy processes and in capacity development, which need support over a number of years. One short-term project is never enough. These three principles are elaborated further below:

Collaborative management approaches

This refers to three main dimensions: cross-government collaboration; partnerships between government and communities; and partnerships between government and non-state actors. Cross-government collaboration is necessary because of the cross-cutting nature of adaptation, and also because of the general trend for decentralization of government powers in an effort to provide better service. At the level of communities, experience shows that having communities at the centre of the experimentation process and supporting their decision-making are essential to adaptation and innovation and can help to overcome the risk of aversion to new technologies. This engagement should also be gender-responsive. Women and men have different problems and offer different solutions. In addition, participatory-led processes for the identification of problems and solutions within the framework of an analysis of climate risk help to overcome risks inherent in ideas that are externally imposed and/or that stay within conventional development pathways. Partnerships with the private sector for capacity development are essential to bring in ideas, finance and technologies for adaptation implementation. They are also critical for sustainability and to scale up initiatives supported with public funds. In Sections 2 and 3, we provide examples of successful approaches.

Sustainability-led programming

In order to ensure that measures are sustainable beyond the lifetime of the grant, measures selected and designed should be locally appropriate and flexible in accommodating climate change effects on temperature, rainfall and related parameters. This may seem obvious, but there are temporal, financial and political pressures to follow business as usual. In addition, imposed predetermined technologies and strategies can lessen an

intervention's prospects for sustainability if there is weak buy-in from communities. Evidence has shown that learning from experience is weak across the board, even though learning is critical to adaptation and innovation. At the level of climate risk monitoring, forecast development and communication, the barriers to making these projects work are practical and political; they include the lack of know-how to establish a workable and sustainable data transmission network between different planning levels, weak forecasting and interpreting skill at various levels of government, and institutional barriers to collaboration across government agencies. Projects dedicated to improving institutional and individual capacities, as well as partnership networks, are a necessary first step in low-capacity countries. Likewise, partnerships with financial service and market development organizations would promote financial sustainability. In Section 2, we show how a selection of our projects is addressing these barriers to sustainability.

Adaptive capacity development

Capacity development is the range of actions that promote better decision-making and bring about changes in behaviour in anticipating and responding flexibly to external factors. In the context of adaptation, this is the ability to design and implement effective strategies for adaptation in the context of the uncertain effects of climate change and evolving hazards and stresses in order to reduce the likelihood of the occurrence and / or the magnitude of harm from those hazards. The monitoring of results, learning and the integration of lessons learned into policy development and practices are critical in order to build planning capacities. In Section 4, we discuss the elements of adaptation policy design, implementation, monitoring and evaluation and show how UNDP has supported governments' efforts to develop their capacities for such policy design, implementation, monitoring and evaluation.

Continuing forward, all UNDP-supported programmes and projects are to be designed through the lens of sustainable human development. This means, in practice, assessing whether they address the opportunities and capabilities of the poor and excluded as well as promote sustainability, in effect combining the lenses of both sustainable and human development. Programmes and projects will adhere to uniform quality standards and processes for which managers will be accountable while investment in monitoring and evaluation will help identify improvements required to achieve sustainable results.[12] A systematic organization-wide investment for improved results-based management is under way and will be expanded in the future. [13]

12 UNDP Strategic Plan 2014 - 2017
13 Ibid

Photo: Imen Meliane/UNDP

Photo: Imen Mellane/UNDP

UNDP's Adaptation Policy Framework (2005) defined adaptation as a process by which individuals, communities and countries seek to moderate and cope with the consequences of climate change, including variability.

At the centre of this process is the need to support decision-making of communities and governments so that they are able to anticipate weather variability and adjust plans and investment strategies accordingly.

Lessons learned 2000-2015

ADAPTATION

2. ADAPTATION

2.1 What do we mean by 'adaptation'?

UNDP's Adaptation Policy Framework (2005) defined adaptation as a process by which individuals, communities and countries seek to moderate and cope with the consequences of climate change, including variability. At the centre of this process is the need to support decision-making of communities and governments so that they are able to anticipate weather variability and, in response to this and on the basis of experience, adjust plans and investment strategies accordingly. Adaptation can be pursued at four levels that should be considered as components of an adaptation strategy:

Improving baseline resilience to current climate variability

This is akin to development more broadly and represents investments in established livelihood systems in response to expected or known patterns of climate variability (which nevertheless incorporate some degree of human-induced climate change). Disaster risk reduction and preparedness are components of resilience-building. Resilient systems are characterized by the ability to self-organize, by the ability of diverse livelihoods to deal with economic and social shocks and their anticipation and reaction to variability and climate surprises. Agency, empowerment and the skills, knowledge and networks needed for action are key drivers of resilience for which investments in human, social, physical, natural and financial assets and political capabilities such as voice and participation are needed. Coping capacity refers to actions that are taken to react resiliently to climate variability; yet these actions can also affect livelihood prospects negatively, particularly in situations of increasing frequencies of climate shocks and the cumulative effects on coping capacity, as in losing or selling assets such as livestock during repeated droughts. Investments to help vulnerable communities improve their coping capacity are an essential building block of adaptation.

Adaptation to climate change hazards

Adaptation to climate change hazards requires system changes to prepare for climate change, which requires investments in human, social, physical, natural and financial assets, enabling capabilities and adaptive capacities. Adaptation is not about managing a transition to a determined and predictable future state. Rather, it is about managing uncertainty, for which adaptive capacity development is critical. Results monitoring, learning processes and integration of lessons learned into policy development and practices are important tools to develop adaptive capacities. Nor is adaptation about protection, since measures that keep people tied to locations or particular livelihoods can lead to heightened vulnerability vis-à-vis a dynamic and growing risk. Rather, it is about giving people economic options with which they can rebound and recover from climate shocks. Planned adaptation is essentially a process of the controlled management of change. In order to guide the adaptation process, climate trends should be tracked to determine which of the possible futures best represents the trend. Likewise, the monitoring of 'tipping points' - where economic and ecological systems cease to function in established ways - would provide essential information to inform adaptation strategies. For higher levels of climate change that could lead to abrupt and large-scale changes, dislocations in ecological and economic systems are likely to lead to widespread losses and prevent adaptation to the new context.

The adjustment of policies and budgets

Policy and institutional mainstreaming is necessary for the scaling-up and replication of successful adaptation approaches as well as the promotion of innovation. We can distinguish between baseline capacity development that encompasses actions to improve the effectiveness and efficiency of government institutions and adaptive capacity that refers to planning for climate change. Capacities can be developed through the generation and use of technical analysis in policy-making, through consultation processes and organizational development strategies. Climate finance is expected to grow to US$100 billion annually for developing countries and there are increasing efforts to prepare government planning systems for climate finance so that they would be able to absorb and track climate finance through core government budgetary systems and to deliver adaptation benefits.

Addressing the residual risk

Losses are likely to be inevitable, since it is not possible to reduce risk to zero, given dynamic patterns of climate variability. Helping communities bear the costs of residual losses builds resilience, but, for adaptation, support must also be given to promoting self-organization, learning and agency.[1] With greater levels of climate

1 Overseas Development Institute, 2011

change, 'tipping points' will be reached where established economic systems will cease to be productive and the costs of residual risks are bound to become a bigger part of the overall adaptation effort.

A dynamic interaction characterizes the relationship between resilience and adaptation: both seek to reduce vulnerability, which can be used as a common results metric. There is also an overlapping temporal incidence of the two: as the climate baseline changes, adaptation in a desired future state becomes resilient upon implementation; future state eventually becomes current state.

Successful adaptation of an economy should incorporate all of these elements. Firstly, adaptation is difficult without addressing baseline vulnerabilities. For countries with high levels of inequality and poverty, low levels of basic service delivery and limited livelihood options, vulnerability to climate change is high; addressing basic needs is the foundation for adaptation. Moreover, there is evidence that, unless baseline stresses are addressed, unhelpful 'feedback loops' can become activated, increasing vulnerability that magnifies climate change effects. For example, stream bank cultivation due to failing irrigation systems in Zimbabwe further reduces the amount of river flow due to siltation affecting the remaining irrigation systems.[2] In Ethiopia's Gambella region, community social safety net mechanisms that are important for resilience are becoming weaker because droughts increase time spent searching for water, livestock feed and food. For health systems, baseline stresses and capacity needs are relatively big compared to the additional stress posed by climate change. Therefore, an improvement in health service provision more generally would increase people's resilience. In the case of agriculture, exposure to changing rainfall variability together with recurrent droughts and floods means that adaptations are needed now and are as important as addressing the baseline gaps.

Second, improving the quality of public-sector decision-making for the efficient and effective use of scarce public resources requires that decisions consider all risks and drivers, including climate change, which will become increasingly important. Policy responses to climate change are complex, will cost money and will challenge conventionally accepted policy solutions and implementation pathways. Governments have a key role to play in promoting adaptation through stakeholder consultation processes, developing enabling policies and extending economic and institutional support to the private sector and civil society, which are important actors in delivering growth and reaching the poorest and most vulnerable. A strategic policy approach will need to consider i) linking a long-term adaptation vision to short- and medium-term targets and plans; ii) horizontal connections across sectors, given cross-sectoral production linkages; iii) vertical linkages, given the decentralized nature of government; and iv) partnerships between government, private sector, community and civil society, as the problems are too complex to be resolved by any group acting alone. Recently, governments in eastern and southern Africa have been developing climate change policies as a first step to mainstreaming adaptation in regular policy planning processes. Further work is needed to embed the recommen-

2 Murwira, 2013

Photo: UNDP Sierra Leone

dations of climate change policy into regular government work. And, as climate change is a dynamic risk, line ministries need to be able to continuously adjust their policies and programming to address the changing risk, making capacity development critical. These high-level processes should be informed by grassroots evidence of the costs and effectiveness of adaptation measures. Finally, households should be supported to bear the residual losses due to climate change that are associated with the cost of managing extremes such as surprise flooding and heat waves or slow-onset risks such as sea level rise or due to the fact that there have not been adaptations. To do nothing will mean that many individuals, households and communities will slip back into vulnerability and poverty.[3]

UNDP's Strategic Plan 2014-2017, outlines a major focus on what happens before climate disasters strike. This includes those that are low intensity but high frequency, as well as differentiated vulnerabilities by social and economic groups (such as women, female-headed households and populations located in the poorest regions); policies and long-term planning and investment frameworks that are disaster risk-sensitive, integrate disaster risk reduction with adaptation to climate change, and address differentiated social and economic impacts; and preparedness for disaster management and recovery at the subnational and national levels (including innovation to manage risks through insurance and resilient infrastructure).

We can distinguish four types of policy responses that cut across the four elements of adaptation: asset accumulation; capacity development; risk transfer; safety nets and relocation. A discussion of each policy response follows.

Asset accumulation: The general picture for vulnerable communities in Africa, particularly in least developed countries, is one of limited human capital (education, technical know-how), natural capital (fertile soils, water and seeds), physical capital (water storage, roads, schools) and financial capital (markets, savings, micro-financing) and limited capabilities because of weak voice and participation in political processes, all of which result in low adaptive capacity. This renders households with a limited ability to survive climate shocks and to strengthen their livelihoods in the face of climate change. Baseline weaknesses as well as harsh climates often prevent people from prospering even in patterns of natural climate variability, so investments in health and education (girls as well as boys), water and energy supply, livelihood diversification and participation in economic processes are important in helping communities build resilience. Climate change is an additional stress for which additional investments and capacity support are needed. Thus, resilience-building and adaptation require investments in assets and in voice and accountability processes that, over time, will deliver adaptive capacity development. Because vulnerability is multifaceted, headline indicators that try to measure vulnerability reduction – such as income changes – are useful to signal a change of outcome, but tell only part of the story. More data is needed to measure changes in ecosystem health and other determinants of human potential. This could help in monitoring the ability of ecosystems to continue to provide a range of services (e.g. water supply, flood control and soil formation) to support the basic foundation of livelihoods.

3 Shephard et al, 2014

Photo: UNDP Uganda

Risk Transfer: Risk transfer works by spreading the risks of extreme weather events to a large pool of individuals, usually through private-sector insurance schemes, but sometimes also through family and community networks, as well as country-level or regional loss-sharing mechanisms.[4] Well-functioning schemes reduce the negative effects of shocks and encourage risk reduction behaviour, but are based on three important success factors. First, to be feasible, insurance must be for hazard events that are sudden and unforeseen; in places where natural disasters are frequent or where there are slow on-set events such as sea level rise or increasing temperatures, insurance is not a viable risk management option. Second, risk probabilities should be calculable in order for actuarial risk to be computed, so climate modeling becomes important. Third, to be sustainable, insurance schemes must collect more in premiums than they pay out over a number of years. Poor households may not be able to afford this protection. Insurance is being explored in various initiatives globally and in Africa, but there are major gaps in knowledge about successful approaches to transferring risk.[5]

Safety nets and relocation: To address residual risk, safety nets and insurance (with caveats as stated above) or relocation are possible policy responses. Relocation may not always be possible if droughts or floods are countrywide. Millions of vulnerable people return to extreme poverty or get pushed into poverty when they are hit by a combination or sequence of climatic and economic shocks,[6] so social protection will be an important tool for resilience to climate variability.

Table 1 (page 34) draws the connection between these four categories of policy responses and the aspects of vulnerability addressed: exposure and sensitivity.[7] Box 1 applies the typology to a community climate change action plan developed in the Gambella region of Ethiopia.

First-generation adaptation projects in Africa were small-scale and largely focused on investing and diversifying assets largely through agricultural technologies and practices with mixed level of support for adaptive decision-making. These projects were important for demonstrating effects and raising the profile of the adaptation agenda, but lacked sustainability generally because of low human capacity, weak affordability and limited public-sector support. Projects were also too short to see through the capacity development needed to make a difference to communities' decision-making processes. A more integrated approach to markets, institutional development and adaptive capacity development was missing. Recent programming efforts have focused on larger and more programmatic efforts that address multiple sectoral entry points and make better use of partnerships. Most projects have been in the area of livelihoods diversification and have been designed to reduce sensitivities to climate change. Some projects are also focused on reducing exposure to climate change, with most of these being ecosystem-based projects (see Table 2). Just a handful of projects address the residual risk of climate change – unavoidable losses for which there are no feasible response options, such as insurance piloting for vulnerable communities in Ethiopia. These projects are in their early stages and we have no results yet. Annex 1 sets out all adaptation projects in sub-Saharan Africa, indicating the type of adaptation response being followed.

Effective programming approaches for all four adaptation components will need to be continuously evaluated against the climate baseline and projections. This will allow an evaluation of the results in the context of changing weather patterns during the lifetime of an investment and an assessment of their meaning for future adaptation programming in the face of climate change projections.

4 UNFCCC, 2013
5 UNFCCC, 2013
6 Shephard et al, 2014
7 IPCC, 2001

Photo: UNDP Ghana

Photo: UN Mali

Photo: UNDP Uganda

Table 1 I Adaptation programming approaches

Elements of adaptation to be addressed	Types of adaptation response	Aspects of vulnerability addressed
Baseline resilience	Asset accumulation Capacity development Adaptive capacity development Risk transfer	Sensitivity
Adaptation	Asset accumulation (protection)	Exposure
Policy and institutional mainstreaming	Capacity development Adaptive capacity development	Sensitivity and exposure
Residual risk of climate change	Risk transfer; safety nets; insurance	Sensitivity
	Relocation	Exposure

Photo: Imen Meliane/UNDP

Table 2 I Examples of ecosystem-based asset building for reduction of vulnerability (sensitivity and exposure) to climate change

Country	Fund	Type of EbA interventions	Aim and details
Asset accumulation - livelihood strategies			
Benin	LDCF	Agroforestry	Improvement of soil fertility. 1,069 producers including 210 women are engaged in agroforestry. 108,380 plants to achieve 160 hectares of agroforestry plots.
Eritrea	AF	Soil and water conservation	232 km hill terracing, 7307.23m^3 capacity check dams, 143,000 economical trees such as acacia senegal (130,000) and (13000) sisal planted.
Ethiopia	SCCF	Watershed rehabilitation	Integrated soil and water conservation on a total of 3049 hectares in six micro watersheds. 89,200 different trees and grasses planted. Jatropha planted to reduce charcoal consumption. Gully rehabilitation by gabions and sacks. 'Cut and carry' fodder collection practiced.
Mali	LDCF	Agroforestry	Improvements in soil fertility and erosion management practices (Zai method and stone bunds).
Zimbabwe	SCCF	Watershed management	Sustainable livelihoods development. Measures included: building / rehabilitating low-cost adaptive infrastructure, conservation agriculture, rainwater harvesting strategies, product diversification (i.e aquaculture, bee-keeping), drought-resistant crops, intensification of production, improved water and soil fertility management, confined pastures, feedlots, improved livestock diets, drip irrigation, integrated pest and weed management, agroforestry for example.
Asset accumulation - protection and livelihoods			
Burkina Faso	LDCF	Reforestation	Seeding propagation and planting resulted in the production of 15,000 plants (acacia radiana, acacia nilotica, acacia senegal, mesquite) for reforestation. The protection of riverbanks was improved by the implementation of an anti-erosive barrier (20 hectares), reforestation and greening of the water banks of Gourol river.
Congo	LDCF	Reforestation / agroforestry / soil conservation	Rehabilitation of eight acres of wooded parks to reduce pressure on forests and fight against floods. Three participatory agroforestry trials were conducted in Kiyaka, Ngandajika and Kipopo to reduce land degradation and soil erosion. 160 farmers benefited from training in appropriate management practices of water and soil fertility.
Guinea	LDCF	Reforestation: mangroves	Coastal protection project focused on promoting the sustainable harvesting of wood for charcoal production.
Rwanda	LDCF	Watershed rehabilitation	Reduction of soil erosion, landslide risk and valley flooding. Tree planting on uncovered slopes, terracing of muddy land, water retention barriers and opening of trenches.
Asset accumulation - protection			
Comoros	-	Reforestation	Water basin management and prevention of soil erosion. Target: 60 hectares (60,000 trees) with at least 50% survival rate.
Mauritius	AF	Planting of mangroves; and planting of beach crest vegetation	Coastal protection in two project sites. Project targets are for no further coastal erosion; no surge flooding.

BOX 1 I PROMOTING AUTONOMOUS ADAPTATION IN ETHIOPIA

Adaptation strategies proposed in the community development plan

The Gambella region is a lowland rift valley territory in southwestern Ethiopia, bordering on South Sudan. The main hazards experienced in the region are flooding, drought, highly variable and unpredictable rainfall, fire and extreme temperatures. Maximum temperatures are around 44°C in mid-March and temperatures are increasing by 0.2°C per decade. Agricultural yields have declined due to erratic rainfall, droughts and floods. Seasonal rain is usually one month late and sometimes breaks mid-way when crops are flowering. Sometimes, farmers are forced to sow seeds three times in one season because of erratic rain distribution, which is a heavy burden on poor, vulnerable communities. Crop pests and strong winds also damage crops, and malaria and waterborne diseases are common. Coping strategies can be harmful (e.g. artisanal charcoal production), can deplete assets (e.g. repeated planting of seeds) or can become increasingly ineffective (e.g. using wood ash or covering maize cobs with soil to ward off pests). Community safety nets are also reportedly harder to maintain in the face of increasingly frequent drought.

The communities propose the following strategies:

Resilience	• Rehabilitation of traditional wells • Digging deeper wells • Community-level safety nets • Establishment of community groups to strengthen social ties • Education • More effective, efficient and participatory management of natural resources • Raising community awareness about climate-change issues for better preparation • Savings and credit
Adaptation	• Migration • Diversification of financial resources and income generating activities • Modification of farming practices, planting early maturing crops, irrigation agriculture, use of crop residues for livestock feed • Preserving / storing grains • Conservation of water • Construction of water infrastructure • Reforestation / tree planting

Photo: UNDP Ethiopia

2.2 Case studies 2000-2015

The following case studies offer an insight into the types of community-level projects being implemented with adaptation funding. Many are focused on improving resilience to current patterns of climate variability. UNDP-supported adaptation projects in Africa are largely developing rural economies by diversifying crop types, improving varieties and testing system changes. Some of the following case studies also illustrate how ecosystem-based investments are approaching the protection of livelihoods from climate shocks.

Case study 2.2.1: Livelihood resilience and ecosystem protection: Rwanda

Rwanda is promoting an integrated ecosystems-based approach that combines environmental conservation and livelihood improvement through income-generating activities. For example, tree nurseries and payment to local people who were involved in planting trees have ensured project ownership. The commitment of local cooperatives is central to success of the project's activities. The Rwanda Environmental Management Authority has a memorandum of understanding with the Rwanda Agricultural Board (RAB). The RAB pays cooperatives to prepare seedlings and plant through a cash-for-work scheme and via a national network of savings banks. The cash-for-work scheme reaches 500 people (10 project sites with around 50 people in each cooperative), who receive 1,000 Rwandese Francs (US$1.5) for 80-100 seedlings planted, depending on the difficulty of the terrain. The payment is made directly to the cooperative bank account and a small percentage is retained in a mandatory savings scheme. The established tree nurseries have constantly supplied thousands of tree seedlings, thus ensuring sustainability of the project and providing income to the people who work in these nurseries. To date, five million seedlings have been produced – three million planted in 386 hectares – across four districts in the Gishwati region. The numerous benefits of some trees, e.g., grafted mangoes, avocado, calliandracalothyrsus, grevillea robust and podocarpusspp in Gishwati ecosystems, will have a greater impact on farmers' well-being because they fulfill more than one basic human need.

In order to control flooding and to reduce soil erosion in the region, trees were used to protect riverbanks in the catchment and along the Muhembe and Nyamukongoro rivers. Because the area is hilly, trees are planted along contour lines to help in reducing the speed of storm water flow, therefore helping to control soil erosion. These trees will also improve the livelihoods of local people by providing fruits and fodder for livestock and by improving soil fertility. The fruits will improve the nutritional value of people's meals, while the sale of excess fruits will generate income, thereby helping to fight poverty, which is very high

Photo: Progressive terraces constructed on a 35 hectares in the Nyabiru district, Rwanda. Credit: Rik Moors One UN Rwanda.

in the region. In addition, fodder provided by the trees will support livestock rearing. Indigenous tree species that are planted also have medicinal value and will help to conserve biodiversity, with greater environmental benefits. The next stage in the project will involve introducing agricultural-value chain businesses to promote economic development.

Case study 2.2.2: Livelihood resilience: Onamulunga School garden project, Namibia

The project coordinator for the Onamulunga School garden project in Namibia, Johannes Nelongo, is an agriculture and life science teacher who has provided inspirational leadership for 87 grade 9 and 10 students. The aim is to put the theory they learn in the classroom into practice in the field growing maize, sunflowers, cow peas, spinach, carrots, onions and other vegetables. They apply conservation ripping, water-saving techniques, mulching, organic and chemical fertilizer, crop rotation and alternative growing methods. As such, the project provides learners with practical adaptation techniques.

> "Practical exercises make it easier for learners to interpret theoretical information. It thus gives them wisdom and insight and teaches them how to apply these methods at home," says Nelongo.

Comments from learners illustrate the lessons and impact of this pilot project: "Through this project, we have learnt the importance of mulching and pest control. I told my Dad about these techniques because he is a farmer and can benefit from it," comments 18-year old Victoria Mulunga, who hopes to study nursing after she graduates. "At home, my sisters and brothers and I have started our own garden. We grow spinach, carrots and onions and we eat them," adds 15-year-old Erastus Martin, who hopes to become a scientist.

"Through this practical exercise our grades have become much better. The subjects are easier now because we have seen and done it in real life. Knowing how to plant properly is a skill that provides opportunities and makes it possible to make an income," says Emilia Johannes, who at 17 already wants to be a medical doctor.

Case study 2.2.3: Livelihood resilience and ecosystem protection: Ethiopia community-managed grazing lands

The project implemented integrated soil and water conservation activities in order to increase agricultural productivity and to protect the resource base. A total of 3,049 hectares of land in six micro watersheds was rehabilitated. Communities enforced restrictions on open livestock grazing in designated areas, which led to the regeneration of hillside vegetation through area closure. Six nurseries were established to assist the plantation and about 892,000 different trees and

Photo: UNDP

grasses were planted. With these advantages, the farmers are enjoying greater productivity of crops due to greater conservation of soil moisture and less erosion. Jatropha, an evergreen drought-resistant bio-fuel plant that grows easily in degraded lands, is being used to reduce deforestation and to control erosion rates, which contribute to poor agricultural productivity. Jatropha has reduced the amount of charcoal used by 50 percent. Oils can be extracted for cooking and lighting, thereby saving money, and this also generates income. The forage and tree plants – pigeon pea, acacia policanta, jatrofa, sesbania and lablab – as well as gully rehabilitation by gabions and sacks on the selected watershed have performed well. The communities were also able to enforce 'cut-and-carry' fodder collection as a strategic advantage for climate change adaptation in Ethiopia. Focus group discussions with the farming community and agriculture experts revealed that springs and rivers had greater discharge, that forage grasses had developed from formerly degraded lands and that there had been a reduction in floods and an improvement in soil moisture for cultivated lands.

Case study 2.2.4: Livelihood resilience: Smallholder agriculture, Namibia

The Ministry of Agriculture, Water and Forestry (MAWF) recorded that smallholder farmer Johannes Keshongo in Omuntele constituency, Oshikoto region, had a bumper harvest of 4,660 kilograms of mahangu (pearl millet) per hectare, although 2013 was a drought year. The baseline for the current yield of Namibia's staple food cultivated by approximately 160,000 subsistence farmers is less than 300 kilograms per hectare. Keshongo is applying conservation tillage techniques where a ripper and furrower prepare the land. This cracks the hard plough pan open – allowing for deep root development – and forms ridges of 30 centimetres between the ripped planting lines, which create an in-field water harvesting effect that guides rain water to the plants. Key to the success of Keshongo were early land preparation, planting with the first rain, thinning seedlings and applying a mixture of manure and fertilizer.

> "I prepared my land early and planted in the first week of November 2012, having received a heavy rain. It rained on and off till end of December, but since January I have only received scattered showers. However, the soil moisture in the ripped lines is still high," says Keshongo.

The mahangu roots in the ripped lines have developed to a depth of 48 centimetres. "I apply fertilizer and manure in the ripped lines only, thus saving on inputs compared to the conventional method where I used to broadcast the inputs."

Conservation tillage is increasingly replacing conventional land preparation methods such as disc harrowing and ploughing all over the world. It is a method within the wider concept of conservation agriculture that involves minimal soil disturbance, maximum soil cover and crop rotations in order to reverse soil degradation and to increase soil fertility and the water-holding capacity of soil.

"I have practiced conservation tillage and crop rotations for the last three years. The tractor rips and furrows the same lines year after year. I rotate mahangu and omakunde (cow pea) in order to increase soil fertility".

Keshongo is using indigenous seed carefully selected from the best performing plants.

"As I witnessed my yields increasing, I have expanded to five hectares under ripping and furrowing. Now I will put my entire farm of seven hectares under conservation tillage. My neighbours have registered their interest for taking up conservation tillage."

Ripping and furrowing land preparation can be done throughout the dry season, beginning straight after harvest, thus creating optimal planting opportunities for farmers, who can then plant with the onset of rain. As a lead farmer, Mr. Keshongo will train 30 aspiring conservation tillage farmers in his area per year.

Case study 2.2.5: Adaptation: Smallholder agriculture, Mali

In the Sandaré, Massantola, Cinzana and M'Pèssoba municipalities in Mali, resilient agro-pastoral practices and technologies were introduced in 2012-2013; drought-tolerant and short-cycle cereal, fodder and rice seed varieties were also introduced. Initially, 42 collaborating farmers, whose number rose to 1,500 individual farmers in 2013-2014, as well as eight youth groups have been supported in the production and sale of seeds. In addition to the new seed varieties, reforestation and agroforestry plots have been expanded, erosion control with stone bunds is being strengthened and water resource management techniques are being introduced, for example, three micro-dams and wells for vegetable gardens. Women are another beneficiary group. In the municipality of Sandare, nine women's associations comprising 633 members have been supported to implement market gardening in plots of one-half to two hectares (in total 8,239 hectares). Under this arrangement, one women's association of 150 women is growing maize and ground nuts (one hectare) and another association of 24 women is growing cow pea (half hectare). In the municipality of Massantola, four associations comprising 324 women have been supported to grow vegetables in four plots totaling 3.61 hectares. In the municipality of Cinzana, eight associations of 466 women are being supported to grow vegetables in eight plots totaling seven hectares. In the municipality of Mpessoba, three associations of 83 members in total are being supported to grow vegetables in three plots totaling 0.44 hectares. Incomes earned are additional to previous subsistence livelihoods. . These prior livelihoods were based on wood charcoal production, a practice very vulnerable to the effects of climate change.

These adaptive practices have shown a potential of improving yields and agriculture production in a context of drought and shifting rainy seasons. For example, the demonstrations of the cow pea grain variety korobalen gave an average yield of 600 kilograms per hectare per harvest against 300 kilograms per hectare of local varieties; the millet variety toroniou gave an average yield of 1,300 tonnes per harvest against 800 kilograms per hectare (local variety); the sorghum variety CSM 63 produced an average yield of 2,900 tonnes per harvest against 1,300 tonnes for the local variety; and the maize sotubaka produced 4,140 tonnes per harvest compared to less than 1 tonne for the local variety. As one of the members of the Assa Tièmala women's association in Sandare has said, the income stream from the vegetable gardens has enabled the women of the association to pay their children's school fees. With higher income generated through the project activities, beneficiaries are able to sustain the new agricultural approaches and potentially expand their access to other markets. Subsequently, training will be provided to women on literacy, book-keeping and business management to promote enterprise development.

Case study 2.2.6: Adaptation: Smallholder Agriculture, Zimbabwe

Ms. Shylet Makondo, a mother of eight from the district of Chiredzi, chose a sorghum variety based on its shorter height and reduced post-harvest workload. Improved yields due to the drought resistence of the seed variety and soil moisture conservation techniques learned through project activities gave her access to the local market. She notes that the money from sales "will allow us to send our children to school." Mrs. Evelyn Hanyani, a mother of five also from Chiredzi, says that the cassava crop that she hosts on one of the project's pilot sites "has really boosted household food security. Since we have enough grain to see us through to the next harvest, as a mother and being largely responsible for the daily food needs of the family, I have made a decision to have the cassava tubers as a substitute for bread in the morning. […] Since we do not always have money to buy bread and the bread is also not readily available in these remote areas, cassava has come in handy."

Case study 2.2.7: Adaptation: Coastal zone management, Guinea

The project's objective is to strengthen the protection of vulnerable Guinean coastal communities and areas against the negative effects of climate change for 94,169 people (52,561 women and 41,608 men) in 35 districts (21 in Koba, six in Kakossa and eight in Kaback) in three municipalities in two regions / prefectures (Forecariah and Boffa) through an integrated approach of coastal protection measures and land restoration. Coastal protection comprises the clearing out of silt and sedimentation from 4,200 metres of the drainage channels in Kaback and the building of 13,000 metres of stone dykes in Kaback, Kakossa, Koba and Kito between 50 to 150 metres from the sea. These actions allowed the recovery of 879 hectares of agricultural land that had been abandoned due to salt water invasion. They have also protected 1,356 hectares of rice fields against salt water intrusion, erosion of channels and salt water flooding. An increase in rice growing yields is expected from 600 kilograms per hectare to 2,500 kilograms per hectare, based on trials among 20 farmers (10 in Koba and 10 in Kito). This increase will improve food security in these communities. Communities have already reported rice yield increases from less than one tonne per hectare to two tonnes per hectare; these increases are attributable to the protection dykes and the use of seeds tolerant to salt water and soil acidity.

The protection of mangroves is being driven by five activities:

- Management of 200 beehives carried out via a community association. This is therefore a common, though closed, resource.
- Adoption of an efficient charcoal production kiln called "the meule casamançaise", which was first experimented with in Casamance (south of Senegal). Eight hectares that will be reforested in order to concentrate the wood logging for charcoal production in managed areas. The sustainable forest management plan will define the logging zones, regulate access to these areas and specify the sustainable harvesting yield.
- Improved cooking stoves, with an enhanced efficiency of 35 percent.
- Oyster cultivation.
- The use of the solar kits for salt production to replace the resource-intensive traditional method, which requires more than three tonnes of green biomass (mainly from mangrove forests) to produce one tonne of salt.

The project is a close collaboration between the public sector and Non-governmental Organizations (NGOs). The Bureau d'Études de Réalisation et de Conseil Agricoles Guinea (BERCA Baara) and Groupe Africain pour la Gestion de l'Environnement (GAGE) have been contracted by the project for technical support. BERCA Baara has supported the local council to develop a management plan to enable rice producers to maintain drainage structures. In terms of financial sustainability, the community and the municipality have agreed to contribute towards the maintenance of such structures.

Case study 2.2.8: Adaptation: Goat rams and guinea fowls, Namibia

In 2009, the project "Adapting to Climate Change through the Improvement of Traditional Crops and Livestock Farming" helped farmers to adapt to climate change by distributing improved livestock and seeds. Tate Reinhard explains how the

goats have helped him adapt to ever drier and hotter conditions in sub-Saharan Africa's most arid country.

"Boer goats have more meat, they grow faster, produce more offspring and are well-suited for hot, arid conditions," he sums up while studying the feeding herd of the goats. Like most farmers, he knows the genealogy of every animal in his kraal by heart. "The aim is to cross these Boer goats with our local goats to create a breed that has a higher rate of re-productivity, is more valuable and better resistant to drought," he explains.

At the remote Elondo village in the district around the northern town of Tsandi where guinea fowl were distributed to replace chickens, the community praises the better reproductive qualities of guinea fowl and their ability to withstand global warming.

"Guinea fowls lay more eggs, are bigger, so they have more meat and they reproduce quite fast." - Miina Ipinge

"Guinea fowls lay more eggs, are bigger, so they have more meat and they reproduce quite fast," says Miina Ipinge, who is a member of the Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome (HIV / AIDS) support group Imangulula, which means 'freedom for all'. The adaptation project donated fowls to the group and to women living with HIV in order to help them overcome their disadvantage in fighting climate change.

"Temperatures have completely changed," says Miina who provides for 14 people in her household. "On top of that, there has been a shift in rainfall, making the growing season much shorter. This demands too much of both humans and animals that have to squeeze all their energy into a very short time. We just don't have enough food to sustain those high energy levels." Imangulula member Lempia Ndiili adds that, because the rains are late, they cannot cool down the soils that become too hot to walk on during the summer months, making it hard to work the field.

The floods that occur with an alarmingly rising frequency, on the other hand, also make it harder to cultivate the land. "And the floods bring more birds, which eat the little grain that we have managed to grow," she adds. Their status as women living with HIV compounds the challenge they already face because of climate change. "If you are sick, it is important to eat so that you are strong, can take your medicine and can work to grow more food," explains Ndiili. "But where there is little food to start with, that is the problem. Even women that don't have HIV are spending time taking care of those that do have the virus. In that time, they cannot work the land," adds Ipinge. "So, if you are not infected, you are still affected."

Photo: UNDP Namibia

Photo: Imen Meliane/UNDP

The case studies in the sections that follow are organized around the three principles defined in Section 1 that have been shown to lead to achievable and sustained adaptation benefits: i) collaborative management approaches; ii) sustainability-led programming; and iii) capacity development for mainstreaming and policy / programme implementation.

Lessons learned 2000-2015

SUCCESS FACTORS

3. SUCCESS FACTORS

The case studies in the sections that follow, derived from UNDP-supported projects, are organized around the three principles defined in Section 1 that have been shown to lead to achievable and sustained adaptation benefits: i) collaborative management approaches; ii) sustainability-led programming; and iii) capacity development for mainstreaming and policy/programming implementation (as expanded upon in Chapter 4). The case studies also show that, despite good performance of new technologies under variable climate conditions, the widespread adoption of the technologies remains constrained by the high up-front cost, weak institutional support and underdeveloped value chains. Technological innovation alone is not sufficient for scaling-up.

3.1 Collaborative management approaches

Collaborative management approaches are about shared decision-making among a range of stakeholders. At the level of government, cross-government collaboration is necessary because of i) the cross-cutting nature of adaptation; ii) the trend across governments to decentralize government powers in order to promote better service delivery; and iii) the reality that challenges to business as usual usually have to come from outside the given line ministry, at least initially. Partnership between governments and communities improves the identification of the adaptation strategy, promotes ownership, spurs innovation and learning, and develops change agents. Furthermore, partnerships between governments and non-state actors draw on the knowledge, experience and resources of other stakeholder groups that may help the implementation process. Because of the need for experimentation, learning and collaboration, bureaucratic and centralized implementation models are likely to be poorly suited for adaptation to climate change.

The following case studies are organized into three categories to illustrate collaborative management approaches. The first category demonstrates the need for cross-government collaboration, given the often experimental nature of adaptation. The second provides experiences from projects that promote different types of community-led partnerships, including participatory assessments of adaptation needs. The final category provides case studies that illustrate partnerships with among different stakeholders.

3.1.1 Cross-government collaboration

Whether the pilot projects significantly raise the profile of climate change and influence entrenched policies critically depends on the leadership, motivation and influence of the implementing partner delivering the project. Placing adaptation projects in sectoral ministries without the appropriate adaptation technical support embedded into the project structure can lead to business-as-usual implementation, as experiences in some countries have shown. In many cases, the ministries motivated to promote adaptation are ministries of environment, natural champions for addressing environmental drivers of change. (See Table 3 below for an outline of the Implementing Partners for UNDP-supported projects.) For the countries that UNDP supports, external support to ministries tasked with portfolios for environmental and disaster risk reduction issues is proving to be an important driver for promoting climate adaptation across government. Yet there is an important caveat: partnerships with line ministries are important in order to test adaptation approaches that combine sectoral knowledge of proven productive work amidst climate variability. The process of coordination and management of these different actors is time-intensive, and sufficient resources should be dedicated in any project to ensuring that these tasks can be carried out effectively. As the climate finance architecture evolves and calls for greater funding flows are met with initiatives to expand the absorption of climate finance flows in developing countries, core ministries of planning and finance are increasingly buying into the need for policy change. Section 4.3 explains one such tool that UNDP has supported governments in applying that has been effective in engaging ministries of finance.

3.2 Case studies

Case study 3.2.1: Mainstreaming programme in Africa

UNDP has supported twenty African countries to strengthen intersectoral coordination under the Japan-funded Africa Adaptation Programme (AAP). Many new institutional structures were established, including commissions and councils on climate change, interministerial working groups on climate change adaptation, parliamentary taskforces and/or networks, national climate change secretariats and government donor working groups. In Malawi, for example, the president created the Ministry of Environment and Climate Change Management in 2012.

Table 3 I Implementing partners in projects supported by UNDP in sub-Saharan Africa

Country project	Sector	Ministry
Burundi	Environment	Institute of Geography of Burundi (IGEBU)
Comoros LDCF	Environment	National Directorate of Environment and Forestry (NDEF)
Democratic Republic Congo	Environment	Direction of Sustainable Development (Congo) (DDD)
Eritrea	Agriculture	Ministry of Agriculture
Ethiopia SCCF	Agriculture	Ministry of Agriculture and Rural Development (MoARD)
Ethiopia LDCF	Environment	Federal EPA
Gambia	Environment	National Environment Authority (NEA)
Guinea	Environment	Ministry of Environment
Ghana	Health	Ministry of Health
Guinea Bissau	Environment	Secretariat of State for the Environment and Sustainable Development
Kenya SCCF	Environment	National Environmental Management Authority (NEMA)
Liberia	Lands, Mines, Energy	Ministry of Lands, Mines and Energy
Liberia	Agriculture	Ministry of Agriculture
Liberia	Transport	Ministry of Transport
Malawi	Environment	Ministry Environment and Climate Change Management
Mali	Environment	Agency for Sustainable Development (AEDD)
Mauritius	Environment	Ministry of Environment and Sustainable Development
Mozambique SCCF	Environment	Ministry of Coordination of Environmental Affairs (MICOA)
Mozambique LDCF	Environment	MICOA
Namibia SPA	Environment	Ministry of Environment and Tourism
Namibia SCCF	Environment	Ministry of Environment and Tourism
Niger	Environment	National Council for Environment and Sustainable Development
Rwanda LDCF	Environment	Rwanda Environmental Management Agency (REMA)
Sao Tome and Principe	Environment	Ministry of Public Works, Infrastructure, Natural Resources and Environment
Senegal	Environment	Ministère de l'Environnement et du Développement Durable (MEDD)
Sierra Leone	Water	Ministry of Water Resources

A sector-wide approach will now be coordinated through this new ministry, which is responsible for climate change adaptation.

A similar situation exists in Mozambique, where the AAP helped to establish the Inter-Institutional Group on Climate Change, a cross-sector technical body that provides direction for the development of the National Climate Change Strategy. At first, three ministries led Mozambique's adaptation programme: the Ministry of Environment, the Ministry of Planning and Development and the Institute for Disaster Risk Reduction. But they soon realized that they needed to 'mainstream' the programme into more sectors in order to design effective ways to reach communities. Consequently, the intersectoral technical group was established with institutional focal points comprising 14 members (including three women) who represented the different sectors. This group aimed to promote and coordinate joint action and earning. It is continuing to plan and implement ac-

tivities together integrally and inclusively, sharing information and knowledge about climate change, and seeking synergies between different initiatives in the country.

In Kenya, UNDP supported the establishment of the new Climate Change Planning Unit within the Ministry of State for Planning, National Development and Vision 2030. It is now a full-fledged government unit consisting of 12 modelers based at different ministries: the Ministries of Planning, Agriculture, Education, Environment and Mineral Resources; the Kenya Meteorological Department; the Kenya Institute for Public Policy Research and Analysis; the Department of Remote Sensing and Resource Surveys; and the Kenya Bureau of Statistics. They all meet regularly to use the new long-term modeling tool that the AAP provided, share ideas and discuss how best to integrate adaptation into their respective development sectors. In addition to the Unit, which incorporates climate change into the work of various ministries, UNDP also supported the establishment of a Climate Change Secretariat with a staff of six housed at the Ministry of Environment. They are responsible for ensuring that various components of Kenya's Climate Change Action Plan are carried out.

Community-led partnerships

Another important element of collaborative management is community led partnerships that improve the identification of the adaptation strategy, promote ownership of the adaptation strategy, spur innovation and learning, and develop change agents. In general, community-based management models are based on exemplary farmers who lead in testing new approaches and who engage in a progressively extended web of farmer–to-farmer learning and thereby build social capital and empower people from within their social system. Case study 3.2.2 in Namibia is a good example of this approach. In self-help groups, resources are pooled, transaction costs are reduced and bargaining power can be increased. In this respect, adaptation projects have facilitated the building up of social capital, i.e., the building of farmers' capacity to solve their own problems. A similar principle is applied in commonly found 'pass-on models' that take an initial investment of seed stock for a first tier of beneficiaries, subsequently extending to a second and third tier with each successive multiplication of the seed stock. Experience has shown that having communities at the centre of the experimentation process and supporting their decision-making are essential components to adaptation and innovation and can help to overcome aversion to new technologies. Vulnerable communities often already understand emerging climate changes, a fact that provides them an additional incentive to look for ways to improve their lives. For example, in Zimbabwe, the positive response to new pearl millet varieties, new maize and hybrid sorghum varieties, the planting of cowpeas to effectively use the late rains, and the acceptance of cassava were important results from the farmer trials. The Zimbabwe experience also showed that it took regular technical backstopping and multi-year refinement of field technologies based on local experience to ensure that effective climate change adaptation measures are accepted, adopted and sustained. Support over a number of years is needed for further refinement, reinforcement and experience-based adjustment of the adaptation measures. The experiences agree with recent research that shows the importance of building local competencies and establishing linkages between farmers for successful implementation, rather than imposing blueprints and pushing for change too quickly.[1]

Adaptation is not a linear process. Some actions require a cultural change in deeper assumptions and this will take time and resources. For example, in Mozambique, a hydrological study and sampling predicted that ground water was unsuitable for consumption, but it took a process of drilling various boreholes to persuade communities that this was the case. Similarly, changing preferences for maize with a drought-resistant crop like pearl millet can be difficult in communities where cooking, eating and cultural practices revolve around maize. Thus, even if projects deliver weak results with respect to their designated 'headline' targets, they may have long-term benefits in promoting the knowledge and motivation to seek out better-adapted ways of developing. Promoting learning behaviours is an important element in adaptive capacity development to help communities take up adaptation technologies and strategies autonomously. Adaptation is a process that takes time and requires sustained support. Projects that are supposedly 'no-regret' solutions may come up against important economic and social barriers. This is especially the case in low-income communities and where it is necessary to overcome cultural barriers to adaptation (e.g., resistance to strategies to sell livestock to avoid losses, reluctance to take credit to expand agricultural production and unwillingness to pay for natural resources to address resource scarcity).

Project experiences also offer important lessons on why community-driven adaptation strategies are so important for identifying locally appropriate technologies. In Mozambique, the transplanted rainwater storage technology from Brazil and the livestock enclosures could not be maintained or replicated with local materials and means. Moreover, the unavailability of veterinary products and services severely limited the intended improvement in animal health management expected from the improvement of enclosures, highlighting the need to approach projects integrally. This emphasizes the importance of putting people in the driving seat of project design, rather than of driving it from the perspective of a particular technology or ideology.

The following case studies show how collective action is being undertaken in the implementation and identification of adaptation strategies.

1 Wiggins and Keats, 2013

Case study 3.2.2: Namibia self-help groups

This GEF Small Grants Programme (SGP) successfully showed that community-based groups established to share common experiences and concerns about climate change lead to better and more resilient farming practices. The methodology in Namibia involved a voluntary, village-based group of 15-20 community members – youth, and women and men of all ages who are all subsistence farmers – who regularly meet for mutual problem-solving, knowledge-sharing, savings and lending, and enterprise creation. Self-Help Group (SHG) community coordinators (volunteers) were trained to guide the groups. The main aim of the groups is to address common concerns related to climate change, climate risks and climate impacts. The community-based adaptation experience has shown that the SHGs have developed into informal Farmer Field Schools that drive project implementation. The Farmer Field Schools mobilize farmers into SHGs where the most experienced SHG farmer offers training about climate change impacts and adaptation, low-tillage agriculture, conservation agriculture and multi-purpose crops, farm planning and management, nutrition and crop diversification, poultry and livestock health, and silage fodder production.

Case study 3.2.3: Ethiopia's revolving livestock system

The Ethiopia Coping with Drought and Climate Change project piloted a revolving livestock system as a low-cost way of multiplying livestock and distributing to communities. This pilot benefited 265 people in its first round and 295 beneficiaries in its second round, 24 percent of whom were women. The original purchase of 1,330 animals led to another 930 offspring animals being distributed to other needy community members (a total of 2,260 to date). Each beneficiary of five female sheep or goats was required in turn to distribute five offspring female animals to another designated beneficiary. The first-, second- and third-round beneficiaries were selected at the outset and knew one another. The beneficiaries were required to sign a document ensuring transfer of the five female offspring. During random interviews, livestock beneficiaries were able to name the subsequent beneficiary in the community. Thus, the inherent accountability mechanism was a key factor of success in the distribution of livestock.

The beneficiary transfer rate (i.e., the percent of new livestock beneficiaries created) was high for goats (90 percent for male and 140 percent for female) and low for sheep (22 percent for male and 29 percent for female). Given the close community monitoring of livestock offspring-sharing, the distinct differences in the transfer rate between goats and sheep and the forage availability in many of the highland areas of the beneficiaries, the project demonstrated that sheep (grazers) were less suitable than goats (browsers) to the landscape, vegetation and rainfall, likely reasons for the differences in the success of the livestock health and replication.

Case study 3.2.4: Zimbabwe fruit orchard land use system

This was developed within a five-hectare plot for the benefit of 78 people in Ward 7 of Chiredzi District (624 people, when including all household members). The pilot demonstration integrates commercial mango production with cassava and vegetable production as an adaptation strategy. Working with the local community leadership and community workers, the farmers formed a farming group and identified a former community garden for rehabilitation. To get the project off the ground, farmers received support from the project to fence off the area, rehabilitate the borehole, install a diesel-powered water pumping system and drip line for one acre, and introduce high quality, certified vegetable seed and grafted mango fruit seedlings. Farmers also received training in fruit and vegetable management, entrepreneurship, group leadership, cooperativism, group constitution-making and market development. Spurred by the successful establishment of mango trees, farmers decided to use the free space to establish citrus trees. Initially, farmers paid a once-off membership fee of US$5 to contribute to maintenance and repairs. Later, the farmers were encouraged to introduce a monthly or quarterly membership fee of US$1 to improve the group's cash flow. Members of the Tamuwanyika group (78) collected US$390, enough to cover basic operating costs. The cost-benefit analysis for mango production shows favourable outcomes: participants generated US$27,500, equivalent to US$352 per household per year. Start-up costs were $32,440 in the first year, thereafter dropping to $260 per year. In addition, from the first harvest of tomatoes and green vegetables in 2012, some households earned from US$15 to US$35 per farmer per harvest – an improvement over largely subsistence livelihoods.

"From the money I made after selling my vegetables, I used US$15 to buy sorghum to brew traditional beer for sale. This way I increased my income to more than US$80, which I then used to buy maize grain for the family and pay some school fees. The 2011-2012 cropping season was particularly dry and most farmers did not harvest anything from the rain-fed crop. This integrated fruit orchard is therefore an important safety net for us, especially widows," said Mrs. Sharai Shiviti, a 26 year old widow and mother of three children.

Case study 3.2.5: Mauritius coastal protection through community-driven mangrove planting

The coast of Mauritius is increasingly vulnerable and exposed to the risks that climate change poses to local societies and economies. Coastal communities are already impacted, bearing witness to land erosion and changes in fish stock that threaten their livelihoods. Faced with the 'new' reality of sea level rise and frequent tidal surges, the local populations of some coastal areas are taking matters into their own hands. They are implementing strategies to adapt and to establish new, climate-resilient approaches to safeguard their future. The inhabitants of the village of Grand Sable, a small planters' community wedged between the mountains and a lagoon, are planting 20,000 mangroves, which serve as a natural

coastal defence against rising water, flood and lagoon siltation. Local associations have joined forces and are innovating new techniques for incubating and planting mangroves to yield better results.

"We are already experiencing the effects of climate change. On the one hand, our land is eroding and part of the mountains washes into the sea in times of rain. On the other hand, the livelihoods of our spouses, which are for the most part fishermen, decrease year after year because of the continuing impoverishment / despoliation of the lagoon." – Geraldine Aristide, founder-secretary of the Grand Sable Sand Women Planters', Farmers' and Entrepreneurs' Association.

Local associations are partnering to develop home-grown solutions that address the pressing climate change-induced risks that the communities are battling. The Grand Sable Fishermen Association and the Grand Sable Women Planters', Farmers' and Entrepreneurs' Association are on a mission to protect and to transform the coastline by developing and using an innovative nursery method to prepare mangrove seedlings for planting. The method allows the seedlings to mature before transplantation, a process that results in a survival rate of nearly 90 percent – a marked improvement over the 30 percent survival rate seen when applying traditional direction insertion methods.

The women of Grand Sable are playing an important role in sensitizing the community to the risks and impacts of climate change and to the need to, and benefits of, adapting the local ecosystems and economies to climate change. Twenty-five women are graduates of a Train the Trainers programme targeted at raising awareness in schools and the community at large; over 700 people are expected to benefit. The programme also teaches the women how to produce cloth bags, which can be used as marketing materials in their outreach campaigns and can be sold at a profit to generate income that can help pay for household expenditures.

"Building more resilient coastlines is also contributing to a stronger local economy and fairer society. The 20,000 Mangroves Strong project is not only protecting nearly 1 kilometer of coastline, it is also addressing important economic and social issues. It is opening up new opportunities for income-generating activities and women's empowerment. An increase in mangroves could result in improvements in local fishing, with positive consequences on individual livelihoods. By planting the mangrove propagules (seeds), women obtain an income for their families, and, afterwards, once the land is stabilized, they can engage in other types of planting, which, in turn, supports the livelihoods of their fisherman husbands." – Geraldine Aristide, founder-secretary of the Grand Sable Sand Women Planters', Farmers' and Entrepreneurs' Association.

The simple, low-cost, yet highly effective nursery method is scalable and can be applied in other coastal regions in Mauritius and beyond. The Government of Mauritius has earmarked US$60,000 to replicate the project. The private sector is also interested in incorporating the response into its Corporate Social Responsibility Scheme programmes. Local action can form the basis for national strategy development. The 20,000 Mangroves Strong project sparked interest in the Ministry of Environment to look at the longer-term benefits, beyond climate change adaptation, of mangrove implantation, including the development of a new ecotourism industry in Mauritius.

Case study 3.2.6: Agricultural sector adaptation in the Democratic Republic of Congo

This project is located in four regions and works with four Ministry of Agriculture centres that research seed production, 44 seed producers (1,540 farmers) and 400 households. More than 200 staff from extension services and three NGOs are supporting implementation.

The objective is to break away from reactive livelihood approaches. The project adopted the 'business approach', whereby pilot villages are selected according to their dynamism (e.g., villages that already well managed other initiatives), ability to support development efforts, and, according to the existence of community organizations - specifically women associations. In each village, households showing good leadership in previous experiences were selected by their peers. They benefited from a technological package from the project: drought-tolerant seeds; livestock breeding to start a revolving livestock breeding initiative; sharecropping; maize and cassava processing unit; aquaculture ponds; among others. These activities strengthen group dynamics to promote inclusive development in pilot villages. The project's long-term viability and sustainability of income-generating activities depend greatly on its 'ownership' by beneficiaries, who have already taken the responsibility to manage the technology package without project intervention. The community associations are building their capacities by coaching beneficiaries in technology package management, thus ensuring long-term buy-in. The project developed memoranda of understanding with 18 community associations – in which more than 50 percent of households were female headed – to support income-generating activities in target villages and contracted three NGOs to execute irrigation schemes works in East Kasai (Ngandajika) and Bas Congo (Nsanda).

To date, the project has created 800 jobs with the production of climate-resilient seed and the implementation of income-generating activities (40 women's associations involved).

Participatory assessments of adaptation needs

Participatory assessments are an important element of collaborative management approaches because they enable the adaptation response to be tailored to the needs and priorities of the affected populations. They can also be an exercise in

personal development of the target communities, broadening individual horizons and acting as a vehicle for collective education, so that these approaches can in themselves build adaptive capacity. The empowerment and meaningful participation of individuals and civil society are an approach that addresses inequality and promotes social inclusion. Both are important aims of UNDP's work, which growing evidence shows is critical to sustainable development.[2]

Case study 3.2.7: Participatory assessments in Mozambique

Participatory assessments are a common approach in the design of UNDP-supported adaptation projects. One project design process in Mozambique highlights the differences in solutions proposed according to the method of vulnerability and adaptation assessment used. A technical assessment based on expert views and a rational evaluation against criteria was undertaken alongside a community-based assessment. The technical assessment and the community-based assessments showed that there is broad agreement in the climate risks prioritized over all communities, but some divergence in the proposed solutions. Communities placed more weight on their sensitivity to climatic hazards, so many of the measures are development-oriented. On the other hand, the technical assessment focused on reducing exposure to climate change, guided by the National Adaptation Programme of Action's priority on coastal erosion reduction, and so this emphasized managed realignment and coastal protection measures such as dune management and coastal forestry. Table 4 below sets out the analysis for one project community. This also shows this community's negative coping strategies, one of which entails selling assets.

Case study 3.2.8: Women's participation in adaptation project design and implementation

Women's participation in decision-making in the use of programme resources is essential in order to minimize biases in the adaptation technologies chosen and to ensure that projects emphasize productive capacity, since, in many countries, women are crop farmers and have a direct interest in improving returns from agriculture. In Zimbabwe, bottom-up project design and participatory processes have been crucial for strong ownership and identification of adaptation responses that are acceptable in the local cultural context. By enabling women to participate in problem analysis and selection of adaptive strategies, practical and feasible measures that stood a good chance of succeeding were selected. For example, irrigation development was jettisoned as an adaptation option, as stakeholders decided that improving the efficiency of rain-fed crop and livestock production as a climate resilient technique would be more cost-effective. The participation of women also helped the project to focus on strategic issues that highlight household vulnerability to the impacts of climate variability and change, such as limited access to knowledge, technology and climate information as well as poor agronomic practices.

Table 5 shows the different priorities of women and men in the selection of adaptation measures in Zimbabwe.

Participatory processes should also extend to monitoring and evaluation and learning strategies at the level of communities and planners at all levels of government. This is an integral part of an adaptation process because it promotes planning decisions based on experience. This is particularly important in marginal environments, where even small increases in temperatures or reductions in rainfall will have large impacts on communities. In semi-arid areas of Africa, the environment is already challenging, but, coupled with climate change, this can result in tipping points – at which livelihoods cease to be feasible. In this case, effective adaptation responses would most likely be an exit from crop production into small stock or out of the agricultural sector altogether, which is often a challenge, given the level of poverty and lack of alternative opportunities. Thresholds and impacts on livelihoods should be monitored carefully (see Section 4.4.3). The role for government in providing an appropriate policy response over the medium to longer-terms will be critical to smoothing the path of structural change and to helping communities adjust to climate change with minimized losses. For sustainability and innovation, the process that empowers households to adjust to environmental change and learn from the process is as important as the end result, a proposition that has roots in resilience thinking.

Partnerships with other stakeholder groups

Partnerships are useful from the point of view of bringing in ideas, experience and knowledge from other stakeholder groups and can therefore develop capacity for climate change adaptation. Examples of partnerships with non-state organizations are as follows:

Case study 3.2.9: Kenya Adaptation to Climate Change in Arid Lands

The project aims to improve resilience to climate variability and change largely through livelihood projects. A CSO / NGO was engaged to mobilize local communities and roll out energy-saving cooking devices. In the partnership, the NGO paid its staff and strong presence on the ground to reach and identify the beneficiaries, while Kenya Adaptation to Climate Change in Arid Lands (KACCAL) provided funds for purchasing the energy liners and catered for distribution logistics, including training of installers.

Another NGO partnership was with The International Centre of Insect Physiology and Ecology (ICIPE), which provided 12 farmers with training in silkworm farming and an initial set of

2 UNDP, 2013

Table 4 I Vulnerability and adaptation assessments for Chuiba community in Pemba, Cabo Delgado Province, Mozambique

Project community	Climate risk / stressors from community consultations	Climate risk / stressors: Scientific assessment	Community adaptation solutions	Coastal management protection solutions	Current coping mechanisms
Chuiba - Pemba	1. Drought 2. Kussi 3. Illnesses and epidemics 4. Coastal erosion 5. Tidal flooding 6. High temperatures 7. Infertile soils	• Progressive and episodic shoreline erosion increasing from the south to the north • Saltwater intrusion • Inundation of low-lying land behind low primary dune • Damage to coast road • Loss of development in the area • Decreased beach recreational value • Decrease in viability of artisanal fisheries	Droughts - Resilience • Pump water from wells to fields • Rent agricultural machinery for use during the rainy season • Water storage Droughts - Adaptation • Water storage • Establish a community adaptation fund • Move inland where soils are more fertile Kussi - Adaptation • Build a cement house with a zinc roof • Buy stronger fishing nets and boats • Alternative livelihoods Illnesses and epidemics - Adaptation • Adapt water storage structures Coastal erosion - Adaptation (protection) • Plant trees and grass along the coast. Local understanding that building sea walls would be futile, as these would be taken by the ocean High Temperatures - Resilience • Build wooden shade to cover / protect crops from sun High temperatures - Adaptation • Move inland to find better soils • Use heat resistant seeds and improve agricultural extension Infertile soils - Adaptation (relocation) • Move inland for cropping	• Managed realignment • Dune management • Fisheries best practice • Sustainable coastal forestry • Sustainable eco-tourism	• Petty commerce • Build wooden shade to cover seedlings from the sun • Move inland to find better soils • Sell assets (chickens)

cocoons. ICIPE paid 2-3 Kenyan shillings to the paid communities for each cocoon supplied back to ICIPE. Wild silk is spun using machines in Mwingi, purchased also from the 'commercial insects' UNDP-GEF project.[3] Woven yardage is sold to ICIPE, which sells it to foreign markets.

In 2012, UNDP entered into partnership with the University of Nairobi Enterprise Services to provide training to raise the capacity of stakeholders in the following areas:

- Engaging stakeholders in constructive adaptation dialogue.
- Assessing situations and creating a vision and mandate for adaptation initiatives.
- Formulating policy and strategy on adaptation initiatives.
- Budgeting, managing and implementing adaptation initiatives.
- Monitoring and evaluating adaptation initiatives.

The curriculum and training plan was implemented in three sessions of four days each in April and May 2013.

Case study 3.2.10: Civil society engagement in Zimbabwe

The project engaged civil society organizations that were interested in achieving scale and impact building on the pilot project area. The strategy of the project was to initially target government extension workers, who are usually the entry point for any agriculture development assistance at the local level. The technologies and practices that the project had successfully demonstrated with the extension workers were then easily replicated by civil society organizations. While the project initially had 23 demonstration sites and 23 households as direct beneficiaries per ward, civil society organizations replicated the interventions for the benefit of an additional 700 households per ward. So in the four wards of the project, about 3,000 households were covered in just one cropping season. In other cases, the project shared its experiences with civil society organizations at strategic planning workshops, thereby influencing their programming to mainstream climate change concerns. The project also included some NGOs in the Project Steering Committee to benefit from their field experiences.

The private sector has been a source of technologies, some of which had not previously been tried out in environments such as Chiredzi district. Some of the hybrid seed obtained from the private sector turned out to be quite drought-tolerant and relevant to the needs of female farmers in the pilot project area. These included improved varieties of maize, sorghum and groundnuts. The beer-brewing industry has also provided a ready market for red sorghum, offering a vital incentive for farmers to produce more of the crop.

Case study 3.2.11: Multi-stakeholder partnerships in Niger

Niger's endemic poverty, a dry climate and economic dependence on agriculture make it exceptionally vulnerable to climate change. A climate change adaptation project

3 UNDP- GEF, Developing Incentives for Community Participation in Forest Conservation Through the Use of Commercial Insects in Kenya, June 2005-December 2008

Table 5 I Community weighting of the adaptive / vulnerability indicators by gender

Vulnerability indicator	Weighting by women	Weighting by men	Overall weighting
Cattle ownership for draught power	0.95	0.53	0.80
Cattle ownership for sale	0.65	0.51	0.71
Goat ownership for sale	0.49	0.19	0.49
Chicken ownership for sale	0.40	0.0	0.40
Donkey ownership for draught power	0.31	0.0	0.31
Availability of appropriate seed	0.86	0.23	0.74
Ownership of farm implements (plough)	0.68	0.17	0.63
Use of soil moisture conservation practices	0.60	0.22	0.43
Access to market (for buying grain, inputs, sell crafts, sell livestock)	0.64	0.18	0.64
Availability of communication infrastructure (all-weather roads, bridges)	0.60	0.31	0.50
Availability of nutrition gardens	0.44	0.24	0.24
Access to boreholes (deep)	0.25	0.22	0.41
Access to dams	0.23	0.52	0.42

funded by the Least Developed Countries Fund (LDCF), "Implementing National Adaptation Programmes of Action (NAPA) Priority Interventions to Build Resilience and Adaptive Capacity of the Agriculture Sector to Climate Change," targets the resilience and adaptive capacity of the agriculture sector. Under this project, approximately 27 different adaptation measures were implemented in the selected project sites. These measures, coupled with comprehensive training and technical support, resulted in 3,500 farmers using new varieties of drought-resilient seeds in seven towns and in 70 trained producers sowing at least 35 hectares of fields with varieties of millet, sorghum and cow pea. The outcome has been an increase in profits earned from the multiplication and sale of improved seeds by 70 producers, including 14 women. At the same time, the project promoted fruit and vegetable gardening in the sites by providing women with fenced gardens, motor-driven pumps, seeds and adequate training. Through providing resources, tools and training, women who previously had no steady source of income have now generated significant and reliable revenues (approximately 25,000 to 100,000 FCFA)[4] and secured a balanced diet. These results contribute significantly to the food security of beneficiaries. In fact, according to the Famine Early Warning Systems Network, food security has improved markedly – 50 percent – since 2011, when six million people were vulnerable to food insecurity. This improved condition is due to the very good state of cereal crops (millet, sorghum), diversification (cow pea, groundnut), good agro-climatic conditions and adequate crop marketing. This project contributed to such results, especially for the poorest communities, through improved productivity and purchasing power generated from increased income.

The successes can be partially attributed to the collaborative approach that the project took in engaging with stakeholders at all levels. At the local level, all technical supervision was conducted by administrative and local authorities, including decentralized services of the Ministry of Agriculture and the National Institute of Agronomic Research of Niger (INRAN), which relies on the commune's agricultural services to supervise the producers and seed multipliers. At the national level, partnerships with INRAN and the National Centre for Seeds Research (CNSF) supported the testing and dissemination of agricultural and forest seeds and helped strengthen national knowledge about the most drought-resistant varieties. In addition, partnerships cut across different government ministries. Aside from the Ministry of Agriculture, the project partnered with the Directorate of National Meteorology (DNM), which installed rain gauges at the village level and shared agro-meteorological information about agricultural production and gardening sites.

The Ministry of Planning, Urban and Land Use Planning and Community Development (MPAT / DC) supported the integration of climate change into local development plans. Finally, the Ministry of Education organized training in climate change and adaptation for academic supervisors of basic education. Beyond government partners, the project also relied on part-

4 West African Franc (FCFA), approximately US$48-193

BOX 2 I LESSONS LEARNED, ZIMBABWE AND WOMEN'S PARTICIPATION

Contexualize

The initial Needs Assessment was critical in identifying the different vulnerabilities, needs and capacities of men and women in regard to climate change adaptation and drought resiliency. If gender considerations are missed during the project design phase, it may not be as easy to bring them on board during implementation.

Conceptualize

According to the plan, selected households would be agents of change in their community; hence, the targeting of women-headed households, which were amongst the most vulnerable in the community.

Implement

After recognizing the gender context of the project area and establishing the goals of gender parity, women were included as beneficiaries and participants. Their inclusion is evident in the success of the project. While community members should have flexibility to organize themselves into a project group, guidance on gender aspects was necessary to ensure that women weren't left out. In some cases, it becomes difficult to get women on board if they have initially been left out.

nerships with four key NGOs,[5] which supported implementation of gardening and animal fattening micro-projects. One critical component of these micro-projects was that, before and during all activities, NGOs informed and educated beneficiaries about the effects of climate change on agriculture and about adaptation strategies against these effects. This enabled beneficiaries to understand the project's rationale and approach, thereby increasing their ownership in driving project activities in partnership with the NGO and other project stakeholders.

3.3 Sustainability-led approaches

This section explores sustainability-led approaches as a success factor for adaptation at two levels: the degree to which climate risks are considered by communities and planners; and financial sustainability, which ensures links to markets in order to maintain and advance activities.

Climate risk management

Future climate is likely to diverge from historical patterns, so climate risk information - including projections for long-term timescales and weather forecast information for short timescales – should inform the design of adaptation investments. Short-term and seasonal forecasts are important tools for agricultural planning and an input into macro-level early-warning systems. In addition, the process of training and using participatory processes for feedback on the effectiveness of these tools for agricultural planning is a key opportunity to promote community engagement, awareness-raising, initiative and capacity development. Most adaptation projects include a climate information and early warning system component. Results from a limited number of projects show that farmers can make better management decisions if they have access to climate monitoring, information and forecasts.

Boxes 1 and 2 illustrate two examples from Ethiopia and Zimbabwe. These examples show that participation from farmers in the design and implementation process is crucial for success because user needs are at the forefront of the development of climate advisories, thereby making them more likely to be used which makes for effective use of resources.

There are challenges to getting these types of initiatives to work effectively. The sometimes patchy and limited data records, combined with weak monitoring networks and stretched capacities to develop forecast products and disseminate useful interpretations of the information to the user community, hinder public sector and household level decision-making that takes account of the risks of climate variability and change. Because of recent government decentralization processes, there is often institutional uncertainty as to how the different governmental levels will work together in the observation, transmission, processing and dissemination of climate monitoring data and forecasts. Institutional barriers between meteorological services and other planning ministries inhibit collaboration, making it difficult to apply climate risk information to public sector plans.

In recognition of these many challenges, UNDP initiated a regional programme on early warning systems in 2014 that aims to enhance the capacity of a range of countries to monitor and forecast extreme weather, hydrology and climate change and to make efficient and effective use of hydrometeorological information for generating early warnings and supporting long-term development plans. A regional component will facilitate procurement of equipment and expert advisory services, thus increasing efficiencies and providing an important knowledge-sharing and learning mechanism between countries. Box 3 explains this initiative further.

A shared understanding of projected climate change risks should also underpin participatory processes to determine adaptation responses and to monitor responses and to monitor results, since stakeholder-based vulnerability assessment approaches without consideration of the science can "emphasize consensus building around current knowledge,"[6] thereby further cementing business as usual rather than adaptation.

Participatory approaches can be used to add value to macro-level modeling results. The community participatory climate risk analysis in Zimbabwe made it possible to generate more information on the temporal and spatial dynamics of drought and its impacts in the project area than could have been obtained from scientific modeling. Community participatory climate risk analysis for the Chiredzi district revealed that drought, of which five types are normally experienced in the district, is the most important climatic hazard. The five types of drought are: early season (characterized by delayed or slow onset of the rains); mid-season (rains break for weeks on end about January / February); terminal (rains just terminate from about January / February); seasonal (rains are light and patchy throughout the season); and extreme drought (in this case, rains fail for two or more consecutive seasons). Table 6 shows the drought types that smallholder farmers identified. Scientific modeling validated the community risk assessment.

Prior to this participatory risk assessment, the project partnered with NGOs and government departments to raise awareness among local communities, particularly women and children, through advocacy, information kits, educational materials, training workshops and in-depth analysis of drought risk and impact on socio-economic development, recognizing that vulnerable communities, including women, have limited access to information about the risk that environmental degradation and climate change pose to them.

5 These NGOs included: Association pour le Développement Local (ADL) , Association de Lutte pour l'Autosuffisance et Développement (ALAD), ONG-l'École Instrument de Paix (EIP) and Organisation pour un Développement à la Base (ODB)

6 Vermeulan et al, 2014

In Namibia, a similar approach was taken prior to implementation of the adaptation pilots: a climate information toolkit on climate change and adaptation responses was developed and disseminated to thousands of households in the Omusati region. The toolkit has subsequently been replicated in five other regions.

Programming for multi-hazards

A lack of planning for multiple hazards ultimately leads to the lack of system resilience, as the following case studies show. In Zambia, a project primarily focused on adapting to droughts faced an unforeseen risk of army-worms. In December 2012, a combination of higher temperatures and late rains brought about an army-worm infestation that threatened food security in the country. Army-worms devastate crops such as maize, cassava leaves, sorghum and rice fields and, on this occasion, affected about 70 percent of fields, including project areas. Meanwhile, the Zambia National Farmers Union urged the government to invest more in research, pest surveillance and extension services in order to detect army-worms and other outbreaks that could compromise the country's food security. In this case, a focus of future programming efforts could be research into the links between climate variability and pest infestations in order to be able to design an effective early warning system.

Namibia is showing a drying trend, but, in early 2011, it suffered its worst floods on record. The affected region was the Cuvelai Basin, which drains southern Angola via a complex of streams that typically result in an annual flood called the efundja, which is named for the fish that spawn in spring. Sixty-thousand people had to be relocated and more than 260,000 people were severely affected, prompting a presidential declaration of emergency – the second in three years. Twenty-five-thousand animals were killed, yields were reduced by 40 percent and the cultivation area was cut by 50 percent, leaving up to 600,000 people dependent on government relief. The flood wiped out all implementation progress of an adaptation project in Namibia aimed at drought adaptation. The second adaptation project, due to start implementation in 2014, is now learning from this experience and will address floods and droughts through water storage with traditional structures, promotion of alternative livelihoods to take advantage of floods as a climate opportunity, and drought-related adaptation measures.

Similarly, a project in the Guija district in Mozambique, which is traditionally known as a dry region, was wiped out by floods, once again showing that climate variability will be as much a feature of climate change as a trend towards drier conditions. Future efforts will need to look at how farmer-level adaptation strategies can be adjusted to prevent losses associated with floods and droughts, supported by weather forecast information. In the same vein, planners and communities should be helped to assimilate learning of what works and what does not work into new development investments so that these are effectively adapted and that scarce resources are efficiently used. The project experience showed that efforts to plan for replacement investments following flood damage to crops, such as a seedlings nursery and meteorological infrastructure, followed known methods, so vulnerability to climate change remained high. Support for active learning processes among communities and planners to help internalize the changes and to evaluate how development strategies should be adapted, is essential in what is ultimately a process of behavioural change.

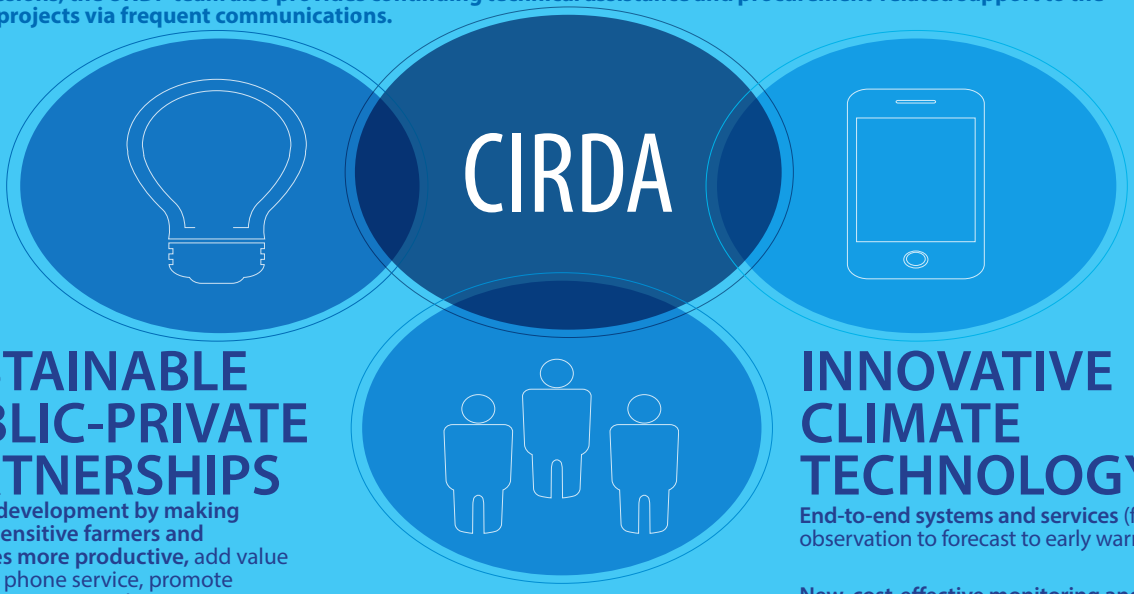
Table 7 shows the multiple climate stressors in a community in one northern province in Mozambique. A vulnerability assessment in Namibia showed diverse climate-driven hazards across different regions in North Central Namibia. This multi-hazard complexity shows the need for a differentiated approach to the design of adaptation projects. Case study 3.3.1 on Uganda describes how one project is addressing multiple climate hazards. Multi-hazard complexity also increases the need for monitoring results and for active learning about what is working, for knowledge about how the assumed causal pathways are in fact operating and for timely adjustments to the project strategy as risks and impacts materialize.

A NEW VISION

FOR WEATHER AND CLIMATE SERVICES IN AFRICA

Empowered lives.
Resilient nations.

The UNDP Programme on Climate Information for Resilient Development in Africa (CIRDA) connects innovative weather and water observing technologies, end-to-end forecasting systems, and sustainable public-private partnerships to build resilience to climate change in 11 of Africa's Least Developed Countries. UNDP technical experts provide on-the-ground support to national climate information and early warning systems projects. Leading experts in the fields of meteorology, hydrology, innovative technologies, private-sector engagement and communications comprise this team, over half of which is based in Africa. During frequent, demand-driven country support missions, these UNDP experts facilitate the essential transition of National HydroMeteorological Services from traditional science-oriented organizations to modern service- and customer-focused organizations. In addition to the missions, the UNDP team also provides continuing technical assistance and procurement-related support to the national projects via frequent communications.



SUSTAINABLE PUBLIC-PRIVATE PARTNERSHIPS

Promote development by making weather sensitive farmers and businesses more productive, add value to cellular phone service, promote public-private partnerships

Transition National HydroMeteorological Services to service both public and private users of weather and climate adaption information

Mobile telecommunications partnerships for infrastructure hosting and warning distribution

Private sector partnerships for industrial application development and commercialization

DELIVERING EARLY WARNINGS ACROSS THE LAST MILE

Saving lives and providing vulnerable communities with critical warnings to prepare for climate change

Drought monitoring and forecasting

Flood monitoring and warning

Crop planting and harvesting

Lightning prediction and high impact weather nowcasting

INNOVATIVE CLIMATE TECHNOLOGY

End-to-end systems and services (from observation to forecast to early warnings)

New, cost-effective monitoring and forecasting technologies (all-in-one automatic weather stations, lightning detection, nowcasting, and Numerical Weather Prediction data assimilation)

New, operationally effective ICT services (cell tower hosting, cloud data management, and locally relevant application development)

FUNDING

$50 MILLION (GLOBAL ENVIRONMENT FACILITY'S LEAST DEVELOPED COUNTRIES FUND)

$4 MILLION MULTI-COUNTRY SUPPORT (UNDP)

www.adaptation-undp.org/projects/cirda

Source: CIRDA Programme

Photo: Georgie George/UNDP

Table 6 I Drought types identified by smallholder farmers and their potential impacts on various livelihood systems in Zimbabwe

	Maize		Sorghum			Pearl Millet	Livestock			Natural Resources	
Drought type	Local variety	Hybrids	Local variety	Marcia	SC Smile	Pearl Millet	Cattle	Goats	Donkeys	Pastures	Under-ground
Early season	0	●	●	●	●	●	0	●	●	0	0
Mid season	●	0	0	●	●	●	●	●	●	●	●
Terminal	0	0	0	●	0	●	0	●	●	0	●
Seasonal	0	0	0	0	0	0	0	●	●	0	0
Extreme 1-2 yrs	0	0	0	0	0	0	0	0	0	0	0

Key ● Can withstand drought type.
0 Unlikely to withstand drought type.

Source: Nherera, B., et al 2009

Table 7 I Climate hazards observed/common in five regions in North Central Namibia

Kavango East	Kavango West	Omussati	Oshikoto	Oshana
Drought	Flood	Flood	Drought	Flood
Coldness	Drought	Drought	Armyworms	Drought
High temperature	Coldness	Gusty wind	Gusty wind	Gusty wind
Gusty wind	High temperature	Salinity	High temperature	Salinity
Wild life	Gusty wind	Armyworm / insects	Plant disease	Plant disease
Plant disease	Wild fire	Plant disease	Animal disease	Animal disease
Animal disease	Plant and animal disease	Animal disease		

Source: Katjiua, 2014

Case study 3.3.1: Programming for multi-hazards in Uganda

The Ecosystem-Based Adaptation in Mountain Ecosystems Project in Uganda (a pilot in a wider global programme, supported by the German Government and implemented by UNDP, the United Nations Environment Programme (UNEP) and International Union for Conservation of Nature (IUCN)), conducted a Vulnerability Impact Assessment (VIA) in the Mount Elgon region of Uganda and analysed multiple hazards intensified by climate change: increased frequency of landslides, soil erosion, flooding and drought. Adaptation mechanisms recommended through the VIA included tree planting, agro-forestry, digging terraces, planting grass along riverbanks, using manure, using contour bands, mulching, rotating crops, using water conservation structures and reserving some slopes for grazing.

Many of these interventions are designed to address changes in precipitation patterns involving more frequent, more intense rainfall. Despite this trend across Mount Elgon, however, certain lower slope areas in the Bulambuli and Kween districts that fall in the "rain shadow" are experiencing prolonged periods of little rain in the dry season, making it difficult to sustain crops. In this context, dealing with multiple hazards has required a differentiated approach that can address the most pressing need for livelihoods in a particular area. In Sanzara Parish, the project has introduced a gravity flow scheme, enabling irrigation of crops, and this has been combined with restoration work on the Spi River at catchment level. Landowners have been enrolled under an incentive scheme to facilitate their participation in these initiatives.

Case study 3.3.2: Forecasting technology in Niger

In Niger, there are major limitations to the use of this information for addressing climate change risks. Seasonal forecasts for specific regions are not available and the DNM relies on national or continental information from meteorological institutes in Europe and United States of America. The format of the information is inappropriate for use by rural farmers and often does not reach the appropriate end-users. The project Implementing NAPA Priority Interventions to Build Resilience and Adaptive Capacity of the Agriculture Sector to Climate Change, through the LDCF, supports the installation of rain gauges to reinforce the collection, processing, archiving and dissemination of agro-meteorological information.

In partnership with the DNM, the project has installed more than 100 rain gauges in 80 villages and provided farmers with relevant information and advice on the planting date and the amount of useful rain to sow. Given that the hot season starts in April and ends in June, the beginning of June is hotter and drier (having not rained for some months' time) and requires more rain for sowing than later in June and the beginning of July. For instance, at the town of Roumbou, it takes a total rainfall of 40 millimetres in order to sow in the

BOX 4 I ETHIOPIA

The Climate Information and Early Warning Systems in Ethiopia project provided rain gauges and other equipment and training to woreda (district) staff and placed 20 gauges at farm sites to establish a new system of weather forecasting that used local information and knowledge. The spatial and temporal variability in rainfall in Ethiopia underlies the need for such a system. See Figure 1 for more details. The key points in this system are that:

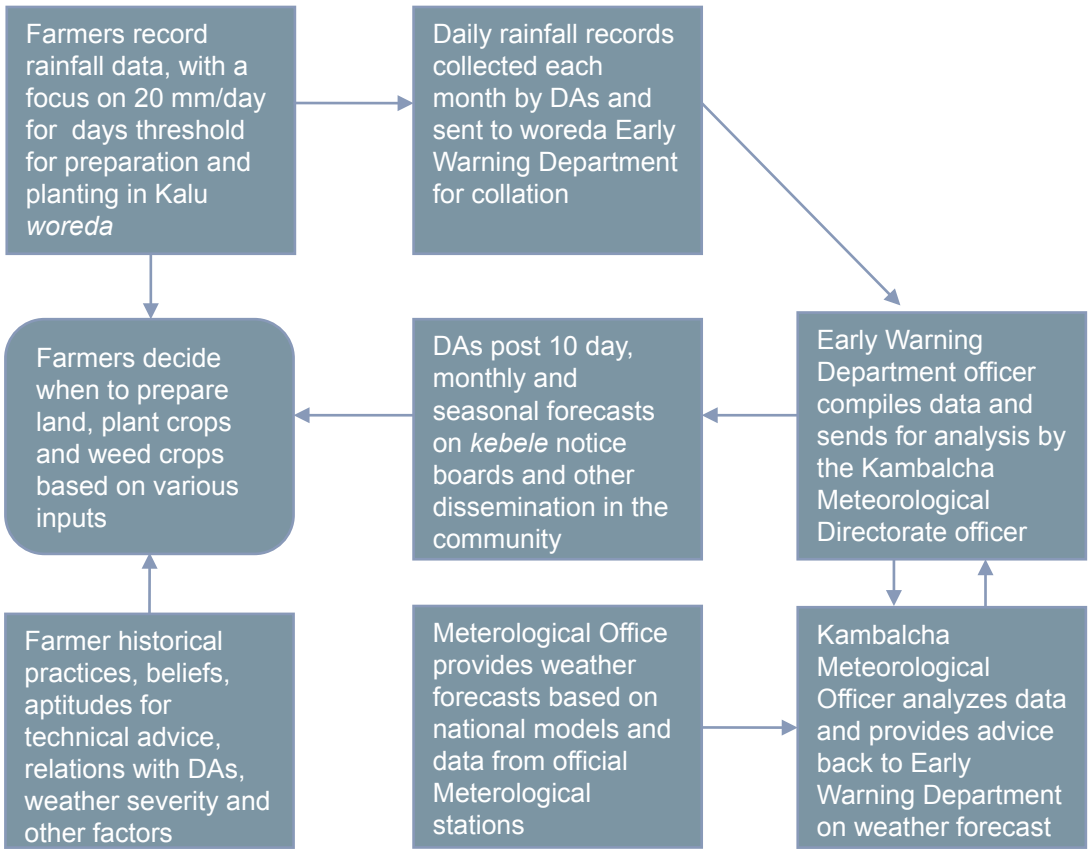
1. DAs and farmers observe the rainfall and determine an appropriate timing for land preparation and planting based on certain thresholds (20 millimetres per day for four days).
2. Development agents collect raw data from farmers using standard formats that are sent to the early warning section of the woreda agricultural office, which also receives 10-day, monthly and seasonal forecasts from the Kombolcha meteorology office.
3. Early warning section prepares newsletters that interpret the climate forecasts. These newsletters are posted on notice boards in each kebele (ward). Lead farmers take the messages out to the rest of the community.

first 10 days of June, 20 millimetres in the next 10 days, and 10 millimetres in the last 10 days. Finally, sowing can be done without rain in the first 10 days of July.

The information system worked well and reached all farmers, including the most vulnerable and marginalized within farming communities, such as women and youth. In addition, DNM trained two farmers in each project site to read rain gauges, and gave them reporting sheets and mobile numbers for three institutions (representatives of the Ministry of Agriculture, the town and the prefecture) for the transmission of rainfall data, which would in turn is transmitted to the national level (presidential radio and DNM). Providing beneficiaries with the technology and training in how to use the technology and analysing the information gives them continued access to this information, which can inform decision-making well after the project ends.

The project evaluation noted that further work between communities, Development Agents (DAs) and extension agents to develop the messaging around locally collected rainfall data would likely improve decision-making and the effectiveness of the early warning system.

Figure 1 I Local rainfall data collection, analysis and use in Kalu Woreda, Ethiopia through the CI/EWS Project



Source: Ferguson, 2013

BOX 5 I TAILORING SEASONAL CLIMATE FORECASTS FOR CLIMATE RISK MANAGEMENT IN RAIN-FED FARMING SYSTEMS OF SOUTHEAST ZIMBABWE

Communities revealed that key to application of seasonal climate predictions among smallholder farmers in the Chiredzi district was knowing the odds of a drought occurring during the October, November, December (OND) and January, February, March (JFM) sub-seasons. A binary forecasting model trained over the period 1967 / 68 to 1999 / 2000 using climatic variability cycles of El Niño Southern Oscillation (ENSO) and the Indian Ocean Diapole (IOD) as drought predictors was adopted to tailor climate forecasts for the Chiredzi district. Evidence from previous research shows a strong correlation between these predictors and the occurrence of drought in southeast Zimbabwe.

When a negative IOD is anticipated, the chance of an extreme drought affecting the OND and JFM sub-seasons is almost zero. In the event of a positive IOD combining with El Niño, the chances of drought affecting southeast Zimbabwe are enhanced. When IOD and ENSO are in a neutral phase, drought is unlikely to affect the OND and JFM sub-seasons. Early or timely beginning of rains will indicate planting of normal crops, while late arrival of rain in OND or drought in either OND or JFM must lead to a change in the cropping pattern, soil moisture conservation or other cropping strategies.

The binary forecast model for the Chiredzi district performs much better than the 'tercile' model, whose accuracy levels are below 50 percent for the OND and JFM sub-seasons. This study identified the paucity of long-term local-level rainfall data as a major obstacle in making more accurate tailored seasonal climate forecasts. At present, the Chiredzi district, which covers 1.71 million hectares, is represented by one synoptic station at Buffalo Range Airport. The establishment of six village-level climate monitoring stations by the project Coping with Drought and Climate Change should be a big boost to the district's forecasting and climate application activities in the long-term.

Developing a culture of using locally observed climatic data and simultaneously slowly introducing the farmers to climate forecast products built trust for using meteorological tools and firmly established the uptake of medium-range and seasonal forecasts. A project survey from June 2011 showed that demand for medium-range (i.e., 10- to 14-day) and seasonal climate forecasts grew to include about 43 percent to 83.5 percent of the farmers across the four pilot Wards. Farmers were interested in continuing to receive climate risk information and in developing rules of thumb – and particularly in making decisions on when to plant, when to weed and when to harvest and in determining plant density.

Source: Unganai, L., Troni, J., Mukarakate, D. (2013) Tailoring seasonal climate forecasts for climate risk management in rain-fed farming systems of southeast Zimbabwe, Climate and Development.

Financial sustainability

Financial sustainability is important for the continuation of the project interventions beyond the project grant. For adaptation benefits that are primarily captured by private households, this could be achieved through cost recovery payments such that the communities themselves pay for the service (relevant to water supply or irrigation projects, for example) or through supply chains and markets that would be essential for the diversification and expansion of livelihoods. For production of public goods necessary to adaptation – the key one being climate risk information – there is a strong economic argument for government support to continue these services. To justify continuing public-sector financing of work in this area, projects should generate evidence of the developmental results from using this information for planning. The following case studies examine the importance of market incentives and cost recovery for financial sustainability.

Supply chains and markets

Adaptation projects by and large aim to diversify livelihoods and income sources into areas and practices that are less climate-sensitive. For many pilots, the demand from local

markets may be sufficient to provide a market incentive to continue the adaptive practices. For example, in Zimbabwe, with the livestock management knowledge and skills farmers acquired from the adaptation project Coping with Drought and Climate Change, farmers organized themselves into groups and linked up with private abattoirs to access working capital and markets. However, returns are usually modest and typically put towards paying for household level needs (school and health care). Investments in enterprise development or, in cases where drought-tolerant crops such as cassava or pearl millet are introduced into an area, government support for value chain development, supporting infrastructure and marketing know-how are likely to be needed.

The first project experiences have been weak in analyzing market conditions to assess the potential for these initiatives to grow into businesses and create a local economy. Four of the 11 recommendations in the terminal evaluation for the project Adapting to Climate Change through the Improvement of Traditional Crops and Livestock Farming in Namibia listed access to affordable credit and lack of market access as barriers to sustainability. In addition, the same were listed as barriers to scaling-up of the successfully piloted commercial Boer ram, guinea fowl products and drip irrigation as well as a subsidy scheme for adoption of plastic granaries. The drip irrigation scheme, in particular, demonstrated good cost-benefit ratios, but had high start-up costs. In Zimbabwe, some of the natural resource management livelihoods initiatives did not achieve expected results, mostly due to lack of technical and financial resources and the lack of specialist skills for business development. The barriers to replication of the adaptation measures include credit and input bottlenecks, which force farmers to resort to their own traditional varieties of grains despite their poor performance. The lack of post-production value addition and the development of a marketing strategy were also barriers to sustainability. These experiences show that business models and strategies to obtain financial viability need to guide the agricultural technologies promoted. Table 8 on page 64 summarizes the complex web of actions required to scale-up adaptation pilots in Kenya. Many of these measures are baseline investments that are vital for advancing adaptation.

Clearer strategies for dissemination, replication and scaling up should have a prominent role in future climate change projects. For example, in Ethiopia, facilitating access to markets has enabled farmers to sell their products at reasonable prices, thereby increasing their income through measures such as the establishment of marketing points for haricot beans, mung beans and sesame seed for onward sale to the Ethiopian Commodity Exchange and the introduction of storage houses, processes and equipment for horticultural products. In addition, cooperatives received training in value addition, marketing and cooperative management.

A few projects from UNDP's portfolio show how a local economy has been initiated through technology innovations that, with market connections and institutional support, could expand economic opportunities and reduce vulnerability.

For example, the experimental integrated pest management (IPM) pilots in Ethiopia were tested with support from the Office of Agriculture and Kombolcha Pest Surveillance and Study Centre. The IPM groups produced 16,360 litres of botanical pest control from different plants and animal urine, experimenting with different mixes and promoting adoption among local farmers. Approximately 1,000 hectares of croplands were treated, which helped to reduce damage from pests and disease by 20 percent, resulting in a doubling of the cereal crop yields and savings on chemical pesticides. The effectiveness of the method against the stock borer pest suggests that it could become a financially viable and sustainable approach if sufficient institutional and financial support were provided. The IPM experiment in Ethiopia has proved successful and now needs to explore self-sustaining market approaches that would charge farmers who are interested in using the locally produced pesticide.

The Small Grants Programme in Namibia has allowed cow peas (omakunde) to become a commercial option, creating much-needed job opportunities for at least 500 female communal farmers in the northern parts of the country during 2011.

In Zimbabwe, local farmers discovered a low-cost, locally available drought fodder (zhombwe) that they successfully used to sustain their cattle through extreme drought on zero grazing. Households that participated in interventions such as use of urea-treated crop stover, molasses, sugar cane tops and bana grass have experienced no livestock losses during droughts after the project, whereas non-adopting households experienced livestock deaths in excess of 20 percent. (See Case study 3.3.3 for more details.) There is a market for these technologies, but projects often fall short of supporting farmers to develop these as businesses. Support is needed to help producers organize into producer groups; to make necessary partnerships with suppliers and distributors; to provide seed financing for essential infrastructure, input packages, training and marketing support; and to develop and expand the supply chain.

Cost recovery for services

Delivery to enable adaptation responses must consider the communities' willingness to pay for the adaptation measure as evidence of the value that they place on the service, which can be an in-kind contribution for the poorest communities. For example, the project Ethiopia Coping with Drought and Climate Change showed that vulnerable households in a largely subsistence economy will pay 3 to 5 birr (approx. US$.025) per month for potable water supply made possi-

Photo: Imen Meliane/UNDP

ble by opening spring water wells; the proceeds are being used for maintenance costs. Yet, for many poor and vulnerable communities, the prospect of paying for services in the shorter term may be unrealistic because of financial and cultural barriers. The willingness to pay for services needs to guide the agricultural technologies promoted in order to avoid aid dependency. For example, irrigation would certainly help agricultural productivity in Africa and could help smallholder farmers adapt, yet the cost, lack of government funds for maintenance and low affordability of user fees for larger-scale irrigation development have remained major barriers to implementation. In-field rainwater management, individual micro-irrigation as well as the capturing, storing and use of rainwater for production and consumption are likely to be more affordable. Drip irrigation is a promising technology for water-scarce African economies, but has high upfront costs (although with short payback periods). There have been positive experiences with drip irrigation in Namibia, but these have needed financial and technical support to get farmers started.

Financial services will be key to expanding successful initiatives, creating demand for goods and services and promoting a self-sufficient approach to adaptation. In Mozambique, a strong message that came from the communities during the vulnerability assessment carried out during project design was that financing must diversify their livelihoods. The micro-financing component was developed on the basis of a successful United Nations Capital Development Fund (UNCDF) / UNDP programme: Building Inclusive Finance in Mozambique, which showed that paying for capital, as opposed to receiving grants, was a key driver of sustainability. A major component of the project is household enterprise development that uses micro-financing as a delivery mechanism. This includes an innovative package comprising: financial services; a technology package (climate smart agricultural inputs); methodological guidelines for each type of crop; and advisory services dedicated to each community through via long-term agreements. Grant blending for financial service providers will cover the cost of the additional costs of technical assistance for this pilot test.

Case study 3.3.3: Adaptation technology development in Zimbabwe

Matsilele Njanji, a livestock farmer from Ward 7, is 42 years old and a father of four. He has been practicing livestock farming since 2000 and has 33 cattle, 14 goats, 12 sheep and three donkeys. He is one of the beneficiaries of the livestock pilot project and has been conserving and making value-added feed rations for his livestock on the basis of knowledge gained from the project. Mr. Njanji stated, "The project taught us how to harvest maize stover, store it in a rack, process it in the treatment pit using urea and then store it in a cool dry place." The project also provided veterinary equipment for deworming, castration, and dehorning. During the July-November dry spell, he has been feeding his livestock with the treated feeds and he did not lose any to the drought. He uses three kilograms of the treated feed per animal per day and adds molasses to the feed to increase the nutrients. His farm has been used as a demonstration site for other farmers in the ward.

His cattle graze close to his home and so they gain more weight. He spends less on vaccination since he has clean water from the borehole in his compound. Farmers are also planting bana grass and leucaena seeds to use as substitute feeds. His oxen are strong and provide draught power; he sometimes hires them out to farmers whose animals are too weak to plough during planting season. He is able to make US$100 per hectare from the ploughing. A cow is sold at US$500 at the market, while a goat and sheep are sold for US$35 and US$70, respectively.

Table 8 I Business models proposed for adaptation pilots, Mwingi District, Kenya

Energy efficient cookstoves	
Investor	Champion investor: i) energy liners for fixed stoves; ii) mobile stove production.
Market	Women / households. The average rural family spends 20 percent or more of its income purchasing wood or charcoal for cooking.
Inputs (clay preparation)	Women group members. Proven suppliers, but market bigger than suppliers can meet. Needs micro-financing to expand production (e.g., kiln). Training provided by existing producers, government, NGOs. Water and clay supply; land; kiln construction.
Distribution	By contract with women's groups/village chains. Form a Community Based Organization (CBO) from merging of SHGs. Marketing / business management training inputs needs.
Stove installation	Independent service providers.
Challenges	Technical and financial capacity weaknesses that compromise the supply and quality of energy liners. Gaps in distribution, community sensitization, installation technology.
Goat farming	
Investor	Breeders and farmers.
Market	Farmers for milk and meat production - linked to traders through Kenya Livestock Marketing Council and butcheries associations. Kenya Meat Commission. Households: market kiosks. Financial services needed to access improved goats.
Inputs	Establish breeders association linked to CBOs (to be established from local SHGs), which will set up milk collection centres and processing. Establish animal-breeding centres and health services with Ministry of Agriculture and Livestock; distribution/transport to market; milk processing facilities. Purchase of Galla goats and provision to some farmers. Training provided by Ministry of Agriculture and Livestock.
Distribution	Milk to be sold through established milk collection centres in urban areas. Meat to be sold to butcheries associations and Kenya Meat Commission. District livestock marketing councils and open-air markets.
Challenges	Goat meat enjoys huge domestic demand, but improved goats have not been successful due to lack of sustainable business and market-driven initiatives. Lack of processing facilities. Low bargaining power of goat breeders and poor market infrastructure. Disease burden of local breeds for crossbreeding.
Horticultural production	
Investor	Producer groups.
Market	Juice processors and consumer market (jams, fruit concentrates, dried mango).
Inputs	Establish cooperative society from local producer groups. Mango: Establish nurseries. Training for quality seeding production and processing methods. Establish collection centres and cold storage. Provide a village-level mango fruit processing facility. Irrigation for mango seedling production. Demo plots for mango-improved varieties. Green growers: water storage technology for year-round irrigation.

Table 8 I Business models proposed for adaptation pilots, Mwingi District, Kenya continued

Seed bulkers	
Investor	SHGs / farmers.
Market	National school feeding programme to traders through the Grain Business Hub (GBH).
Inputs	Establishment of a GBH for seed bulking, setting up stores, bringing together SHGs and linking with traders. Kenya Plant Health Inspectorate Services (KEPHIS) technical input. Training for seed producers. Foundational seeds procured from Kenya Agricultural Research Institute (KARI) stations. Financial services for farmers to purchase foundational seed (10 kg - 30 kg / crop variety).
Distribution	To farmers through stock distribution channels and GBH seed stores, also open-air markets.
Challenges	Several efforts to enhance smallholder access to seed have failed in the past due to absence of a formal bulking and distribution system. In addition: high costs of production, low and unreliable yields, high transaction costs, price fluctuations. Weak and unreliable demand due to low affordability, low awareness of performance data, and unreliable seed supply. Low and unpredictable rain, pests and diseases, labour-intensive methods of cultivation, weak skills in seed production.
Poultry improvement	
Investor	Wholesale company / distributor, farmers.
Market	Wholesale company / distributor; farmer CBOs linked to hotels and restaurants.
Inputs	Form CBO to provide inputs to poultry farmers – feed, drugs and vaccines – on credit to be paid monthly from proceeds of egg sales. Purchase feed grinders from the Kenya Industrial Research and Development Institute (KIRDI) and/or work with existing millers. Financial services needed. Farmers will purchase chicks from CBO or chicks can be given on credit (financial services needed). Hatching technology provided by wholesale company under supply contract.
Challenges	The trend in commercial poultry production has been unsteady due to unreliable supply of feed, a low supply of day-old chicks and poor health control. Gluts on the local egg market, but unreliable feedstock for external market. Low skills in chicken production. No cooperation between farmers and traders to improve supply chain and reduce transaction costs. No umbrella organization that oversees the development of this subsector.
Domestic fish farming	
Investor	Farmers or SHGs.
Market	Link fish farmers to high-premium buyers and retailers.
Inputs	Fingerlings to be produced by specialized farmers trained as 'seed' producers. Formation of fingerling production group: set up and manage fishpond with supervision of Ministry of Fisheries. Fingerlings supply promoted as a business; fish farms used also for demonstration and learning centres. Training provided by Ministry of Fisheries. Promote agro-dealers to sell fish feed. Use radio and mobile phones to send and receive market and price information. Business development services; tailor-made financial products.
Distribution	Fish to be sold to local markets and traders.
Challenges	Lack of access to market and market information; delayed delivery of fingerlings; lack of access to fish feeds and fish harvesting gear; lack of financial services; poor roads and energy supply; lack of storage and transportation systems to ensure freshness and quality.

Photo: Imen Meliane/UNDP

The following section discusses capacity development and how it can be applied to answer climate change challenges and inform adaptation policy design, implementation, evaluation and scaling up.

Lessons learned 2000-2015

CAPACITY DEVELOPMENT

4. CAPACITY DEVELOPMENT

This chapter discusses what we mean by capacity development, looking at the capacity constraints to adaptation as well as capacity development work supported by UNDP in the areas of adaptation policy design, implementation and evaluation.

4.1 Definition

UNDP defines capacity as "the ability of individuals, institutions, and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner." Capacity development is the 'how' of making development work better and is, in essence, about making institutions better able to deliver and promote human development.[1] Capacity development is more than just training: it is the range of actions that aim to promote better decision-making and bring about changes in behaviour in anticipating and responding flexibly to external factors. Capacity development is critical for the development of a commitment to change and establishment of champions for change because of its potential to activate internal learning processes. Adaptive capacity is the ability to design and implement effective adaptation strategies or to react to evolving hazards and stresses so as to reduce the likelihood of the occurrence and/or the magnitude of harmful outcomes resulting from climate-related hazards.[2] People-centred design and implementation processes as well as policy and institutional development are therefore key promoters of adaptive capacity.

Empirical evidence from UNDP's work shows that there are four commonly encountered capacity inputs into effective institutions: institutional arrangements, leadership, knowledge and accountability. These capacity inputs are cross-cutting in the mainstreaming process. The capacity inputs contribute to effective institutions in three ways: i) performance (effectiveness and efficiency); ii) stability (performance standards and risk mitigation); and iii) adaptability (innovation and continuous improvement).[3]

4.2 Challenges for adaptation

In climate change adaptation, the following challenges often affect performance, stability and acceptability:

- Overlapping and conflicting laws regulations and mandates, resulting in inadequate understanding of the limits and responsibilities of individual agencies.
- Limited collaboration among ministries.
- Weak coordination between actors in the development space.
- Weak capacities to plan, finance and implement adaptation initiatives.
- Weak culture of information and knowledge sharing.
- Weak evidence-based learning and take-up of learning into policy processes.
- Weak planning for results-based management.

Furthermore, baseline weaknesses undermine the possibility to improve capacities in all areas and are a significant feature of many governments across Africa.

For example, they seriously hindered project implementation in Zimbabwe.[4] Government partners in the Chiredzi district faced serious transport and communication challenges, which increased project implementation costs, since the Project Management Unit had to provide logistical support from Harare even for minor activities. None of the project partners from government were on email and telephone landlines did not always work. Consequently, there were high communication costs. For the adaptation interventions to take root and outlive the project, these capacity constraints must be addressed. The project identified low capacity among local institutions as one of the most important barriers to climate change adaptation. Wards in the Chiredzi district stretch over several tens of kilometres and it is virtually impossible, without suitable transport, for extension agents to reach out to all or even some of the farmers.

1 UNDP, 2010. UNDP has undertaken extensive research to understand core capacity issues, why such capacities are important and how external partners can support countries' efforts to further deepen and effectively use such capacities to achieve their development goals. For more information, see the Capacity Development Practice available here: http:undp.org/content/undp/en/home/librarypage/capacity-building/capacity-development-practice-note/
Additional recent resources can be found on the UNDP website, including a Practitioner's Guide to Capacity Development for Environmental Sustainability, A UNDP Primer on Capacity Development, and A Paper on Measuring Capacity, available at: http://www.undp.org/content/undp/en/home/ourwork/capacitybuilding/approach

2 UNDP 2005

3 UNDP, 2008

4 Ferguson, 2012

Other implementation issues in Zimbabwe included poor remuneration and a lack of incentives within government, which dampened morale and motivation to work on the project. Weak capacities and scarce funding directly affected the potential for sustainability of farmer-accepted interventions because there was no ongoing technical field support. For example, cassava, well known in eastern and southern Africa for being drought-resistant, was introduced to Zimbabwe, but, although households accepted it, its uptake remained low, because there were not enough planting materials and promoters of the crop among farmers.

In a 2011, UNDP supported a training needs assessment for climate change management for the government of Malawi. It was found that there was a 30 to 40 percent vacancy rate across government departments, with some departments such as the Forestry Research Institute having a vacancy rate as high as 80 percent. Positions that were central to climate change management in Malawi were unfilled and the few existing personnel are performing numerous roles. Thus, capacity deficits exist not only in the inadequacy of individuals' skills and experience as well as institutional processes, but also in the sheer lack of individuals available to do the many jobs required for effective engagement in the policy process.

Severe fiscal constraints, together with inadequate capacity to manage adaptation challenges, require continued support to governments and communities that seek to implement adaptation priorities, test new approaches and mainstream adaptation into policies, plans and budgets for scale-up. Baseline investments in education, health, infrastructure and growth strategies will be equally important in developing capacities, generating domestic resources for adaptation and building up resilience.

4.3 UNDP approach to capacity development for adaptation

This section is organized according to the steps in designing and implementing policy, corresponding to three main areas of work: i) designing the policy; ii) implementing the policy; and iii) evaluating the policy. The section illustrates how we are supporting capacity development in these areas.

Designing the policy

The two main tasks in designing the policy are about defining the problem and identifying the solutions. Who participates in consultations, the level of discourse promoted by government and the quality of the documented evidence used are important in determining the final shape of adaptation strategies. Contestation of adaptation policy responses is very likely, given required departures from established technologies, practices and growth models, especially as the climate change signal becomes more pronounced and greater adjustments are needed. Adaptation strategies are likely to have distributive impacts, e.g., energy pricing to take account of fuel-specific carbon content or water pricing to induce consumption efficiency. Even for commonly cited 'no-regret' measures – i.e., measures with short pay-back periods, whatever the degree of climate change – often have low uptake because of financial, technical or social barriers. If there are many claims on an already stressed national budget, cost-effective adaptation strategies may not get funded. In addition, different stakeholders may frame problems differently, the problems may be difficult to interpret in the absence of good information, the boundaries of so-called "messy problems" may be difficult to draw and solutions may not necessarily be easy to agree on.[5] Problem-solving is thus likely to involve negotiation rather than to be based solely on the rational consideration of information. Often, the availability of baseline and results data is poor and government only weakly applies evidence in developing spending plans.

The following section sets out various UNDP capacity development support programmes that aim to help governments define the problem, identify the adaptation solution and mainstream adaptation policy responses into regular planning processes, namely:

- Case study 4.4.1 synthesizes UNDP-supported work on developing climate risk assessments and climate change response strategies under the National Communications Support Programme.
- Case study 4.4.2 sets out two approaches to measuring vulnerability undertaken in Comoros and Rwanda.
- Case study 4.4.3 illustrates mainstreaming approaches undertaken under the Africa Adaptation Programme.
- Case study 4.4.4 describes the Climate Public Expenditure and Institutional Review (CPEIR) process that engages budget processes and is useful for engaging a powerful constituency, i.e., ministries of finance.
- Case study 4.4.5 demonstrates a consultation process undertaken in Cape Verde that paid due attention to stakeholder interest and influence in promoting policy change.
- Case studies 4.4.6 and 4.4.7 are support programmes to develop economic appraisal capacity. The first example describes an investment and financial flow analysis approach that was piloted in a range of countries to help build a climate change response strategy and the second example presents an economics capacity development programme in Africa.

Capacity development for adaptation planning is being taken forward in the UNDP-UN Environment National Adaptation Plan-Global Support Programme (NAP-GSP). See Box 6.

5 Senior and Swailes, 2010

4.4 Case studies

Case study 4.4.1: UNDP-UN Environment National Communications Support Programme – developing climate risk profiles

The National Communications Support Programme (NCSP) was established in 1998 and has provided technical and policy support to 142 non-Annex I parties for the preparation of their Initial, Second and Third National Communications (INC, SNC, TNC). The first phase of the Programme ended in 2001 and the second phase began in 2005. The creation of a National Communication allows countries to develop technically sound studies and generate information that can be used to design mitigation and adaptation strategies that can increase their resilience to the impacts of climate change. Activities generally include: Vulnerability and Adaptation (V&A) assessments, greenhouse gas inventory preparation, mitigation analysis, education, and awareness-raising. Ultimately, the National Communication process seeks to integrate climate change considerations into relevant social, economic and environmental policies and actions. The services of the NCSP include direct technical backstopping; development and dissemination of technical guidance documents; capacity development; and the facilitation of information and knowledge sharing among countries.

A process and technical progression can be seen over the lifetime of the NCSP. An increasing number of ministries are now getting involved in the NC preparation processes, widening ownership of the results and strengthening connections to sectoral policies and plans. A wider range of stakeholders, including the private sector, NGOs, academia and research organizations and civil society organizations, is being engaged in the process, expanding the information considered in the assessment and building political constituencies of support for action on climate change. Many countries are now carrying out or guiding the process more closely through their own governmental institutions rather than through consultants, thereby promoting institutional capacity-building and ownership of the process. NCs, once considered 'projects' with 'stocktaking exercises', are now seen as regularly scheduled analytical activities that are useful for policy-making and the quality of these assessments has improved from the INC to the SNC. Capacity-building methods that countries have used include learning-by-doing approaches, online platforms and networks, workshops and training seminars supported by networks and peer-to-peer learning. Recently completed V&A assessments show a growing technical expertise in the development of scenarios and the use of models.

Case study 4.4.2: Approaches to measuring vulnerability in Comoros and Rwanda

A climate change vulnerability assessment can serve two purposes: i) to identify adaptation measures based on needs and priorities as an input into programming and ii) to set up a measurement scale to be able to compare 'before-project' and 'after-project' vulnerabilities. The following compares two methods of measuring vulnerability reduction in Rwanda and Comoros: the first is more quantitative, attempting to measure concepts by identifying and measuring indicators that make up each of the three concepts (components); and the second is more qualitative, where more 'bundled' concepts are measured. The Rwanda tool has placed more emphasis on vulnerability, whereas the Comoros tool places more emphasis on barriers and sustainability. The validity of such approaches depends on how well the indicators that make up the composite vulnerability index reflect elements of vulnerability and, in the case of the 'bundled' approach, how well the communities being interviewed have understood concepts and questions. Further application of the approach at project end is necessary to test the robustness of the methodology in measuring change.

In Rwanda, the measurement scale is made of the three components identified in the IPCC definition of vulnerability: i) exposure (the nature and degree to which a system is exposed to significant climate variations); ii) sensitivity (responsiveness of a system to climatic influences shaped by socio-economic and environmental conditions); and iii) adaptive capacity (ability of communities to cope, reorganize and minimize loss from climate change impacts at different levels, the key determinants being those communities' access to natural, financial, social, human and physical resources). Fourteen environmental and socio-economic indicators measure these three components. A combined household vulnerability index was calculated by combining the exposure, sensitivity and adaptive capacity indices. A structured questionnaire was developed to collect information at the household level. Twenty questionnaires were administered in four villages in three districts (the project is working in four districts).

In Comoros, focus groups in each of the pilot sites were convened to assess the baseline level of vulnerability to climate change in relation to water availability and quality. The methodology used was the UNDP Vulnerability Reduction Assessment (2008), based on a composite of four indicator questions: i) vulnerability of livelihood / welfare to existing climate variability / change; ii) vulnerability of livelihood / welfare to livelihood / welfare to development climate change risks; iii) magnitude of barriers to adaptation (institutional, policy, technological, financial); and iv) ability and willingness of the community to sustain the project intervention. To orient the project's local stakeholder community, awareness-raising about emerging trends and future projections preceded community meetings. There were the following challenges:

- People had difficulties in assessing their own vulnerability, barriers to adaptation and adaptation abilities and in

Photo: Imen Meliane/UNDP

deriving a scoring.

- People did not clearly understand the difference between climate variability and climate change.
- It was sometimes difficult to regroup people while no practical support was offered.

Case study 4.4.3: Integrating climate change resilience into investment plans (Africa Adaptation Programme)

Under the Africa Adaptation programme, 16 of the 20 countries incorporated climate change considerations into government investment plans. For example, AAP Malawi concluded a study of best practices and developed a handbook on climate change adaptation measures in communities, which served as an input into the Government of Malawi's national investment plan. In Niger, the AAP contributed to the integration of climate change resilience through its Economic and Social Investment Plan. The Government of Nigeria integrated climate change into national macroeconomic policies. In Kenya, the Kenya Threshold 21 (T21) model provided socio-economic evidence for Kenya to invest in climate change adaptation. The model is now integrated in the Ministry of State for Planning, National Development and Vision 2030 in the Macro-Planning Directorate. A core team of 12 modelers have been trained to maintain T21 and use it for policy scenario analysis. The modeling results were integrated into the 2014 Kenya Green Economy Assessment report.

Case study 4.4.4: Climate expenditure analysis

Climate Public Expenditure and Institutional Reviews (CPEIRs) provide an assessment of climate-related policies, institutions and expenditures. CPEIRs are based on financial expenditure review methodologies, something that is very familiar to ministries of finance. Ethiopia, Tanzania and Uganda are now undertaking CPEIRs to track climate expenditure through the budget. CPEIRs have demonstrated that, even in some low-income countries, most public finance for climate change is raised domestically, although these expenditures are often not well coordinated and managed. The lack of effective coordination of climate finance has encouraged the greater engagement of ministries of finance, which prioritize effective management of public finance. CPEIRs can be useful in determining opportunities for cross-sectoral collaboration on policy development and implementation and in highlighting mismatches between policy intention and budget allocations.

Case study 4.4.5: Institutional analysis in Cape Verde

In 2009, UNDP launched the project Integrating Climate Change Risks and Opportunities into National Development Processes and UN Country Programming, funded by the Government of Spain and implemented in five countries, two of which were Cape Verde and Malawi. The purpose of the project was to pilot mainstreaming processes. The mainstreaming processes comprised creating country climate profiles, preparing an institutional map, engaging stakeholders, assessing climate change risks, building the capacity of stakeholders and mainstreaming climate change into relevant policy documents.

In Cape Verde, institutional drivers for uptake of adaptation in policy processes were: formal buy-in to the UNFCCC; supportive legislation that identified the main institutional leads and provided sound principles of implementation; recognition of the cross-cutting nature of adaptation; the intended decentralized governance of environmental management; a favourable political climate for adaptation action; agents for change residing in various institutions; and public awareness and support. Constraints to adaptation were the overly centralized model for environmental management; uncoordinated and contradictory policies; a lack of institutional coordination; overlapping mandates; rigid bureaucratic controls; resistant political interests; and weak involvement of the citizenry in policy development.

Case study 4.4.6: Investment and financial flow analysis

With support from various bilateral donors, UNDP set up the programme Capacity Development for Policy Makers to Address Climate Change in 2008 to help 19 developing countries in Africa (Gambia, Liberia, Namibia, Niger and Togo), Asia and Latin America develop policy options for addressing climate change across different sectors and economic activities that could inform negotiating positions under the UNFCCC. The capacity development project was launched and ran in parallel with the Bali Action Plan process, the UNFCCC negotiations on long-term cooperative action on climate change. Countries analyzed different climate change measures and investments, different years for which investments need to occur and investment entities. Two main reasons make the assessments of future investment and financial flow analysis (capital and recurrent costs) particularly critical for developing countries: first, capital is scarce, so new investment decisions need be appropriate for a changing climate; second, there is a need to ensure the marginal efficiency of capital while shifting investments to a low-carbon economy. The analysis of investment and financial flows to address climate change was an important activity for the development of effective and appropriate national responses to climate change in the areas of mitigation and adaptation. The methodology was a robust, bottom-up, development-oriented, country-led and participatory approach that governments have used to raise awareness of parliamentarians, to feed into national development planning processes, to develop climate change policies and to provide information for budgeting systems.

Case study 4.4.7: Capacity-building programme on the Economics of Climate Change Adaptation (ECCA)

UNDP, the Global Water Partnership (GWP) and the Centre

for Environmental Economics and Policy in Africa (CEEPA) of the University of Pretoria developed a two-year capacity-building regional programme entitled Economics of Climate Change Adaptation, Water Security and Climate-Resilient Development in Africa. This programme seeks to strengthen the capacity of technical officers in ministries of planning / finance as well as line ministries (e.g., those of environment, agriculture, water, public works and others) to assess economic costs and benefits when evaluating how different adaptation alternatives relate to medium and long-term national, subnational and sectoral development plans. The intention of this capacity-building programme is to produce a cadre of practitioners who can prepare high-quality economic analysis related to climate change adaptation projects and programmes. In coordination with other ongoing and planned UNDP initiatives, the programme is also expected to strengthen governments' capacity to more fully integrate climate change adaptation into national, subnational and sectoral planning and budgeting. Ultimately, the programme seeks to institutionalize these important analytical skills into ministries and departments, enabling countries to formulate economically efficient and climate resilient development plans, including National Adaptation Plans (NAPs) – a process established under the Cancun Adaptation Framework to help countries identify their medium and long-term adaptation needs. The programme is aligned with the ongoing initiatives of countries in Africa that are developing medium and long-term adaptation plans such as NAPs.

Policy implementation

Policy implementation is a dynamic process whereby ideas are put into action. Many good policies have been derailed by poor implementation. Perfect implementation requires there to be:[6]

- no crippling external constraints,
- adequate time and resources,
- combinations of appropriate resources at each stage of the implementation sequence,
- a cause-effect relationship that is direct and has few intervening barriers or disruption,
- one agency that is responsible for coordinating the implementation of the plan and is not dependent on other agencies and actors,
- complete understanding of and agreement on policy objectives,
- tasks performed by each participant that can be specified beforehand and managed in sequence,
- perfect communication,
- implementers who carry out their tasks with complete full commitment.

All too often, these conditions are weak due to a combination of factors: financial constraints to carry out even basic responsibilities; weak management; insufficient authoritative and fiscal decentralization and empowerment; vested interests; absence of institutional learning; and weak performance management systems. Lack of skilled technicians is an additional, serious constraint to performance, especially in least-developed countries, where the most vulnerable communities often live in rural, remote locations where access and supply lines can be difficult and it is hard to attract skilled staff.

Adaptation management challenges

Projects need trained, experienced and motivated implementation staff for effective design and implementation of adaptation measures. Weak project planning, financial management and reporting are other factors leading to implementation gaps. In Zambia, for example, a capacity assessment carried out in 2012 showed that four of the eight pilot sites had inadequate capacity for staffing, record-keeping, commercial facilities and technical support, increasing the overall transactional and implementation costs. Except in Lusaka, there were no fully qualified chartered accountants at any of the decentralized government levels in 2012.[7]

The intention to mainstream project management within the existing government portfolios follows the international principles of aid effectiveness. Nonetheless, project experiences in Ethiopia, Kenya and Zambia show that a dedicated project team is needed, often beyond the capacity of existing ministry staff (largely due to resource scarcities), particularly as these adaptation projects are intended to challenge existing ways of planning and programming. In addition, project managers often do not have the skills needed to deliver all components of a project, especially the different technical skills required for the meteorological work compared to community participation processes and to policy mainstreaming. Because adaptation projects are cross-cutting, they must consist of different implementation strategies that have multiple sets of activities across sectors; this requires the formation of partnerships as well as the tracking of operational issues such as procurement schedules and delivery. Consequently, they are inherently complex to deliver. Management tends to be activity-based rather than results-based. Results frameworks tend not to be used for management purposes or as an input into institutional learning.

Adaptation projects typically operate in remote and challenging areas because of the mandate to address the needs of the most vulnerable. In these areas, insufficient access to the Internet, to electricity, to banks and to adequate staffing is typical. For example, it is common in Zambia for a dis-

6 Wanna et al., 2010

7 Hewo, 2012

trict to rely on a banking facility that is 150 kilometres away – a four-hour drive. In Mozambique, a project located in the central region of Guija (Gaza Province) operated over a large area (3,589 km2) with a dispersed population (38 major settlements in 2008). Seasonal streams and muddy dirt roads made communications and travel extremely difficult. These areas are most likely to be the most challenging when procuring and supplying goods. Adaptation activities are often several hours away from the capital by car and are in multiple locations, which makes effective monitoring of implementation performance expensive, particularly where there is a wide range of interventions being implemented.

Projects would benefit from support for fewer communities in a more focused and comprehensive way. A more realistic targeting of projects would enable better on-the-ground field presence and more direct facilitation, increasing the likelihood of a successful pilot and magnifying its potential to contribute to the body of learning on high-impact, resilience-building approaches. An adequate project management budget must reflect these contextual realities.

Last, the trend in the region is for more decentralization of government, as in the case of the new constitutions of Zimbabwe and Kenya. But capacities are weaker still at the decentralized level (e.g., district, community). Planning functions were often decentralized while fiscal resources were still held centrally. Thus, empowerment at the local government level to plan and to be accountable for resources is still evolving in many countries in the region and requires external support for the process to work effectively. See case study 4.4.8 for an illustration of how UNDP is working in Malawi on this point.

Case study 4.4.8: Incentivizing mainstreaming and promoting evidence-based learning in Malawi

UNDP has been supporting the Government of Malawi with the design of an innovative mainstreaming process in Malawi that will see the adjustment of budgetary screening checklists for the mobilization of domestic resources for adaptation and the strengthening of the generation and use of monitoring and evaluation information in policy-making.

In Malawi, all sector working group strategies and sector-wide approaches are submitted to the Ministry for Economic Planning and Development, which assesses them against a number of criteria before recommending that the Ministry of Finance release (or withhold) appropriate funds. Currently, the criteria used to assess spending plans and monitor implementation progress do not include climate adaptation indicators. UNDP will be supporting them to modify these checklists and indicators. This approach will bring about transformational change in the integration of adaptation priorities into Malawian sectors because it will make domestic resources contribute to adaptation and make it imperative for different sectors to consider the potential for their plans to contribute to adaptation. At the level of the Local Development Fund, the main fiscal decentralization fund in Malawi, adaptation indicators will be introduced into the existing environmental safeguards system applied to proposals so that proposals will be accepted only if they promote adaptation and resilience in the face of climate change. Applying this criterion to the main funding source for District Development Plans creates an additional upstream incentive to include adaptation within the plans by ensuring that such activities will be eligible to receive funding.

The project supports Malawi's ongoing commitment to decentralization by strengthening the connections between the decentralized adaptation planning process and the central government adaptation planning process. Districts will also have incentives to incorporate adaptation into their development planning through the allocation of budgets and a system of locally appropriate adaptation indicators for monitoring and evaluating the rollout of these plans; this arrangement will also provide the national planning system with feedback. The project will build the capacity of monitoring and evaluation units of district councils to use adaptation-relevant, results-based management so that past and present lessons can inform the planning and design of future adaptation-relevant initiatives at the district level and up to national level.

Monitoring and evaluation

Knowing what works for adaptation, in which conditions and why, for whom and at what cost are still largely unknown quantities in many countries, particularly those that are developing. This partly reflects the relatively short experience in adaptation programming since 2006, but importantly also reflects weaknesses in supporting learning environments and the internally championed development of evidence-based policy in adaptation programming throughout the adaptation community. Because of the complexity of adaptation across scales and locations and over time as the climate signal becomes more pronounced and because climate change poses multiple hazards, effective monitoring and learning are important components of adaptation.[8] Monitoring and evaluation are central to learning from experience and are one of the basic points of the pilot-testing of adaptation measures. Nevertheless, results data is poorly used for policy development, reflecting a common global challenge of ensuring that research results inform policy-making. Results data is often patchy because implementing partners generally see project data collection systems as low-priority and because the costs of data collection have to come from a dedicated budget. For the effective use of limited climate change financing and in order to promote the scaling-up of promising pilots, active learning about causal mechanisms, barriers, success factors and adaptation results must be integrated into policies and programming.

8 IPCCb, 2014

Photo: Imen Meliane/UNDP

There are different reasons that learning has such low priority. The motivation to implement quickly and to avoid spending on reports and consultants and a weak culture of reporting and accountability for results can lead to a situation in which organizational learning has low priority. A lack of skills and experience within and outside government for proper investment appraisal of adaptation measures is also a challenge. A clear example of this is offered by the Ethiopia experience.[9]

Rainwater harvesting ponds with geo-textile liners on individual farms may have been a more effective investment for the project than the Felana River distribution irrigation scheme in Kelebe Woreba. This distribution scheme involved major investment to repair a concrete weir and intake (within a river that has a dynamic channel and sediment transport characteristics). There are evaporation and leakage losses associated with the transfer of irrigation water over a large distance (1.5 kilometres) and there are uncertainties in the government's ongoing repair and maintenance of facilities. There may be sustainability concerns associated with potential flood conditions/damages around the intake and managing of the 63 water users on the repaired Felana system. In addition, some of the participating farmers in the Felana irrigation scheme were using basic flood irrigation to grow vegetables, an inefficient and high evaporation practice. The potential for access to groundwater sources could also have been considered in the selection of cost-effective alternatives for improving access to water for small-scale irrigation. For example, in the Felana River Valley in Weraba Kebele, shallow groundwater may provide a household alternative to large irrigation schemes.

A full appraisal of such measures including technical feasibility, cost-benefit, political acceptability, and sustainability analysis could help in designing future adaptation projects more cost effectively. Likewise, dissemination of those results will help inform future programming efforts more widely. Monitoring indicators that would affect performance, such as evaporation loss, temperature and cloud cover (for evaporation losses), flood events, water quality indicators, water usage levels and maintenance costs, are all relevant information that should be considered in an analysis of cost effectiveness.

The monitoring system that UNDP recommends for adaptation programming includes:

- Establishment of headline project indicators and targets to measure project outcomes that should include vulnerability reduction (resilience, adaptation and residual losses) and / or adaptive capacity.
- Development of secondary indicators to measure cause and effect assumed by the theory of change underpinning the project design.
- Establishment of baseline values.
- Establishment of systems for data collection through out the project's lifetime.

The following narrative discusses monitoring approaches pertaining to the two main results: i) effective adaptation decision-making (mainstreaming) and ii) vulnerability reduction.

Effective mainstreaming

Indicators used here generally pertain to adjustment made to policies and budgets, but these say nothing about how decision-making capacity for anticipatory adaptation planning has been improved. Using a scorecard approach, the UNDP capacity assessment methodology[10] was used in two projects in the region to establish baseline and target capacity development scores. Case study 4.4.10 explains the process followed in Mozambique.

Headline indicators on capacity development, while important for management purposes, cannot possibly represent the breadth and depth of the process and outputs behind a change in policy, budget or development plans, as case studies 4.4.1 to 4.4.8 in the preceding section show, nor can they convey the effectiveness of the process, since mainstreaming is just as much as about changing hearts and minds (which is necessary to drive implementation) as it is about negotiating the integration of necessary words and figures into plans and budgets. Qualitative tracking of capacity benefits and documentation of the process would be important evidence of what has worked and why.

Vulnerability reduction

Vulnerability reduction is measured in terms of an outcome change that is typically measured as increases in income or agricultural productivity. But these high-level indicators mask significant complexities that are determined by political, economic, cultural and environmental contexts. More detailed understanding and tracking of intermediate indicators and causal pathways (taking into account environmental, institutional, social and economic factors) between the application of an adaptation intervention and the expected result are needed in order to understand the effectiveness of different adaptation strategies. For example, in the project Coping with Drought and Climate Change in Ethiopia, a lack of appropriate vegetation (due to temperature and rainfall conditions) constrained the pilots on sheep multiplication and honey production, which were initially expected to be beneficial. 'Numbers of hectares expanded' or 'tonnes of yields increased' are examples of intermediate indicators, but would not tell us anything about the effects on vulnerability if, for example, the increased production did not find a market to generate value for the farmer. Indicators can be

9 Ferguson, 2013

10 See www.undp.org/library for capacity development and capacity assessment practice notes

used to measure the chain of causality in order to develop evidence of the cost effectiveness of particular strategies. For example, in verifying the chain of causality between planting trees and mountain stabilization initiatives, water turbidity could be used to measure soil run-off. Broader questions about the socio-ecological system might deal with the types of trees that are critical for watershed services and that provide multi-use opportunities for communities. Or they might consider the baseline condition of land and water resources and how close these might be to 'regime shifts' such as salinization and vegetation changes. These questions can guide the selection of cost-effective adaptation solutions that match management intention with ecosystem processes. In addition, the effectiveness of ecosystem-based approaches should be evaluated alongside hard infrastructural approaches. Other knowledge gaps relating to ecosystem-based approaches concern the questions of which measures work best in different ecosystems and socio-economic contexts and what the distribution of costs and benefits over time is.[11]

Attribution of results can be measured through qualitative methods (interviews, focus groups) or through quantitative methods on the basis of survey data or through mixed-method approaches for control and beneficiary groups. Vulnerability levels can improve even if development indicators do not show improvement in cases where climate hazards have worsened.[12] Therefore, establishing attribution also requires that adaptation results be evaluated against the climate baseline during project implementation. UNDP is supporting a pilot quantitative impact assessment for an adaptation project in Namibia that will test the effectiveness of two adaptation measures in reducing vulnerability. Table 9 sets out the steps involved in setting up the impact assessment in Namibia.

The focus groups are an important part of the process of participatory monitoring and evaluation to be introduced in some constituencies in the five provinces and will generate qualitative information on causality and outcomes. This will guide project design and is expected to promote evidence-based learning among communities and policy makers. It will examine the issue of whether assessment, reflection and action among communities affects results. Case study 4.4.9 describes how these participatory monitoring and evaluation processes in Namibia provide an innovative pathway to capacity development for change.

Case study 4.4.9: Transformational change through a participatory monitoring and evaluation process in Namibia

Recent innovations in monitoring and evaluation methods work well in unpredictable and dynamic environments by fostering inclusive, collaborative and responsive project management processes. The process of collecting participatory statistics has been shown to empower citizens while generating reliable and credible data.[13] Climate change is an environmental factor that is a significant driver of change affecting development outcomes. The following approach describes an innovative process approach in developing the monitoring framework for a project under design in Namibia that is expected to generate interactions and partnerships among government, politicians and communities.

The challenge in Namibia is not about a lack of policies. Indeed, the policy content is very good. Rather, there are implementation gaps, such as:

- Lack of results-based management that would guide planning and budgetary allocations.
- Unclear roles and responsibilities.
- Lack of performance management.
- Lack of effective inter-agency cooperation and coordination in agriculture, irrigation and water development, sustainable natural resource management, rural and regional development, rural infrastructure, food security and nutrition, and drought and disaster management.
- Lack of transfer of resources from central government to the regions that would enable locally driven and prioritized development plans.

A few things are needed to improve locally driven development that builds up adaptive capacity:

- Agreement among politicians, government officials and the communities about what works and what does not work in climate-smart agriculture.
- Trust-building between communities and government.
- Sufficient resources for regional councils to be able to respond to local community needs and priorities.
- A results-based management plan for climate-smart agriculture that all parties agree to, that relevant authorities monitor and that feeds into the planning and budgetary cycle.

11 Doswald et al., 2014
12 Brooks et al., 2013
13 UNDPa, 2013

Photo: UNDP

Table 9 I Example of proposed impact assessment of adaptation project in Namibia

Participatory monitoring and evaluation process set-up	Focus group discussions will provide the qualitative basis for the quantitative research on measuring vulnerability reduction. Communities should choose indicators that could be used to measure reduced vulnerability.
Establish treatment groups and control groups	Distinguish treatments (interventions) to be monitored and assessed. Establish when measurement of behavioural change will be taken.
Focus group discussions convened	Aim: to understand how vulnerability is understood, factors causing vulnerability and community strategies to reduce vulnerability. For each region (five in total): • Two project focus groups (male and female) • Two control groups (male and female)
Questionnaire developed	Semi-structured to provide measurements for determinant variables.
Questionnaire pilot tested	To ensure that a) all questions are understood as intended, b) no question leads the respondent to a particular answer or influences any other question, i.e., the questionnaire should be as neutral as possible and c) the questionnaire is complete and avoids duplication.
Sampling and baseline data collection	Sample measurements will be taken from 260 households in the region (total population: 800 households). Control groups will be chosen as follows: Choose a constituency in each region that is farthest from the beneficiary constituencies in order to minimize the risk of spillover effects. Choose a community that has characteristics similar to those of the beneficiary communities by using geographic information systems (GIS) to compare land characteristics and by comparing income and health statistics and livelihood characteristics (using national data sources).
Data collection: Year 2	• Focus groups • Survey • Assess significance of treatment effect and main determinants

A number of focus groups were established in 2014 in the five regions during the project design phase to develop the project results framework. Focus groups answered a set of questions that showed the adaptation measures needed, recommended indicators for a plan to monitor adaptation results and implementation and established baseline values. The questions included:

- What do communities know about climate change and are they concerned about it?
- What are community views on exposure to, sensitivity to and the possible impacts of climate change, based on scenarios presented?
- What is their vision for having high adaptive capacity?
- What factors prevent them from improving their lives?
- What measures would help them improve their lives?
- What adaptation practices and activities do communities want to track?
- How might we measure positive or negative changes from the implementation of these adaptation measures?
- What contextual factors might influence activities and results?

The project aims to raise the awareness of policy makers about the adaptation needs of smallholder farmers by linking the monitoring framework to the work of the regional council and bringing it to the attention of national government.

Case study 4.4.10: Measuring capacity development in Mozambique

It takes the form of a self-assessment questionnaire. The scorecard focuses on the strengths, challenges and priorities as perceived by the group of respondents, by asking them to define: i) their perception of the current level of capacity in their organization; ii) their desired level of capacity in their organization within the project timeframe; and 3) the priority given to each capacity. The scorecard was tested and adapted during field-work in Pemba, Mozambique. Later, the scorecard was replicated in two additional sites in Mozambique: Pebane and Závora. As a triangulation mechanism, qualitative open-ended interviews were conducted with senior- and management-level personnel from the organizations participating in the self-assessment.

The scorecard looks at five different dimensions of the functional capacities of local authorities related to adaptation, namely, the capacity of local communities to:

- Engage in stakeholder dialogue.
- Assess a situation and create a vision and mandate for climate change adaptation initiatives.
- Formulate policy and strategy on climate change adaptation initiatives.
- Budget, manage and implement climate change adaptation initiatives.
- Monitor and evaluate climate change adaptation initiatives.

Each functional capacity area has a series of sub-indicators, 43 in total. To establish the baseline capacity, stakeholders are asked to score their understanding of the existing capacity, where they would like to move the capacity to in the project timeframe and how they would prioritize each capacity. The scoring scale used was:

- No evidence of capacity (1)
- Anecdotal evidence of capacity (2)
- Partially developed capacity (3)
- Widespread, but not comprehensive capacity (4)
- Fully developed capacity (5)

Photo: Imen Meliane/UNDP

BOX 6: NATIONAL ADAPTATION PLANNING SUPPORT PROGRAMME

Following the guidelines developed by the Least Developed Countries Expert Group, nations supported through UNDP programmes are developing integrated roadmaps for National Adaptation Plans, improving evidence-based results, and promoting improved knowledge-sharing. This will result in climate-smart policies, improved evidence-based decision making, and the regulatory frameworks required to prepare industry, society and government for a new climate reality.

UNDP's support for National Adaptation Plans comes from several innovative programmes. These programmes provide both generalized support to National Adaptation Plans as well as specialized attention to specific sectors, such as agriculture. These various programmes are funded through the Global Environment Facility, and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. UNDP also currently supports 41 nations in accessing dedicated Green Climate Fund (GCF) finance for National Adaptation Plans.

Adaptation planning cuts across myriad sectors, and national programmes to improve climate information and early warnings, improve risk analysis and appraise and prioritize interventions with push-on effects that will improve the overall ability to create and implement these plans.

As outlined through the UNFCCC, the National Adaptation Plan process includes laying the groundwork and addressing gaps, analyzing preparatory elements, prioritizing planning and building implementation strategies, improving regional coordination, and facilitating improved reporting, monitoring and review. UNDP supports nations along each section of this framework.

The joint UNDP-UN Environment National Adaptation Plan Global Support Programme (NAP-GSP) is undertaking targeted support for climate change National Adaptation Plan processes. The programme is funded through the Global Environment Facility. NAP support is being provided to more than 30 countries, in various forms on an ongoing basis, in Africa, Asia and Eastern Europe – including assistance with stakeholder consultation, stocktaking, NAP roadmap formulation, sectoral prioritization and cost-benefit analysis, amongst other forms of support. Working with national governments, civil society, donors and other key stakeholders, UNDP is supporting 41 nations in accessing dedicated Green Climate Fund (GCF) National Adaptation Plans finance.

A separate but interrelated collaborative programme between UNDP and the Food and Agriculture Organization (FAO) is dedicated toward Integrating Agriculture in National Adaptation Plans (NAP-Ag). The programme is funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. In all, 11 nations are supported through the programme, including Colombia, the Gambia, Guatemala, Kenya, Nepal, Philippines, Thailand, Uganda, Uruguay, Viet Nam and Zambia.

Photo: UNDP

Figure 2 I Baseline and target scores for the capacity needs in Mozambique

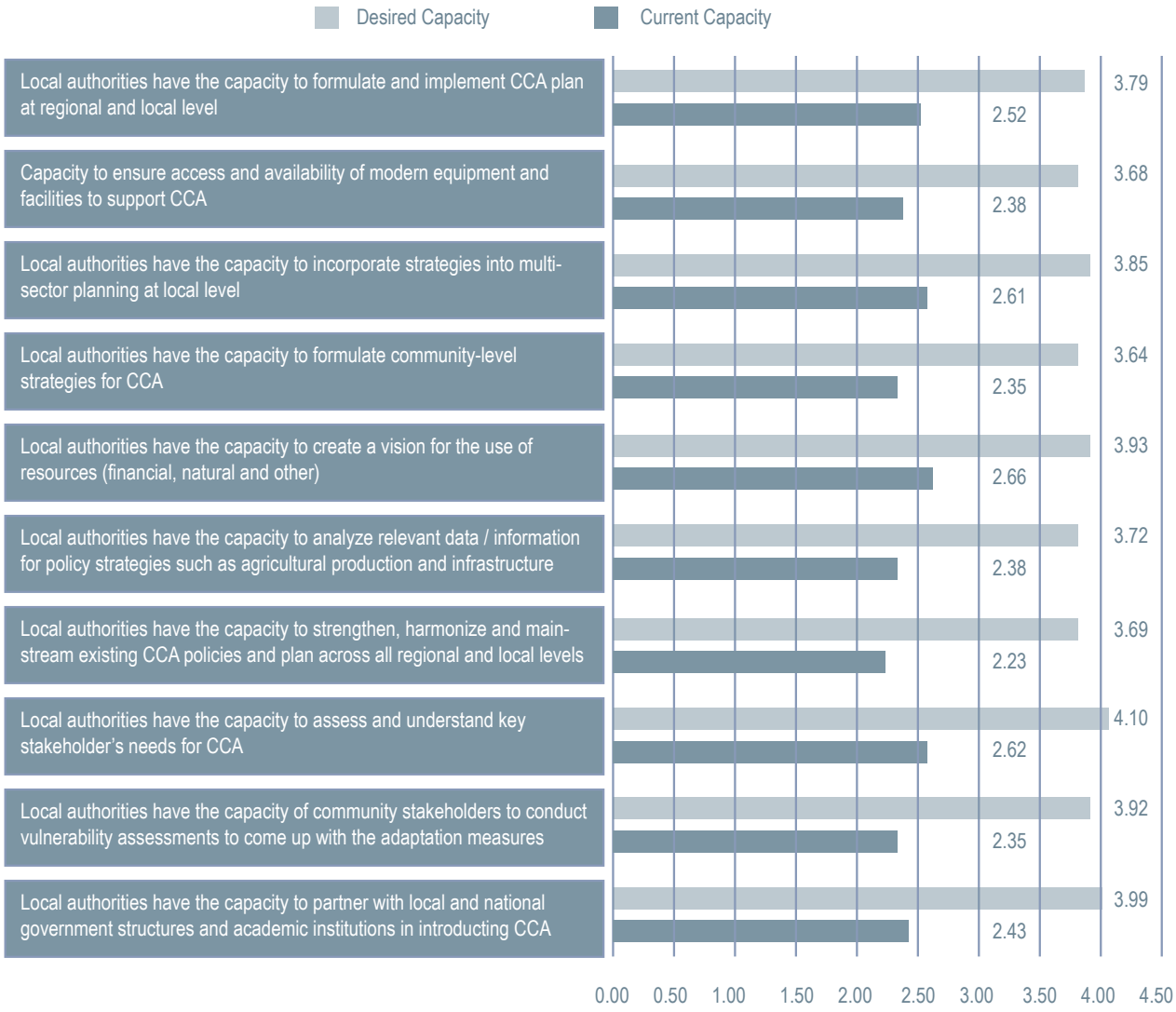


Photo: Imen Meliane/UNDP

Human-induced climate change is real and will harm African economies. Indeed, the early signs of this are apparent today. Without global action to cut greenhouse gas emission, climate change will accelerate, and our opportunity for planned and controlled change management will diminish.

Adaptation is a matter of social justice because those most impacted by climate change have contributed least to the problem. Addressing climate change therefore aligns directly with UNDP's vision and mandate to help countries achieve the simultaneous eradication of poverty and a significant reduction of inequalities and exclusion.

CONCLUSIONS

5. CONCLUSIONS

Human-induced climate change is real and will harm African economies. Indeed, the early signs of this are apparent already today. Without global action to cut greenhouse gas emissions, climate change will accelerate and our opportunity for planned and controlled change management will diminish. The effects on African economies could be devastating. Adaptation is a matter of social justice because those most impacted by climate change have contributed least to the problem. Addressing climate change therefore aligns directly with UNDP's vision and mandate to help countries achieve the simultaneous eradication of poverty and a significant reduction of inequalities and exclusion.

Based on project experience over the last 15 years, we argue that there are three principles behind achieving and sustaining adaptation benefits: i) collaborative management approaches that meaningfully put affected people at the centre of the innovation process and share decision-making over the adaptation process; ii) sustainability-led programming that addresses the barriers to replication and scaling up of promising adaptation interventions; and iii) capacity development for evidence-based policy design, programming, implementation and monitoring and evaluation. These can be disaggregated into five key factors for adaptation project design and implementation that make up the acronym ADAPT, as follows:

Adaptive capacity for sustainability and scaling-up underpins all strategies to strengthen resilience and adaptation to climate change because our climate system is inherently variable and because it is impossible to predict the weather with certainty. Agency, empowerment as well as the skills, knowledge, networks and active monitoring and results learning processes are key drivers of resilience and adaptation. Adaptation to climate change will require an integrated approach that is flexible and anticipates climate variability, bearing in mind that variability and extremes can counter the climate trend in any given year. 'Climate-proofing' development, which suggests end-point solutions being found, is appropriate only for hard infrastructure; adaptation for flows of resources (agricultural production, other income streams, migration, expenditures on services) requires continuous adjustment based on learning from experience. Capacity development takes time and requires continued and sustained support. Implementation challenges can be particularly acute in low-income countries with stretched civil staff and low budgets.

Decision-making on the 'what' and the 'how' of adaptation projects that is shared across government, with communities and other stakeholder groups, is critical to project success and sustainability. Women's involvement in decision-making is also essential to ensure that balanced projects focused on practical and productive strategies are followed. Climate risk analysis is essential to framing stakeholder discussions; this allows the selection of adaptive measures rather than a continuation of business as usual.

Access to markets to enable scaling-up is critical to enable and sustain adaptation benefits. These efforts can encompass market linkages, value chain development and business planning. The selection of technical options and management plans should be based on their market potential (for livelihood expansion) and, where payment for a continued level of service beyond the grant is concerned, the affordability levels for the communities should be a key determining factor.

Policy mainstreaming is key to enabling scaling-up. Pilot projects should be set up with robust monitoring frameworks connected to them so that evidence of what works and why – the causal pathways between the investment and the result – is fed into policy processes. That way knowledge banks of the costs of adaptation, the transferability of experience and the factors that would enable successful adaptation can begin to be built. Effective policy design is critical for the scale-up of successful pilots, recognizing that government is an enabler of household and private sector investment. Likewise, regulation and economic instruments will be important tools.

Technical information to support evidence-based decision-making: Economic information on the returns from investments in hard and soft adaptation options, and the performance of adaptation investments over time, are important for policy-making and planning. This should be supported with adequate systems of data collection pertaining to results. Ecosystem conditions should be monitored in order to manage the environmental resources, understand environmental limits and to assess the effectiveness of the adaptation responses. Support for climate monitoring and forecasting needs occurs at three levels: establishing monitoring networks and data dissemination processes; developing forecasting capacity; and developing user-friendly decision-support tools. Each level requires an appropriate process design to ensure that support meets user needs and to promote collaboration between partner institutions.

We argue that successful adaptation of an economy needs to incorporate all of the following four elements: baseline resilience, adaptation, institutional adjustments, and addressing residual risk. Adaptation progress is difficult without addressing baseline vulnerabilities, which, in themselves, produce negative feedback loops and worsen poverty and vulnerability. System changes are needed to reflect changing environmental conditions driven by climate change. Improving the quality of public-sector decision-making for efficient and effective use of scarce public resources requires that decisions be made while taking into account all risks and drivers, including climate change, which will become increasingly important. Policy responses to climate change are complex and expensive and will challenge conventionally accepted policy solutions and implementation pathways, so effective implementation of a mainstreaming strategy is needed across the board. Lastly, households should be supported in bearing residual losses from climate change, because the cost of managing extremes such as surprise flooding and heat waves or slow-onset risks such as sea level rise will be too high without adaptation.

We also argue that there are four types of policy responses to address these different elements of adaptation: asset accumulation, capacity development, risk transfer and relocation. UNDP experience shows that most action on adaptation is concentrated in asset accumulation and capacity development and that less progress is being made on risk transfer and safety net development. Relocation is happening in many cases, but is underreported. Effective programming for all four types of adaptation approaches must be continuously compared with the climate baseline and projections in order to evaluate results in the context of changing weather patterns during the lifetime of an investment and to assess what this might mean for future adaptation programming.

Photo: Imen Meliane/UNDP

Photo: UNDP

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ANNEXES

ANNEXES

Annex 1 I Key data for UNDP-supported adaptation projects in sub-Saharan Africa

Country	Project title	Livelihood benefits	Average rainfall in country region (mm/yr.)	Main climate stressors	Project grant (US$, in millions)	No. of direct beneficiaries
Burundi	Community-based climate change-related disaster risk management	Water	1,400 - 2,000 (depending on the region)	Drought, floods	8.9	1,000
Comoros	Adapting water resource management in Comoros to increase capacity to cope with climate change	Health, food and water security, poverty reduction	1,187 - 5,888 (depending on the island)	Droughts, floods, sea level rise and salt water intrusion, cyclones	2.85	14,000
Comoros	Enhancing adaptive capacity and resilience to climate change in the agriculture sector in Comoros	Food security, poverty reduction	1,187 - 5,888 (depending on the island)	Droughts, floods, sea level rise and salt water intrusion, cyclones	8.99	12,000
Democratic Republic of Congo	Building women's and children's resilience and ability to adapt to changing climate in Democratic Republic of Congo	Gender, food and water security, poverty reduction	800 - 2,000 (depending on the province)	Drought, floods	4.7	5,000
Democratic Republic of Congo	Building resilience of Muanda's communities from coastal erosion in the Democratic Republic of Congo	Coastal protection, human security	800 - 2,000 (depending on the province)	Sea level rise and coastal erosion,	5.3	5,000
Ghana	Integrating climate change into the management of priority health risks in Ghana	Health	1,100 - 2,100	Droughts, floods, heat	1.7	3,000
Guinea	To increase protection of coastal areas and communities from climate change and variability	Food security, poverty reduction	4,300	Droughts, floods, sea level rise and salt water intrusion	2.97	4,000

Country	Project title	Livelihood benefits	Average rainfall in country region (mm/yr.)	Main climate stressors	Project grant (US$, in millions)	No. of direct beneficiaries
Guinea	Strengthening resilience of farming communities' livelihoods against climate change in the Guinean Prefectures of Gaoual, Koundara and Mali	Food security, poverty reduction	4,300	Droughts	3.716	8,500
Guinea Bissau	Strengthening adaptive capacity and resilience to climate change in the agrarian and water resources sectors in Guinea-Bissau	Health, food and water security, poverty reduction	2,024	Droughts, flash floods, heavy winds	4.0	13,000
Eritrea	Climate change adaptation programme in water and agriculture in Anseba region, Eritrea	Food and water security, poverty reduction	350	Drought, flash flooding	6.5	6,141
Ethiopia	Coping with drought and climate change	Food and water security, poverty reduction	1,200	Drought	1	8,300
Ethiopia	Promoting autonomous adaptation at the community level in Ethiopia	Food and water security, poverty reduction	400 - 2,000 (depending on the region)	Drought, floods	5.3	29,000
Kenya	Adapting to climate change in arid and semi-arid lands (KACCAL)	Food security, poverty reduction	500 - 600	Drought	1	1,000
Liberia	Enhancing resilience of vulnerable coastal areas to climate change risks In Liberia	Coastal protection human security	2,391	Sea level rise, coastal erosion, flooding	2.9	3,000
Liberia	Enhancing resilience to climate change by mainstreaming adaptation concerns into agricultural sector development in Liberia	Food and water security, poverty reduction	2,391	Droughts, flooding	2.38	6,000
Liberia	Strengthening Liberia's capability to provide climate information and services to enhance climate resilient development and adaptation to climate change	Food and water security	2,391	Sea level rise, coastal erosion, flooding, droughts	6.07	4,500

Country	Project title	Livelihood benefits	Average rainfall in country region (mm/yr.)	Main climate stressors	Project grant (US$, in millions)	No. of direct beneficiaries
Malawi	Implementing urgent adaptation priorities through strengthened decentralized and national development plans	Food and water security, poverty reduction	600 - 1,800 (depending on the district)	Drought, floods	4.5	5,800
Mali	Programme support for climate change adaptation in the vulnerable regions of Mopti and Tombouctou (AF)	Food and water security, poverty reduction	800 - 2,000 (depending on the province)	Drought	8.5	12,000
Mali	Programme for the support of the national adaptation strategy to climate change in Mali (BMU)	Food and water security, poverty reduction	200 - 1,200 (depending on the region)	Drought	7.5	10,000
Mali	Strengthening the resilience of women producer group's and vulnerable communities in Mali	Gender, food and water security, poverty reduction	200 - 1,200 (depending on the region)	Drought	5,4	5,000
Mauritius	Climate change adaptation programme in the coastal zone of Mauritius	Coastal protection, human security	800 - 4,000 (coastal to central plateau)	Droughts, sea level rise, coastal erosion, flooding, cyclones	8.4	1,650
Mozambique	Coping with drought and climate change	Food security, poverty reduction	800	Drought, floods	1	800*
Mozambique	Adaptation in the coastal zones of Mozambique	Coastal protection, Human security, poverty reduction, food security	150 - 1200 (depending on the province)	Sea level rise, coastal erosion, drought, floods	4.43	10,741
Namibia	Adapting to climate change through the improvement of traditional crops and livestock farming	Food and water security, poverty reduction	450	Drought, floods	1	3,500

* The Coping with drought and climate change project suffered big losses from the 2013 floods. The target number of beneficiaries was 4267, however the result following the floods in fact impacted less than 1000.

Country	Project title	Livelihood benefits	Average rainfall in country region (mm/yr.)	Main climate stressors	Project grant (US$, in millions)	No. of direct beneficiaries
Namibia	Scaling up community resilience in Northern Namibia	Food and water security, poverty reduction	450 – 580 (depending on which northern region)	Drought, floods	3	4,000
Niger	Scaling up community-based adaptation	Food and water security, poverty reduction	200 - 1200 (depending on the region)	Drought,	3.75	10,000
Niger	Implementing NAPA priority interventions to build resilience and adaptive capacity of the agriculture sector to climate change in Niger	Food and water security, poverty reduction	200 - 1200 (depending on the region)	Drought,	5	5,000
Rwanda	Reducing vulnerability to climate change by establishing early warning and disaster preparedness systems and support for integrated watershed management in flood-prone areas	Food and water security, poverty reduction	1,400	Floods	3.48	1,000
São Tomé and Príncipe	Strengthening climate information and early warning systems in São Tomé and Principe for climate-resilient development and adaptation to climate change	Food and water security, coastal protection	3,200	Sea level rise and coastal erosion, drought, floods	3.6	3,500
Senegal	Strengthening land and ecosystem management under conditions of climate change in the Niayes and Casamance regions – Republic of Senegal	Gender, food and water security, poverty reduction	200 - 1,500 (depending on the region)	Drought	4.1	2,000
Sierra Leone	Building adaptive capacity to catalyse active public and private-sector participation to manage the exposure and sensitivity of water supply services to climate change	Water	300 - 1,500 (depending on the region)	Drought	2.5	200

Country	Project title	Livelihood benefits	Average rainfall in country region (mm/yr.)	Main climate stressors	Project grant (US$, in millions)	No. of direct beneficiaries
Zambia	Adaptation to the effects of drought and climate change in agro-ecological zones 1 and 2 in Zambia	Food and water security, poverty reduction	648	Drought, pests	3.79	1,000
Zimbabwe	Coping with drought and climate change	Food and water security, poverty reduction	454	Drought	1	1,000
Zimbabwe	Resilience smallholder farming livelihoods	Food and water security, poverty reduction	454	Drought	4	10,100

Note: Average rainfall figures disguise the high variability between seasons. Changes in the rainfall calendar such as later arrival of rains, shorter seasons, unpredictable rains and more intense rainfall events are common challenges to livelihoods across the entire project.

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304 East 45th Street, 9th Floor
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www.undp.org