

5-2009

Adaptation to Climate Change in Sub-Saharan Africa: An Investigation of Capacity-Building and National Adaptation Programs of Action

Emily A. Norford

Connecticut College, enorford@conncoll.edu

Follow this and additional works at: <http://digitalcommons.conncoll.edu/envirohp>



Part of the [Science and Technology Studies Commons](#)

Recommended Citation

Norford, Emily A., "Adaptation to Climate Change in Sub-Saharan Africa: An Investigation of Capacity-Building and National Adaptation Programs of Action" (2009). *Environmental Studies Honors Papers*. 1.
<http://digitalcommons.conncoll.edu/envirohp/1>

This Honors Paper is brought to you for free and open access by the Environmental Studies Program at Digital Commons @ Connecticut College. It has been accepted for inclusion in Environmental Studies Honors Papers by an authorized administrator of Digital Commons @ Connecticut College. For more information, please contact bpancier@conncoll.edu.

The views expressed in this paper are solely those of the author.

**Adaptation to Climate Change in Sub-Saharan Africa: An Investigation of
Capacity-Building and National Adaptation Programs of Action**

**Emily Norford
Connecticut College
Environmental Studies
Honors Thesis
May 2009**

Abstract

The phenomenon of anthropogenic climate change requires immediate attention. Many of the most severe effects of climate change will occur in Sub-Saharan Africa. Least-developed countries (LDCs) in this region are particularly vulnerable to climate change, due to their geographical location and their poor ability to cope with the consequences. This study examines the various impacts, vulnerabilities, and adaptation strategies associated with climate change in sub-Saharan African LDCs, using Tanzania, Burkina Faso, and Senegal as case studies. Each of these three countries has developed a National Adaptation Program of Action (NAPA), a country-specific climate change adaptation plan designed by the United Nations Framework Convention on Climate Change. A number of theories on adaptation emphasize the importance of having the capacity to adapt. Interestingly, the NAPAs do not include capacity-building in their prioritized lists of adaptation strategies. I hypothesize that this omission can be attributed in part to the countries' adaptation priorities and to the countries' low levels of extant capacity. It may be the desire of the LDCs to create technology-based adaptation plans that can be implemented by even their most vulnerable groups, namely poor rural populations. Furthermore, colonial legacies and low levels of development have, in some cases, compromised the capacity of governments to carry out the most basic and immediate tasks. Building the capacity to respond to climate change is not always possible for the governments of LDCs.

Acknowledgments

I would like to thank Professor Jane Dawson for her invaluable guidance and advice, for the entire duration of this project. I greatly appreciated her encouragement and her help in developing my ideas, revising countless drafts, and staying on track. Also, thank you to Professor Tristan Borer for being my second reader, despite her extremely busy schedule and the fact that my thesis is not even in her department. I am grateful for her constructive comments. Thanks to my parents and friends for their love and support.

Table of Contents

I.	Introduction	p. 4
II.	Capacity-Building from a Theoretical Perspective	p. 23
III.	Tanzania Case Study	p. 42
IV.	Burkina Faso Case Study	p. 65
V.	Senegal Case Study	p. 87
VI.	Conclusion	p. 106
VII.	Sources	p. 110

I. Introduction

The world's scientists and state leaders have finally reached a consensus that anthropogenic climate change is a reality and that the phenomenon requires immediate attention.¹ While climate-altering gases mix uniformly in the atmosphere regardless of the distribution of emission sources, the impacts of climate change will be far-reaching and unequal in distribution. Future generations of all socio-economic and income levels will feel the effects of climate change, even if greenhouse gas emissions were to be completely cut off today, since substances such as carbon dioxide remain in the atmosphere for an entire century.² Currently, the atmosphere's greenhouse gas concentrations have exceeded the Earth's natural range of the last 650,000 years.³ Scientists believe that a temperature rise of 2°C represents a threshold above which further temperature increases would have catastrophic consequences.⁴ Therefore, despite uncertainties regarding the exact magnitude and timing of the impacts, it is imperative that the world address climate change immediately. The globe's poorest populations are already beginning to suffer from the effects of climate change. However, the countries that suffer the most are also the least responsible for anthropogenic climate change, and are the least able to cope with its impacts.

Poor countries are the most heavily affected by climate change and have the least capacity to adapt. Least-developed countries (LDCs) have the world's smallest greenhouse gas emissions and thus have contributed the least to the climate change

¹ IPCC 4th Assessment Report

² Human Development Report 2007/2008 Summary, p. 3

³ Human Development Report 2007/2008 Summary, p. 9

⁴ Human Development Report 2007/2008 Summary

phenomenon.⁵ Ironically, the developed world – the advanced industrialized countries with the greatest responsibility for causing anthropogenic climate change in the first place – will not suffer nearly as much from climate change as LDCs and, additionally, have a much greater ability to cope with the negative impacts. The developed world is therefore in the position to assist LDCs in their adaptation endeavors, even if it is reluctant to do so, and it is important that special attention be given to the plight of LDCs.

In this thesis, I investigate the principal climate change adaptation strategies of LDCs in sub-Saharan Africa. I selected Africa as my area of study for two reasons: first of all, the effects of climate change will be particularly severe in this part of the world. Secondly, a great number of African countries are extremely poor and thus will face particular difficulties in coping with climate change's impacts. In response to the especially vulnerable situation of LDCs, the United Nations Framework Convention on Climate Change has designed country-specific adaptation strategies, entitled National Adaptation Programs of Action (NAPAs). However, capacity-building, an important component of effective adaptation to climate change, appears to be missing from the NAPAs' prioritized adaptation strategies. I seek to explain the lack of capacity-building plans, using Tanzania, Burkina Faso, and Senegal as case studies. I will argue that capacity-building is missing from the NAPAs because of the countries' low levels of existing capacity, and because of the countries' colonial legacies. I first will provide a background on climate-related vulnerabilities and the impacts of climate change on sub-

⁵ LDCs are a category of countries officially recognized by the United Nations and a number of other international bodies. The three major components of the definition of an LDC are low income, weak human resources, and economic vulnerability. UNFCCC website, "Frequently Asked Questions about LDCs, NAPAs, and the LEG." http://unfccc.int/cooperation_support/least_developed_countries_portal/frequently_asked_questions/items/4743.php.

Saharan Africa. I will also describe the rationale behind the NAPAs. At the end of this chapter, I will lay out the structure of my study.

Vulnerabilities

The continent of Africa is particularly vulnerable to the negative effects of climate change. The Intergovernmental Panel on Climate Change (IPCC) states this with high confidence in its Fourth Assessment Report, adding that the climate situation in this region is “aggravated by the interaction of ‘multiple stresses’... and low adaptive capacity.”⁶ According to both the United Nations Framework Convention on Climate Change and the IPCC, vulnerability is “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.”⁷ The distinction between “weather” and “climate” is also relevant: Weather is the phenomena of wind, rain, sunshine, clouds, and temperature on a day-to-day basis. Climate refers to the overall or average weather conditions that prevail over the longer term.⁸

Africa’s primary climate-related vulnerabilities stem from the negative impacts of climate change on agriculture and food security, water stress, ecosystem degradation, health risks, and weak adaptive capacity. With high confidence, the IPCC claims that adaptation strategies implemented by African farmers are insufficient in terms of responding to future climate change, and that “agricultural production and food security... are likely to be severely compromised.”⁹ Many African countries depend heavily on agriculture for local livelihoods and national GDP. The agricultural sector

⁶ IPCC Fourth Assessment Report, p. 435

⁷ IPCC Working Group II Glossary, <<http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>>.

⁸ Basher et al., in Climate Change in Africa, p. 273

⁹ IPCC 4th Assessment Report, p. 435

comprises between 10% and 70% of the GDP of African countries.¹⁰ The Saharan region of Africa could experience “agricultural losses of between 2 and 7% of GDP” by 2100.¹¹ Many areas in Africa already experience agricultural challenges due to semi-arid conditions, and climate change is projected to render marginal agricultural regions unsuitable for cultivation.¹² Prolonged droughts and floods, often attributed to climate change, intensify other challenges to agriculture such as crop diseases, poor soil fertility, and pests.¹³ Furthermore, it is likely that the changing climate will decrease the duration of growing seasons. In certain countries, crop yields are expected to decline up to 50% in the next twelve years.¹⁴ Small-scale farmers will be particularly negatively impacted, with net revenues from crops falling up to 90% over the next century.¹⁵ Overall, food security in Africa will be threatened and more Africans will suffer from hunger and famine.

Water shortages are one of the major ways in which climate change negatively affects human livelihood. The IPCC predicts with very high confidence that climate change will exacerbate water stress in areas already prone to water shortages, and will place a number of countries at risk of water stress even though they might not currently face water issues.¹⁶ Roughly 200 million people, approximately one-quarter of Africa’s population, already experience high water stress. This number could potentially double by the 2020s and triple by the 2050s.¹⁷ Alterations in rainfall patterns, attributed to climate change, can often lead to drought – a significant problem for Africans, since over

¹⁰ IPCC 4th Assessment Report, p. 439

¹¹ IPCC 4th Assessment Report, p. 447

¹² IPCC 4th Assessment Report, p. 435

¹³ IPCC 4th Assessment Report, p. 439

¹⁴ IPCC 4th Assessment Report, p. 435

¹⁵ IPCC 4th Assessment Report, p. 435

¹⁶ IPCC 4th Assessment Report, p. 435

¹⁷ IPCC 4th Assessment Report, p. 435

a third of Africa's population dwells in "drought-prone areas."¹⁸ Reduced agricultural productivity and increased susceptibility to diseases are two primary effects of drought. The Sahel region already experiences persistent drought, and thus is particularly vulnerable to further water shortages induced by climate change.¹⁹ "Drought affected areas in sub-Saharan Africa could expand by 60-90 million hectares, with dry land zones suffering losses of US\$26 billion by 2060."²⁰ The African Sahel is especially at risk to desertification, a climate process also influenced by rainfall patterns. The Sahelian ecological zone actually shifted southward by roughly 30 km as a result of reduced rainfall in the latter part of the 20th century.²¹ The southward spread of the desert destroyed grassland areas as well as some flora and fauna.²²

Climate change can cause significant ecosystem degradation, which negatively affects the livelihoods of many Africans. With very high confidence, the IPCC reports that noticeable changes are already occurring in an array of African ecosystems, "at a faster rate than anticipated."²³ In most of Africa's sub-Saharan countries, wood and charcoal provide approximately 80 to 90% of the energy consumed by poor households.²⁴ "Extreme poverty and the lack of access to other fuels mean that 80% of the overall African population relies primarily on biomass to meet its residential needs, with this fuel source supplying more than 80% of the energy consumed in sub-Saharan Africa."²⁵ This heavy dependence on biomass adds to Africa's vulnerability to ecosystem degradation. Moreover, a reliance on wood-based energy sources encourages deforestation, which

¹⁸ IPCC 4th Assessment Report, p. 437

¹⁹ IPCC 4th Assessment Report, p. 439

²⁰ Human Development Report 2007/2008, p. 18

²¹ IPCC 4th Assessment Report, p. 439

²² IPCC 4th Assessment Report, p. 439

²³ IPCC 4th Assessment Report, p. 435

²⁴ IPCC 4th Assessment Report, p. 442

²⁵ IPCC 4th Assessment Report, p. 442

accelerates the degradation caused by climate change. Mountain ecosystems, notably Mt. Kilimanjaro, are also undergoing modifications largely as a result of climate change. Mt. Kilimanjaro's ice cap may vanish for the first time in 11,000 years within the next two decades.²⁶ Disappearing ice caps will reduce water availability to neighboring communities.

While some areas in Africa will experience severe water shortages as a result of climate change, other regions will become increasingly endangered by flooding. With high confidence, the IPCC predicts the inundation of coastal lands.²⁷ Lakes and rivers will be impacted as climate change alters rainfall patterns. Both freshwater floods and sea water inundation compromise sanitation and the availability of potable water.²⁸ Changes in marine ecosystems will also contribute to the vulnerability of many African countries to climate change. "In Africa, highly productive ecosystems (mangroves, estuaries, deltas, coral reefs), which form the basis for important economic activities such as tourism and fisheries, are located in the coastal zone."²⁹ Coastal cities contain 40% of West Africa's population.³⁰ Damage to coral reefs, for instance, as a consequence of increased temperatures and acidification of the ocean, could reduce the fish supply. Fish are a vital source of food and revenue for many coastal African countries: for example, over 6% of Senegal's GDP comes from fisheries.³¹ Ecosystems such as mangroves protect against erosion, indicating that the degradation of marine ecosystems could

²⁶ IPCC 4th Assessment Report, p. 449

²⁷ IPCC 4th Assessment Report, p. 435

²⁸ IPCC 4th Assessment Report, p. 437

²⁹ IPCC 4th Assessment Report, p. 450

³⁰ IPCC 4th Assessment Report, p. 450

³¹ IPCC 4th Assessment Report, p. 448

increase vulnerability to sea-level rise. Rising sea levels may also contribute to flooding, which negatively impacts human health.

Climate change has significant implications for the health of populations in African countries, as the IPCC states with high confidence.³² Climate change is believed to “alter the ecology of some disease vectors in Africa, and consequently the spatial and temporal transmission of such diseases.”³³ Malaria already kills 1 million people per year, and climate change could cause an additional 220-400 million people to be exposed to the disease.³⁴ The increased scope of malaria is often ascribed to the warming of temperatures and changes in rainfall. Health stresses are not limited to disease exposure, however; limited food supply and poor nutrition increase human vulnerability as well. Furthermore, poor health in the present generation could have implications for development in the future.³⁵ Many poor countries lack the capacity to respond and adapt to these climate-related threats.

Capacities

Africa’s vulnerability to climate change is compounded by the weak adaptive capacities of its countries. The continent’s low level of development restricts its capacity to respond to the effects of a changing climate. Studies have shown that “sub-Saharan Africa is the only region in the world that has become poorer in this generation.”³⁶ This poverty can in part be explained by diminishing food security, decreasing real wealth, lack of economic growth, poor education, and the spread of HIV/AIDS.³⁷ Public services,

³² IPCC 4th Assessment Report, p. 435

³³ IPCC 4th Assessment Report, p. 435

³⁴ Human Development Report 2007/2008, p. 19

³⁵ IPCC 4th Assessment Report, p. 437

³⁶ IPCC 4th Assessment Report, p. 440

³⁷ IPCC 4th Assessment Report, p. 440

such as healthcare or response to an environmental disaster, often are impeded by poorly designed and implemented policies.³⁸ Many institutional and legal frameworks in African countries are inadequate for addressing climate challenges such as ecosystem degradation, droughts, and floods. Lack of access to technology, infrastructure, information, and markets also create barriers to adaptation.³⁹ For example, “Africa has been described as the world’s great laggard in technological advance in the area of agriculture,” and consequently many countries experience heightened climate change vulnerability due to inefficient irrigation technologies.⁴⁰ Environmental degradation and climate vulnerability are intensified by poor infrastructure and limited technology, as well as a dependence on natural resource extraction for energy, shelter, clean water, and food.⁴¹ African LDCs struggle to respond to climate-related vulnerabilities.

In order for countries to adapt to the effects of climate change, they must have the capacity to do so. Adaptation involves both responding to the negative impacts of climate change and adjusting accordingly. In this context, responding implies acknowledging the effects of climatic change, whereas adjusting consists of making changes in order to cope with the climatic changes. A country’s capacity is its ability or potential to generate a response and make the necessary adjustments.⁴² Studies suggest that institutions, knowledge, and technology are significant components of the capacity to adapt. Knowledge and understanding of climate vulnerabilities are required in order to plan an effective adaptation strategy. Technology enables policy-makers to gather sufficient information about a problem, and also forms the basis of many adaptation plans.

³⁸ IPCC 4th Assessment Report, p. 441

³⁹ IPCC 4th Assessment Report, p. 441

⁴⁰ IPCC 4th Assessment Report, p. 441

⁴¹ IPCC 4th Assessment Report, p. 441

⁴² IPCC 4th Assessment Report, p. 727

Institutions, at both the international and domestic levels, play a significant role in generating and implementing adaptation policies. In this study, I use the term “capacity” to refer to state capacity. State capacity has technical, intellectual, participatory, administrative, and political components. Technical and intellectual capacities are required for identifying adaptation needs and developing appropriate policy responses. Participatory capacity is important in order for stakeholders to have a voice in the decision-making process; and administrative or political capacity is necessary for the implementation of adaptation strategies.

Effective adaptation to climate change is necessary even with the implementation of strict climate change mitigation measures. Greenhouse gases remain in the atmosphere for a century; thus, the world has committed itself to the consequences of climate change well into the future. As demonstrated, poor African countries will be the hardest hit by climate change’s impacts. African LDCs suffer from an array of climate-related vulnerabilities and lack the capacity to adapt – in fact, many even lack the capacity required to generate an effective adaptation plan. Therefore, the international community must provide assistance in the adaptation arena.⁴³ While rich countries have been reluctant to cut down on fossil fuel consumption, the world’s wealthiest have begun to perceive that adapting to climate change is a necessity. Since the wealthy nations have the means to adapt, they are able to provide adaptive aid to those with “far more severe adaptation challenges.”⁴⁴ One way in which the developed world has responded to the plight of LDCs is by facilitating climate change adaptation plans.

⁴³ Human Development Report 2007/2008, p. 4

⁴⁴ Human Development Report 2007/2008, p. 24

National Adaptation Programs of Action

The United Nations Framework Convention on Climate Change (UNFCCC), in effect since March of 1994, has addressed the adaptation needs of LDCs by developing an agenda for National Adaptation Programs of Action (NAPAs).⁴⁵ According to the UNFCCC, the entire “rationale for developing NAPAs rests on the low adaptive capacity of LDCs”⁴⁶ These country-specific documents, developed by LDCs with guidance from the UNFCCC, are designed to facilitate immediate adaptation to the countries’ most urgent climate-related vulnerabilities.⁴⁷ In Article 4 of the Convention, the UNFCCC officially recognizes the “specific needs and special situations” of LDCs in terms of adapting to climate change.⁴⁸ In the 7th Conference of Parties (COP), the UNFCCC acknowledged that LDCs lack the capacity to adapt, as a result of vulnerability, widespread poverty, and poor human, infrastructural, and economic conditions.⁴⁹ Therefore, a number of international actors must provide adaptation assistance. The UNFCCC placed the Global Environment Facility (GEF)⁵⁰ in charge of activities such as improving data collection, analysis, and dissemination, providing specialized technical training, establishing and strengthening research centers, supporting climate change education, promoting technology transfers, and enhancing capacity.⁵¹ A climate change

⁴⁵ United Nations Framework Convention on Climate Change website, “Essential Background”

⁴⁶ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 8

⁴⁷ IPCC 4th Assessment Report, p. 731

⁴⁸ UNFCCC website, “Essential Background,” 4.9

⁴⁹ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7, p. 33

⁵⁰ The GEF is an international partnership of countries, institutions, and non-governmental organizations, designed to “address global environmental issues while supporting national sustainable development initiatives.” The GEF offers grants and also acts as “the designated financial mechanism for a number of multilateral environmental agreements or conventions; as such the GEF assists countries in meeting their obligations under the conventions.” GEF website, “What is the GEF?”

⁵¹ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7, pp. 33-35

fund and/or adaptation fund is designed to provide support for the prompt implementation of adaptation activities, monitoring climate-affected disease vectors, forecasting of severe weather events, and building capacity.⁵² However, the GEF and the climate change/adaptation fund are simply mechanisms designed to facilitate compliance with the UNFCCC, and do not play a significant role in terms of NAPA development.

As a further response to the specific situation of LDCs, the UNFCCC established an LDC work program, intended in part to support NAPA preparation.⁵³ The work program addresses the LDCs' inability to convey their "urgent and immediate needs in respect of their vulnerability and adaptation to the adverse effects of climate change."⁵⁴ The information contained in NAPAs "would help to build capacity" for responding to these needs. The UNFCCC, therefore, sets out NAPA development guidelines. NAPAs should be easily-comprehensible, country-driven and action-oriented, and should prioritize the LDCs' most pressing adaptation needs.⁵⁵ Specific guiding elements include a participatory process, a country-driven approach, a multidisciplinary approach, a complementary approach taking into account extant programs, sustainable development, gender equality, sound environmental management, cost-effectiveness, simplicity, and flexibility.⁵⁶

The NAPA preparation process consists of setting up a national NAPA team "composed of a lead agency and representatives of stakeholders including government

⁵²UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7, pp. 35-36

⁵³ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7, p. 36

⁵⁴ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 7

⁵⁵ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 8

⁵⁶ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 9

agencies and civil society.”⁵⁷ This team, in turn, assembles a group to compile information on the effects of climate change and coping strategies, to carry out a participatory vulnerability assessment, to identify crucial adaptation measures, and to identify and prioritize criteria for the selection of specific activities.⁵⁸ A consultative process generates adaptation ideas, and the national NAPA team turns these ideas into adaptation activities. Evaluating the proposed activities with the specified criteria yields a prioritized list of the most important adaptation activities. Following a specific, UNFCCC-designed format, the NAPA team then creates profiles of the priority activities. Profiles include a title, rationale, description (objectives, inputs, short- and long-term outcomes), and implementation strategy (involved institutions, risks, evaluation, financial resources, etc.).⁵⁹ Next, the document is reviewed by the public and revised if necessary, and a final review is conducted by a team of representatives from both government and civil society. Finally, after endorsement by the national government, the NAPA is disseminated to the public and to the UNFCCC secretariat.⁶⁰

The UNFCCC also suggests a structure for the NAPA document. An introduction should include relevant country-specific background information. A framework for the adaptation program should give an overview of the present and future negative impacts of climate change, how the NAPA relates to the country’s existing development goals, and

⁵⁷ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 9

⁵⁸ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, pp. 9-10

⁵⁹ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 10

⁶⁰ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 11

possible obstacles in implementing the NAPA.⁶¹ The next section should identify vital adaptation needs and pinpoint relevant adaptation strategies (such as policy reform and capacity building). Then, the NAPA should set out its criteria for the selection of priority activities. While it is ultimately up to the LDC to develop its own list of criteria, the UNFCCC proposes that the criteria include “level or degree of adverse effects of climate change; poverty reduction to enhance adaptive capacity; synergy with other multilateral environmental agreements; and cost-effectiveness.”⁶² The criteria should apply to a number of sectors, such as health, agriculture, water, infrastructure, land-use management, and coastal zones.⁶³ Finally, the document should contain the profiles of the selected priority activities.

An LDC expert group (LEG) has been established by the UNFCCC in order to provide LDCs with advice on preparing and implementing their NAPAs. This includes technical advice for identifying data and advice on the “capacity-building needs for LDCs in support of the preparation and implementation of NAPAs.”⁶⁴ The UNFCCC intends that the LEG be comprised of twelve competent experts. Five of the experts should be from African LDCs, two from Asian LDCs, two from Small Island Developing State LDCs, and three Annex II countries.⁶⁵ Therefore, the members of the LEG appropriately represent the regions of the world where adaptation needs are greatest.

⁶¹ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 11

⁶² UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 12

⁶³ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 12

⁶⁴ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 29/CP.7, p. 15

⁶⁵ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 29/CP.7, Annex, p. 15

NAPAs ideally will lead to long-term adaptation to the effects of climate change. One would assume, therefore, that these documents would be designed to increase all the major types of capacity required for effective adaptation. However, while the NAPA development process attempts to incorporate knowledge from a range of international, national, and local experts and stakeholders, and while the NAPA documents tend to prioritize technology-based adaptation, the NAPAs do not include specific plans for increasing state capacity. Many scholars believe that state capacity is an important component of adaptation.⁶⁶ In multiple instances, the UNFCCC mentions the need for capacity. It is curious, then, that the NAPAs that I have investigated appear to lack capacity-building plans.

Case Studies

Using three Sub-Saharan African LDCs as case studies, I investigate the role of capacity in the NAPAs, and attempt to explain why state capacity-building seems to be missing from the NAPAs' prioritized adaptation plans. Burkina Faso, Senegal, and Tanzania provide interesting case studies. These countries experience a range of climate-related vulnerabilities and have all developed NAPAs. All three countries have signed and ratified the Kyoto Protocol, a binding climate change agreement related to the UNFCCC, and belong to the non-Annex I group, meaning that, unlike the advanced industrialized countries, they are not obligated to reduce their greenhouse gas emissions. While Burkina Faso, Senegal, and Tanzania clearly fit into the category of LDCs in Sub-Saharan Africa, their differing circumstances in terms of economic diversity, natural resources, and level of development lead to variations in their vulnerabilities and

⁶⁶ The theories of scholars such as Barbara Connolly, Robert Keohane, Marc Levy, and Peter Haas will be examined in the following chapter.

capacities to adapt, and make them useful countries to investigate. Because the countries experience different sets of climate-related vulnerabilities and have different levels of existing state capacity, a comparison of the three countries helps to provide insight as to why the NAPAs do not prioritize capacity-building adaptation plans. Burkina Faso is the most resource-poor out of the three, Tanzania has the most corrupt government, and Senegal has maintained the closest relationship with its former colonizer.

Tanzania ranks 159th out of 177 countries in the Human Development Index, between Burkina Faso and Senegal.⁶⁷ The life expectancy is 51.0 years, lower than either Burkina Faso or Senegal. However, the adult literacy rate is 69.4⁶⁸ - much higher than either of the other countries. Like Senegal, Tanzania is a coastal country. Other noteworthy geographic features include Lake Victoria and Mount Kilimanjaro. Like both Burkina Faso and Senegal, emission levels are lower than average for Sub-Saharan Africa; though Tanzania contains 0.6% of the global population, average per capita carbon dioxide emissions are only 0.1 tons. Tanzania accounts for 0.0% of the world's emissions. To compare, OECD countries comprise 15% of the global population and account for nearly 50% of global emissions.⁶⁹

Burkina Faso is the only landlocked country out of the three. It is also the poorest and least developed. Ranked 176th out of 177 countries in the Human Development Index, the country's level of poverty is below the average for Sub-Saharan Africa as a whole.⁷⁰ With a population of 13 million,⁷¹ life expectancy is 51.4 years, and only 23.6 percent of adults are literate. The economy of Burkina Faso depends heavily on cotton

⁶⁷ Human Development Report 2007/2008, Country Fact Sheets – Tanzania

⁶⁸ Human Development Report 2007/2008, Country Fact Sheets – Tanzania

⁶⁹ Human Development Report 2007/2008, Country Fact Sheets – Tanzania

⁷⁰ Human Development Report 2007/2008, Country Fact Sheets – Burkina Faso

⁷¹ World Bank, Burkina Faso Country Brief

exports and is considerably less diversified than Senegal or Tanzania's economies. Burkina Faso has fewer natural resources than the other two countries, and receives minimal rainfall.⁷² In terms of climate change, Burkina Faso's emission levels are lower than the average for Sub-Saharan Africa. Furthermore, "with 0.2% of the world's population, Burkina Faso accounts for 0.0% of global emissions – an average of 0.1 tons of CO₂ per person."⁷³ In comparison, in 2004 the United States had per capita carbon dioxide emissions of 20.6 tons.⁷⁴

Senegal, a country of 10.8 million inhabitants,⁷⁵ ranks 156th out of 177 countries in the Human Development Index.⁷⁶ This HDI ranking is the highest of the three countries studied. Located on a coast, Senegal has more natural resources than Burkina Faso. Groundnuts, the chemical industry, services, tourism, and fisheries dominate the Senegalese economy, which more diversified than the economies of Burkina Faso or Tanzania.⁷⁷ Senegal's GDP growth rates have been higher than average for Sub-Saharan Africa. Life expectancy is 62.3 years – a considerably higher value than for the other two countries. 39.3 percent of adults are literate, more than in Burkina Faso but less than in Tanzania. Like Burkina Faso, Senegal accounts for 0.0% of the world's carbon dioxide emissions. Senegal comprises 0.2% of the global population, and emits on average 0.4 tons of carbon dioxide per inhabitant, a slightly higher per capita emission level than that of Burkina Faso or Tanzania.

⁷² World Bank, Burkina Faso Country Brief

⁷³ Human Development Report 2007/2008, Country Fact Sheets – Burkina Faso

⁷⁴ Human Development Report 2007/2008, Country Fact Sheets – Burkina Faso

⁷⁵ World Bank, Senegal Country Brief

⁷⁶ Human Development Report 2007/2008, Country Fact Sheets – Senegal

⁷⁷ World Bank, Senegal Country Brief

As shown by their emission levels, Tanzania, Burkina Faso, and Senegal make negligible contributions to climate change. Though the LDCs are not responsible for creating anthropogenic climate change, they are extremely vulnerable to its negative effects. Agriculture and livestock involve a huge percentage of the populations of the three countries, and these sectors are particularly susceptible to climate change impacts such as rainfall variability. Tanzania and Senegal also depend on their fishing industries, but sea-level rise, changes in water temperature, and coastal erosion threaten this means of livelihood. The need for adaptation is increasingly urgent, and the UNFCCC-designed NAPAs are intended to set forth effective adaptation plans.

Strategies to increase state capacity – a crucial component of adaptation, according to many scholars – appear to be missing from the NAPA documents. In this thesis, I explore reasons for why capacity-building is not a prominent component of the prioritized adaptation strategies. I conduct an assessment of how capacity fits into the NAPAs of the three case study countries. I also examine the climate-related vulnerabilities as perceived by the LDCs themselves and the country's existing levels of capacity. I pay particular attention to the countries' existing state capacity as an explanation for the omission of capacity-building adaptation plans. In addition, I will investigate the specific vulnerabilities of Burkina Faso, Senegal, and Tanzania, and how well the countries are addressing these vulnerabilities in their NAPAs. I had also planned to examine the advisory role of the UNFCCC, and to look at whether the advice provided by the UNFCCC discouraged the integration of capacity-building plans; however, I elected not to continue this particular investigation, as my initial findings suggested that

the advisory role of the UNFCCC did not in fact influence the capacity-building content of the NAPAs.

I begin my study with a theoretical chapter on capacity and the NAPAs. I define capacity, explain the need for capacity, and outline scholarly theories on capacity-building in terms of adaptation to climate change. In this chapter, I also introduce my hypotheses and explain my methodology. I will argue that capacity-building plans have been omitted from the prioritized lists in the NAPAs of Tanzania, Burkina Faso, and Senegal for two principal reasons: One, the countries themselves lack the capacity to implement capacity-building adaptation strategies. Two, as a result of colonial legacies, governments lack the capacity to even develop capacity-building plans. To test these hypotheses, I will analyze the NAPA content, the climate-related vulnerabilities, and the historical background of each country. I use the Environmental Sustainability Index as a measure of existing capacity.

After the theoretical chapter, I include a chapter for each of the three case study countries. In the first case study chapter, on Tanzania, I illustrate the NAPA development process in detail. I show that Tanzania's NAPA follows the UNCCC's guidelines, addresses a number of the country's climate-related vulnerabilities, and yet fails to include any capacity-building plans. Tanzania's low level of existing state capacity explains this omission. The colonial legacy appears to have contributed to the poor ability of the government to function. In the following chapter, I explore the severity of Burkina Faso's climate situation. I also demonstrate that, while the NAPA matches up with the structure proposed by the UNFCCC, the country makes no mention of capacity-building in its list of prioritized adaptation strategies. Like Tanzania, Burkina Faso has a weak

government and suffers from a rough colonial history. Senegal is somewhat different from the other two countries, even though it experiences almost the exact same climate-related vulnerabilities as Tanzania. Like the other countries, Senegal's NAPA does not include capacity-building in its final list of priority adaptation activities. However, this NAPA pays much greater attention to the need for capacity than the other NAPAs in this study. Senegal appears to have a greater amount of existing state capacity than Burkina Faso or Tanzania. Furthermore, Senegal experienced a smooth transition to independence and maintained a close relationship with its former colonizer.

Overall, I will argue that capacity-building plans have not been included in the NAPAs' prioritized adaptation activities because of low state capacity and, in some cases, colonial legacy. In all three countries – and in sub-Saharan LDCs in general – poor, rural populations are the groups the most vulnerable to climate change. These groups would likely be unable to implement adaptation plans that have a capacity-building focus, and those responsible for the development of NAPAs might have purposely selected priority activities that the most vulnerable groups would be able to execute. Tanzania and Burkina Faso have extremely low levels of state capacity; the poorly-functioning governments struggle to provide even the most basic services, and are unable to develop capacity-building plans. Likewise, both of these countries have faced governmental difficulties ever since their independence from colonial rule. Senegal, on the other hand, has enjoyed relatively stable and effective governance – in part thanks to a positive colonial legacy. Consequently, the Senegalese government seems to have a higher level of state capacity than the other two cases, and Senegal's NAPA demonstrates a greater awareness of the need for capacity-building.

II. Capacity-Building and Adaptation from a Theoretical Perspective

Most theorists agree that state capacity is an important factor in increasing a country's ability to adapt to the effects of climate change. However, the National Adaptation Programs of Action of least-developed countries in Sub-Saharan Africa do not seem to consider capacity building to be a priority. The United Nations Framework Convention on Climate Change, the institution backing the NAPA preparation process, recognizes that LDCs lack the capacity to adapt to climate change, and sometimes even lack the capacity to communicate their climate-related vulnerabilities and needs.⁷⁸ Why, then, have countries failed to include specific plans for capacity-building in the NAPA documents' prioritized lists of adaptation activities? An examination of climate-related vulnerabilities, NAPA content, and country characteristics leads to two major hypotheses for why this may be the case. The hypotheses concentrate on the African LDCs' own perceptions of vulnerabilities to climate change and the countries' developmental situation. Tanzania, Burkina Faso, and Senegal provide useful case studies with which to test these hypotheses.

This chapter includes explanations of the approach behind NAPA development, capacity-building, my hypotheses, and methodology. The NAPAs are intended to follow a country-driven, bottom-up approach, indicating that each individual LDC is responsible for developing its own climate change adaptation plans. Definitions and theories on capacity-building demonstrate the need for capacity in order to adapt to climate change.

⁷⁸ In its 2001 Conference of Parties, the UNFCCC set out a specific scope for capacity building in LDCs, which includes the development of an implementation program taking into account "the role of research and training in capacity building," "developing and enhancing technical capacities and skills to... develop national adaptation programs of action" UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 2/CP.7, p. 11

Colonial history and indicators from the Environmental Sustainability Index and the Human Development Report provide a picture of each country's level of development, including state capacity. In particular, I use education, social and institutional capacity, and scientific and technical capacity as indicators of state capacity. In light of the NAPA approach, the importance of capacity, and the low level of existing capacity in LDCs, I develop hypotheses to explain why the NAPAs do not contain adaptation strategies that focus on capacity-building.

The NAPA Approach

In 2001, the seventh Conference of Parties acknowledged that LDCs have a unique situation and lack the capability to cope with the challenges of adapting to the negative effects of climate change.⁷⁹ In response to this recognition, the UNFCCC established an LDC work program and initiated the development of National Adaptation Programs of Action (NAPAs). The NAPA documents are designed to “prioritize urgent adaptation needs” and to “draw on existing information and community-level input” in order to pinpoint adaptation projects that will allow countries to deal with the immediate impacts of climate change.⁸⁰ The UNFCCC reasons that since LDCs have such constricted abilities to adapt, the most appropriate step forward is a new approach designed specifically for these types of countries. The intention is that NAPAs will “focus on enhancing capacity to adapt to climate variability, which itself [will] help address the adverse affects of climate change.”⁸¹ In the previous chapter, I explained the

⁷⁹ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7

⁸⁰ UNFCCC website, “Adaptation”

⁸¹ UNFCCC website, “Adaptation”

specific guidelines and frameworks set forth by the UNFCCC for the preparation of the NAPA documents.

The NAPA programs should consider strategies to cope with climate change that already exist at local levels, and should use these strategies as the starting points for the identification of priority activities.⁸² The alternative would be a top-down approach that begins with scenario-based modeling and looks at future vulnerabilities and long-term national policies, which would be less effective in addressing urgent present-day needs – “those for which further delay could increase vulnerability or lead to increased costs at a later stage.”⁸³ The NAPA process gives a high degree of prominence to community-level input because communities often are the main stakeholders and have local information that could be valuable in greater contexts.⁸⁴ Furthermore, the UNFCCC believes that a bottom-up, country-driven approach is the best option because it ensures that states have an active interest in following through with their adaptation plans.⁸⁵ If a wide range of stakeholders participate in the NAPA preparation process, then the final document should reflect what the country as a whole perceives to be its principal adaptation needs. Everyone involved, from the national government to local communities, should be motivated to implement the adaptation efforts. However, capacity is required in order for successful adaptation to occur. Given the bottom-up, participatory nature of NAPA development, I investigate country-level explanations for why the NAPAs do not include capacity-building plans. Do the NAPAs lack capacity-building because of the country’s

⁸² UNFCCC website, “Adaptation”

⁸³ UNFCCC website, “Adaptation”

⁸⁴ UNFCCC website, “Adaptation”

⁸⁵ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7

own perceptions of vulnerabilities to climate change? Are the countries simply unable to develop capacity-building plans because they lack the state capacity to do so?

Definitions

In order to understand the importance of building adaptation capacity in vulnerable countries, it is helpful to be familiar with the terminology. Definitions of capacity distinguish between capacity-building and adaptation capacity. The IPCC describes adaptation capacity as “the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantages of opportunities, or to cope with consequences.”⁸⁶ The UNFCCC defines capacity-building as “the process of developing technical skills and institutional capability in developing countries and economies in transition to enable them to address effectively the causes and results of climate change.”⁸⁷ In this report, I concentrate on capacity-building, with a focus on the capability to adapt to the adverse effects of climate change. The technical skills and institutional capabilities required for a country to adapt to climate change include technology and expertise to determine appropriate policy responses; the ability of stakeholders (including communities and local NGOs) to participate in decision-making; and administrative and legal frameworks to develop, implement, and enforce new policies.⁸⁸ Overall, I will use the term “state capacity” to refer to this type of capacity to adapt, including technical/intellectual capacity for appropriate policy development; the capacity for participation in decision-making; and political/administrative capacity for policy implementation.

⁸⁶ IPCC website, “Glossary”

⁸⁷ UNFCCC website, “Essential Background”

⁸⁸ The Global Development Research Center website, “Defining Capacity Building”

The Need for Capacity

Climate-related hazards such as droughts, floods, and severe storms affect millions of Africans annually.⁸⁹ African LDCs experience a number of stresses that exacerbate the impacts of climate change, including poverty, infectious disease, fragile environments, unsustainable development, and limited institutional capacities.⁹⁰ Disaster risk reduction theory suggests three major activity areas: risk assessment, risk management practices, and the implementation. Well-designed policies and institutional competence are required for assessment and management activities to be carried out.⁹¹ These activities would benefit efforts to adapt to the effects of climate change. Building the capacity to respond to climatic variability should be part of a country's adaptation strategies. "Adaptation initiatives need to be developed on a frank assessment of the real problems faced in Africa and should be targeted at decision processes that have long-term implications, for example, in respect to land use legislation, urban planning and public infrastructure."⁹² Strategies to deal with future climatic variability should begin with building capacity to tackle current climatic variability. The NAPAs of Tanzania, Burkina Faso, and Senegal do not include specific capacity-building projects of this nature.

Some African countries, including LDCs, have voiced their desire to increase the capacities that they require in order to "effectively implement their commitments under the [UNFCCC]."⁹³ This capacity-building consists of networking and information sharing, developing human resources, and strengthening institutions.⁹⁴ Although

⁸⁹ Basher et al., in Climate Change and Africa, p. 271

⁹⁰ Basher et al., in Climate Change and Africa, p. 271

⁹¹ Basher et al., in Climate Change and Africa, p. 271

⁹² Basher et al., in Climate Change and Africa, p. 275

⁹³ Basher et al., in Climate Change and Africa, p. 301

⁹⁴ Basher et al., in Climate Change and Africa, p. 301

implementing the UNFCCC is different from implementing a well-designed NAPA, many of the capacity requirements overlap. Assessments of climate-related vulnerabilities and adaptation strategies involve a number of socio-economic sectors, including water resources, agriculture, forestry, coastal zones, and human health.⁹⁵ Academic, scientific, technical and research institutions, as well as non-governmental organizations, are of key importance. Vulnerability and adaptation assessments require extensive data collection and analysis, and sometimes involve the use of computer modeling and other advanced technologies. Sharing information and expertise can facilitate the analysis process. It is also important to improve the capacity for incorporating climate change policies into national development plans, for policy-making, and for linking policy and science.⁹⁶

Scholarly theories on capacity-building

Scholars put forth varying theories about how best to increase a country's capacity to adapt to climate change. Barbara Connolly focuses largely on political capacity. She argues that increasing the political capacity of local environmental NGOs is a highly effective way to promote the environmental concern necessary for successful adaptation.⁹⁷ NGOs often are able to inspire self-interest among local communities and governments, and thus encourage a country to develop adaptation initiatives.

Furthermore, increasing a country's political capacity can reduce the country's dependence on external support.⁹⁸ International organizations can help to enhance a country's political capacity by increasing the effectiveness of financial transfers in areas where capacity and concern intersect. For instance, financial transfers can build a

⁹⁵ Basher et al., in *Climate Change and Africa*, p. 301

⁹⁶ Basher et al., in *Climate Change and Africa*, p. 301

⁹⁷ Keohane and Levy, eds., p. 347

⁹⁸ Keohane and Levy, eds. p. 347

country's capability to implement environmental reforms.⁹⁹ Sustained financial aid helps cover the costs of maintaining environmental programs, "by funding technical assistance to create long-term mechanisms, providing seed money, or incorporating conditionality lending to reforms that will yield sustainable revenues."¹⁰⁰ However, NAPAs are not likely to propose adaptation strategies that require exterior financial transfers, because of their country-driven nature.

Connolly emphasizes several major lines of inquiry regarding aid and capacity-building: identification of missing capacity, self-interest of the institution that provides the aid, and the recipient country's level of concern.¹⁰¹ Increasing the effectiveness of aid programs depends on correctly identifying the missing form and location of capacity. Providing aid solely to increase a government's technical capacity may be ineffective if the country lacks the political and administrative capacities required to implement new technology-focused policies.¹⁰² Although the NAPAs do not involve external aid, Connolly's theory is relevant here because many LDCs, such as Tanzania and Burkina Faso, have poorly functioning governments that are sometimes incapable of carrying out basic tasks of the nation-state, never mind implementing climate change strategies.

Connolly also theorizes that even if an aid-providing institution is able to discern the appropriate type of capacity required by the recipient country, the institution's own self-interests may stand in its way.¹⁰³ This statement can also apply to the need for cooperation between the different government ministries that are implicated in NAPA implementation. Additionally, it is helpful if the involved actors have a real interest in

⁹⁹ Keohane and Levy, eds., p. 348

¹⁰⁰ Keohane and Levy, eds., p. 344

¹⁰¹ Keohane and Levy, eds., p. 344

¹⁰² Keohane and Levy, eds., chapter 10

¹⁰³ Keohane and Levy, eds., chapter 10

building capacity to adapt to climate change impacts; “interventions to augment recipient capacity are especially profitable in areas where capacity and concern are mutually reinforcing.”¹⁰⁴ For exterior capacity-building aid to be most beneficial, the recipient country must be genuinely concerned about its vulnerabilities and therefore eager to increase its adaptation efforts once its capacities have been improved.¹⁰⁵ A lack of concern could be more of a constraint than a lack of capacity; aid to generate capacity is unlikely to lead to adaptation if the country is not motivated to act. Likewise, adaptation plans proposed by the NAPAs are more likely to be successful if the country’s citizens are motivated to respond to climate-related vulnerabilities.

Robert Keohane stresses the importance of a high level of concern within a country receiving aid to enhance its capacity to adapt to the effects of climate change. Similar to Connolly’s argument, Keohane believes that if a lack of capacity is the main constraint and concern is high, providing capacity-building aid may lead to greater efforts by the country involved.¹⁰⁶ Building capacity is difficult even if a recipient country has a strong desire to adapt to climate change, as the NAPAs suggest. Keohane mentions that, in the situation of exterior capacity-building aid, donor institutions often face significant challenges that have nothing to do with the recipient country’s level of concern.

According to Keohane, sovereignty issues and poor strategies on the part of international institutions constitute the chief obstacles to effective capacity-building. International institutions often are not authorized to enforce rules within jurisdiction of sovereign states. Since these institutions – primarily the UNFCCC and the GEF, in terms of adapting to the effects of climate change – usually are unable to carry out large scale

¹⁰⁴ Keohane and Levy, eds., p. 344

¹⁰⁵ Keohane and Levy, eds., p. 26

¹⁰⁶ Keohane and Levy, eds., p. 26

projects on their own, they must rely on national governments or domestic NGOs to implement their recommendations and to ensure that the aid is used properly. Therefore, the capacity of the recipient country is crucial.¹⁰⁷ Sometimes international institutions try to find problems in LDCs that match formerly-proposed solutions, instead of developing new solutions for country-specific problems. However, even if an institution provides the appropriate type of aid to enhance capacity, it may have little effect “if the fundamental issue is a lack of concern.”¹⁰⁸ As Connolly points out, aid will likely be much more effective if the recipient country has a strong desire to adapt.

Keohane builds upon his theory in collaboration with Marc Levy and Peter Haas. The three scholars underline the value of technical capacity in addition to concern. National governments require technical capacity in order to develop appropriate policies or regulations that take into account “both the environmental realities and the political and economic incentives facing governments, firms, and other organizations that can affect outcomes.”¹⁰⁹ Even with pressure from international and domestic organizations, governments at both national and local levels sometimes lack the capacity to implement policy change. If an LDC does not have sufficient technical capacity, the government may be “technically ignorant” and thus less able to develop effective adaptation strategies. Even if non-governmental actors proposed the adaptation strategies, “technically ignorant” governments might be unable to evaluate the costs and benefits of these plans.¹¹⁰ In the case of the NAPAs, the NAPA teams require technical capacity to carry out their vulnerability assessments and to evaluate proposed priority activities. Keohane,

¹⁰⁷ Keohane and Levy, eds., p. 12

¹⁰⁸ Keohane and Levy, eds., p. 26

¹⁰⁹ Haas, Keohane, and Levy, eds., p. 404

¹¹⁰ Haas, Keohane, and Levy, eds., p. 407

Levy, and Haas believe that technical capacity is generally necessary in order to come up with appropriate policy responses. However, once “regulations have been specified and agreed upon, the burden of action shifts to national responses, which are often inhibited by low political and administrative capacity.”¹¹¹ Therefore, a country requires strong capacities in a variety of areas in order to develop and implement adaptation strategies.

The three scholars state that international institutions can increase technical, political, and administrative capacities in LDCs through a number of mechanisms. In terms of adaptation to climate change, the UNFCCC is an institution that could potentially enhance capacity in LDCs through its advisory role in the NAPA preparation process. As “vehicles for transferring skills and expertise, and for empowering domestic actors,”¹¹² institutions provide capacity-building aid by sharing norms, technology, and information.¹¹³ The spread of international norms, rules, and principles sets in motion conditions for state capacity-building and policy implementation.¹¹⁴ Often, the internalization of norms and principles precedes the adoption of binding rules. A country is more likely to adhere to new regulations if the regulations reflect existing values. It is also important for a government to already have the capacity to develop and enforce appropriate policies before rules are implemented. While NAPAs are not binding, states might be more likely to prioritize certain adaptation strategies if these strategies fit into existing national norms. Ensuring that the NAPAs reflect national norms and community

¹¹¹ Haas, Keohane, and Levy, eds., p. 404

¹¹² Haas, Keohane, and Levy, eds., p. 414

¹¹³ The UNFCCC, including the LEG, and the GEF might spread norms and share information by setting guidelines for the preparation of the NAPA documents. These institutions also support capacity-building and adaptation by promoting the sharing of technology and expertise, at regional and international levels.

¹¹⁴ Haas, Keohane, and Levy, eds., p. 415

practices is part of the rationale behind the UNFCCC-recommended country-driven approach.

Keohane, Levy, and Haas have categorized the capacity-building efforts of international institutions into three general areas: increasing concern, enhancing the contractual environment, and building national capacity.¹¹⁵ In the first category, institutions reveal direct and indirect linkages of issues, compile and distribute scientific information, and generate opportunities to intensify domestic pressure on policy-makers.¹¹⁶ The UNFCCC fits into this category through its role in the NAPA development process. By encouraging all LDCs to develop a NAPA, the UNFCCC has increased concern in respect to climate-related vulnerabilities. Additionally, the UNFCCC has recommended that each NAPA include a section that explains the linkages between the NAPA and existing national environment/development programs – thus, the UNFCCC contributes to issue linkage. Secondly, institutions are able to provide negotiation arenas that both reduce transaction costs and facilitate the decision-making process, monitor environmental quality, policy, and performance, and increase accountability. Lastly, international institutions can increase national capacity by building interorganizational networks to share technical and management expertise, transfer financial assistance and policy-relevant information, and strengthen domestic bureaucratic power.¹¹⁷ The UNFCCC has not significantly contributed to increasing the capacity of LDCs, since the NAPA is intended to be completely developed and carried out by the individual countries themselves. Overall, theorists argue that international institutions can play a major role in building the capacities of LDCs to adapt to the

¹¹⁵ Haas, Keohane, and Levy, eds., pp. 406-407

¹¹⁶ Haas, Keohane, and Levy, eds., pp. 406-407

¹¹⁷ Haas, Keohane, and Levy, eds., pp. 406-407

impacts of climate change, and also argue that technical, political, and administrative capacities are required for effective adaptation.

Hypotheses and selection of case studies

Connolly, Keohane, Levy, and Haas all believe that international institutions can assist LDCs in their endeavors to build the capacity necessary for adaptation to climate change, and that the recipient country must have a high level of concern if capacity-building aid is to be effective. Connolly emphasizes the need to build political capacity, whereas Keohane, Levy, and Haas stress the importance of technical capacity. The fact that African LDCs have developed NAPAs indicates that they are concerned about their ability to adapt to the effects of climate change, yet the NAPA documents make very little mention of building state capacity, including technical/intellectual capacity and political/administrative capacity. In several instances, the NAPAs list the institutional actors who will be responsible for implementing specific adaptation programs. Senegal's NAPA even cites lack of capacity as a principle obstacle to adaptation.¹¹⁸ Nevertheless, none of the countries' NAPAs propose specific adaptation plans designed to build capacity. Using Burkina Faso, Senegal, and Tanzania as case studies, I will explore the following hypotheses to explain why this might have occurred: (1) African LDCs, particularly poor, rural populations, lack the capacity to implement capacity-building adaptation plans. The countries' highest priorities are adaptation strategies that even the most vulnerable populations are able to implement;¹¹⁹ and (2) as a result of colonial legacies, some LDC governments simply lack the capacity to design capacity-building

¹¹⁸ Senegal NAPA, section 3.4 B

¹¹⁹ Perception of urgent adaptation needs relates to Connolly and Keohane's theories about concern.

plans.¹²⁰ In the beginning stages of this study, I also hypothesized that the UNFCCC-designed process for creating the NAPAs is too action-oriented to include relatively passive adaptation strategies such as capacity-building. Therefore, I had speculated that NAPAs might not contain capacity-building because international advising institutions are not leading them in that direction.¹²¹ However, my initial research yielded results that contradicted this hypothesis, and I did not explore the hypothesis further.

Tanzania, Burkina Faso, and Senegal make valuable case studies for several reasons. They are all LDCs in sub-Saharan Africa, one of the world's most vulnerable regions to climate change. While Senegal and Tanzania are located on coasts, and while Tanzania has Mount Kilimanjaro and Lake Victoria, Burkina Faso is landlocked and extremely arid; geographic characteristics might influence a country's vulnerabilities and its capacity to adapt. Senegal has a higher level of development than the other two countries, which likely has a positive effect on its capacity-building prospects. All three countries have developed NAPAs over the past several years. Overall, the primary similarities of the three NAPAs include the basic structure and the prioritization of adaptation plans addressing agriculture. The documents open with a country background, an overview of the NAPA development process, the objectives of the NAPA, and the project selection and prioritization criteria. A section in each NAPA demonstrates the linkages between the NAPA and existing sustainable development programs. The documents also identify the climate-related vulnerabilities of each main societal structure or geographic zone. At the end of the document, the profiles of the top-priority adaptation

¹²⁰ The notion that governments do not have the capacity to build capacity relates to Connolly's theory about correctly identifying missing capacity, and to Levy, Keohane, and Haas's theory about technical capacity.

¹²¹ This hypothesis was formed after considering Keohane's theory about the obstacles faced by international institutions.

projects are listed. These profiles include a justification of the project, objectives, anticipated outcomes, the costs of specific activities, and a list of the institutions that will play a role in the project's implementation. Slight differences between the NAPAs are found in the amount of detail of specific activities in the project profiles, the criteria for the selection and prioritization of projects, and the inclusion of a section on potential barriers to implementation.

To test my hypotheses, I first carry out an investigation of the climate-related vulnerabilities of each of the three countries. I examine the NAPAs in the context of the scholarly theories, looking for mentions of capacity-building, and I investigate how well the NAPAs addressed the countries' vulnerabilities to the effects of climate change. In order to gain an understanding of existing state capacity, I investigate the political and economic situations of the case study countries. Historical backgrounds and indicators from the Environmental Sustainability Index are particularly valuable tools for measuring state capacity. I will demonstrate that the lack of capacity-building in the NAPAs corresponds to low levels of state capacity, which in turn can be explained by colonial legacies.

Methodology

The 2005 Environmental Sustainability Index (ESI) provides a useful tool with which to measure environmental sustainability, vulnerability, and capacity to adapt. The ESI consists of five broad categories, which are divided into twenty-one uniformly-weighted indicators and then further broken down into seventy-six data sets. Higher degrees of specification allow one to more accurately gauge an individual country's capacity and environmental situation. In terms of examining a country's capacity-

building potential, the Reducing Human Vulnerability and Social and Institutional Capacity categories provide the most useful information.

The indicators in the Reducing Human Vulnerability category are Environmental Health, Basic Human Sustenance, and Reducing Environment-Related Natural Disaster Vulnerability. Data sets for Environmental Health measure the death rate from intestinal infectious diseases, the child death rate from respiratory diseases, and child mortality per 1,000 live births. The most relevant data sets under Basic Human Sustenance are percentage of undernourished in total population, and percentage of population with access to improved drinking water source. Reducing Environment-Related Natural Disaster Vulnerability data sets incorporate the average number of deaths per million inhabitants from floods, tropical cyclones and droughts, and the Environmental Hazard Exposure Index.¹²²

The Social and Institutional Capacity category includes Environmental Governance, Eco-Efficiency, and Science and Technology. Several of the data sets for the Environmental Governance indicator are corruption measure, government effectiveness, percentage of total land area under protected status, local Agenda 21 initiatives per million people, civil and political liberties, knowledge creation in environmental science, technology and policy; and democracy measure. Eco-efficiency data sets measure energy efficiency, and hydropower and renewable energy production as a percentage of total energy consumption. Data sets for the Science and Technology indicator include an innovation index, a digital access index, female primary education

¹²² Esty et al, 2005 Environmental Sustainability Index

completion rate, gross tertiary enrollment rate, and number of researchers per million inhabitants.¹²³

Several specific ESI indicators correspond to the theories put forth by Connolly, Keohane, Levy, and Haas, and relate to the three hypotheses concerning the NAPAs' lack of capacity-building plans. The values for the Environmental Health and Basic Human Sustenance variables could indicate a country's level of concern, relating to Keohane's principal theory. If the health and food supply of a country's population are endangered as a result of the effects of climate change, the country will likely have a high level of concern and be motivated to respond. The Environmental Governance indicator could serve as a measure of a country's political capacity, a focal point for Connolly. Eco-Efficiency and Science and Technology might reveal a country's level of technical capacity, which is emphasized by Keohane, Levy, and Haas. Overall, based on the ESI data sets, it appears as though all three countries should have high levels of concern and low levels of political and technical capacity. Therefore, do the NAPAs fail to include capacity-building in their prioritized adaptation plans because they perceive other adaptation strategies to be more urgent? Do the LDCs lack the domestic technical and intellectual expertise to identify their capacity needs and propose corresponding capacity-building strategies in the first place?

The ESI indicators that relate the most clearly to the NAPAs of Tanzania, Burkina Faso, and Senegal are Environmental Health, Basic Human Sustenance, and Reducing Environment-Related Natural Disaster Vulnerability, under the Reducing Human Vulnerability Category. Under the category of Social and Institutional Capacity, the Eco-Efficiency and Science and Technology indicators relate the most to the adaptation

¹²³ Esty et al, 2005 Environmental Sustainability Index

strategies put forth by the NAPAs. In 2005, the ESI indicator values for Tanzania, Burkina Faso, and Senegal, respectively, were as follows: Environmental Health, -0.75, -0.95, -0.45; Basic Human Sustenance, -1.08, -0.90, -0.52; Reducing Environment-Related Natural Disaster Vulnerability, 0.49, 0.67, 0.46; Eco-Efficiency, 0.93, 0.23, -0.07; and Science and Technology, -0.63, -1.47, -0.74. The NAPAs imply that there is a high level of concern about the negative implications climate change will have for human health. Tanzania's NAPA gives much attention to diseases that are exacerbated by the various effects of climate change. All three countries prioritize adaptation plans related to agriculture, since climate change greatly endangers the ability of their populations to sustain themselves. Early warning systems for climate-related hazards are also high on the countries' lists of priorities. In terms of eco-efficiency, the NAPAs of all countries included plans to install renewable energy sources in households.

It is noteworthy that specific strategies for how to build state capacity, including technical/intellectual capacity and political/administrative capacity, are absent from all three NAPAs. Another interesting absence is a mention of international aid. As the theorists point out, capacity-building and aid from international institutions are often interrelated. If an LDC wished to build technical capacity, for example, it would likely require external aid in the form of funding, a technology transfer, or outside expertise. The UNFCCC already promotes providing aid to LDCs through the Clean Development Mechanism of the Kyoto Protocol, and climate change and adaptation funds provide additional financial resources for NAPA adaptation activities.¹²⁴ Furthermore, it is likely that the NAPAs do not mention international aid simply because the countries wish to

¹²⁴ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session, Decision 5/CP.7, pp. 35-36

become self-sufficient in their adaptation efforts. The NAPAs are intended to yield sustainable adaptation strategies that are able to be implemented by the countries themselves. A reliance on outside organizations might perpetuate the vulnerability of LDCs, causing them to depend on external aid rather than developing domestic mechanisms to respond to in-country challenges. Given the assumption that LDCs want to avoid dependence on outside aid, it is interesting that the NAPAs do not contain domestic capacity-building plans. If Connolly is correct about the importance of political capacity in terms of adapting to the effects of climate change, then the actors involved in the NAPA development process overlooked a significant component of effective adaptation. While all three NAPAs stressed the importance of technology (for early warning systems, agriculture, irrigation, and renewable energy, among others), none of the documents proposed measures to actually build technological capacity. Under the presumption that the UNFCCC provided the correct guidelines for developing the NAPAs, in the next chapters I test my hypotheses as to why the NAPAs do not contain capacity-building plans. Is long-term capacity-building not as urgent as other adaptation priorities? Do the LDCs ironically lack the capacity required in order develop adaptation plans designed to build state capacity?

Burkina Faso, Senegal, and Tanzania have finalized their NAPAs relatively recently. Out of the three countries, Senegal published its NAPA first, in 2006. Tanzania finished its NAPA in January, 2007, and Burkina Faso in November, 2007. It may be too early to study results in order to determine the effectiveness of the documents in terms of successful adaptation to climate change. However, one can gain valuable insight from the NAPA development process and from how well the NAPA adaptation plans correspond

to the country's climate-related vulnerabilities. In the context of the ESI indicators and the scholarly theories on capacity-building, I examine the NAPA preparation process and the role of the UNFCCC, the countries' vulnerabilities to climate change, the priority adaptation projects found in the NAPAs, and the domestic situations of the three countries in terms of geography, natural resources, education, economy, government, and historical background.

III. Tanzania

Tanzania's Vulnerability to Climate Change

As a result of its diverse geography, heavy dependence on natural resources, and low level of development, Tanzania experiences a range of climate-related vulnerabilities. The country's National Adaptation Program of Action (NAPA) is designed to address these urgent vulnerabilities. However, an examination of Tanzania's NAPA content in light of scholarly theories on effective adaptation to climate change suggests that the NAPA may be missing certain essential elements. The NAPA addresses the physical effects of climate change, but fails to include plans for building state capacity – an important component of long-term sustainability and successful adaptation. Two possible hypotheses, as introduced in the previous chapter, help to explain the disconnect between the contents of Tanzania's NAPA and what the scholars mentioned in the previous chapter believe is required for least developed countries to adapt to climate change. Do Tanzanians simply view other adaptation priorities – adaptation strategies that even the most vulnerable groups have the capacity to implement – as more urgent? Does the country lack the domestic expertise, bureaucracy, and infrastructure – in short, lack the state capacity – to devise an adaptation strategy with a capacity-building focus?

Tanzania is situated on the eastern coast of Africa. Kenya, Uganda, Rwanda, Burundi, the Democratic Republic of Congo, Zambia, Malawi, and Mozambique border Tanzania on the north, west, and south.¹²⁵ The Indian Ocean lies to the east. Tanzania's varied geography consists of coastal areas, arid lands, semi-arid lands, plateaus, highlands, and alluvial plains.¹²⁶ Well-known geographical features include Mount

¹²⁵ Central Intelligence Agency, World Factbook: Tanzania

¹²⁶ Tanzania NAPA, p. 6

Kilimanjaro and Lake Victoria. Land is extremely important to the livelihoods of Tanzanians: agriculture accounts for over 40% of the GDP, comprises 85% of exports, and provides employment to 80% of Tanzania's workforce.¹²⁷ However, as a consequence of topography and climate, less than 5% of Tanzania's land is arable.¹²⁸ The country's principal exports include gold, coffee, cashew nuts, manufactures, and cotton. Tanzania is a least-developed country (LDC), and its economic situation reflects its low level of development: the country's per capita income level places it in the bottom 10% of the world's economies.¹²⁹ Over half of the population is below the national poverty line, with the clearest divide between urban and rural communities.¹³⁰

An overview of sub-Saharan Africa's primary climate-related vulnerabilities according to the IPCC was presented in the introductory chapter of this study. Jouni Paavola probes deeper in his case study on Tanzania in *Fairness in Adaptation to Climate Change*. There is a disconnect between the scholarly perception of Tanzania's most significant climate-related vulnerabilities (including human capital, access to technology, inequality, and the quality of institutions) and the conclusions drawn by Tanzania's NAPA team (food, water, energy, industry, health, etc.). According to Paavola, the groups in Tanzania most vulnerable to the impacts of climate change are women, children, pastoralists, and the rural poor – and the NAPA should make a special effort to address these groups. Tanzania's NAPA does mention the needs of the rural poor, and the NAPA team included rural farmers in the consultation process. However, the NAPA does not seem to give particular consideration to women or children.

¹²⁷ CIA World Factbook online

¹²⁸ Pak Sum Low, p. 203

¹²⁹ CIA World Factbook online

¹³⁰ Adger et al. *Fairness in Adaptation to Climate Change*, p. 213

Paavola believes that effective vulnerability reduction requires three distinct components. These components are significant, because they indicate a way in which Tanzania's NAPA diverges from a more successful path to adaptation. The three components are: (1) Effective governance of environmental resources, such as forests or water, because it is important in order to ensure sustainability of livelihoods; (2) Institutional reforms and investments in infrastructure, because they help to improve market access and expand income generation in rural areas; (3) Public programs, spending on health, education, and social welfare, because they contribute to the maintain and enhancement of human capital.¹³¹ All three of these components are types of capacity-building. The absence of adaptive capacity also factors into a scholarly evaluation of a country's vulnerability to the effects of climate change. In his study, Paavola considers social aspects such as class, gender, poverty, and sources of livelihood in addition to the physical status of the environment.¹³² Deficiencies in any of these aspects will set vulnerable groups at a disadvantage. Scholarly vulnerability reduction theories seem strongly linked to state capacity, in contrast to the adaptation measures proposed by Tanzania's NAPA team, which focus on the physical impacts of climate change while ignoring societal factors.

Key sources of vulnerability pointed out by Paavola do not entirely match up with the vulnerabilities addressed in Tanzania's NAPA. The scholar considers a broad array of factors, combining social science with the physical impacts of climate change. Tanzania's NAPA team, on the other hand, seems to concentrate heavily on the physical aspects. This distinction could perhaps be a reflection of the limitations of Tanzania's domestic

¹³¹ Adger et al. Fairness in Adaptation to Climate Change, pp. 202-203

¹³² Adger et al. Fairness in Adaptation to Climate Change, p. 205

capacity – as a whole, the country may lack the capacity it needs in order to determine the kind of capacity it requires. Both physical and intangible human capital such as longevity, health, nutritional status, literacy, education, skills, and access to information are important in terms of adapting to climate change. Deficiencies in any of these aspects could negatively impact income, human development, and the capacity to act (for example, to respond to climate change). A lack of effective technology in transport, telecommunication networks, public utilities, and agricultural inputs shrinks incomes, hinders both specialization and diversification of livelihoods, and constrains human development. Levels and sources of income are vulnerable to climate change, and growing income inequality disproportionately harms vulnerable groups, reduces social cohesion, and thus diminishes a society's ability to cooperate. Social capital can be another factor influencing vulnerability to climate change, since a lack of social capital reduces the capacity and quality of the institutions responsible for devising and implementing adaptation strategies.¹³³

There is a distinction between impacts of climate change and vulnerabilities to climate change. Impacts are the physical effects of climate change, whereas vulnerabilities refer to the human implications of climate change's impacts. NAPAs theoretically are intended to address both aspects, with the overall goal of reducing vulnerability, but Tanzania's NAPA seems to concentrate heavily on the impacts rather than the vulnerabilities. It is also important to take into consideration how both the vulnerabilities and impacts are likely to change over time; Tanzania's NAPA does manage to acknowledge both present and future effects of climate change. The current

¹³³ Paragraph from Adger et al. Fairness in Adaptation to Climate Change, pp. 205-206

and future situations of both climate change impacts and Tanzania's climate-related vulnerabilities are presented in the following tables:

Summary of Predicted Climate Change Impacts on Tanzania:¹³⁴

<i>Climate impacts</i>	<i>Current situation</i>	<i>Future situation</i>
Food production	Climate variability has a significant impact on food production and security	Staple crop yields will decrease and food production risks increase
Forests and land cover	Substantial stocks of forest resources, but land use changes and harvesting levels cause deforestation	Land cover changes, fires and coping with droughts accelerate deforestation
Water resources	Periodic droughts and flooding	Periodic droughts and flooding become more frequent Deforestation increases seasonal flooding and water scarcity
Human settlements	Low-lying settlements affected by floods	Floods will cause property damage more frequently
Human health	Water and insect-borne diseases cause significant mortality and morbidity	The spread and incidence of water and insect borne diseases increases

¹³⁴ Adger et al. Fairness in Adaptation to Climate Change, p. 208

Summary of Current and Future Vulnerabilities of Tanzania to Climate Change:¹³⁵

<i>Vulnerabilities</i>	<i>Current</i>	<i>Future</i>
Human capital	Health and educational outcomes are poor and deteriorating. Rural outcomes are worse than urban ones	Future deterioration in health and educational outcomes is possible and an urban-rural divide is likely to persist
Access to technologies	Weak communications, transport and utility infrastructure	Infrastructure will improve and provide better access especially in urban areas
Income levels and risks	Subsistence agriculture the most important and environmentally risky source of livelihoods and income	Subsistence farming remains important but is increasingly complemented with market participation and its risks
Inequality	Urban-rural divide important manifestation of inequality both in terms of income and human development	Inequality is likely to increase both in terms of incomes and human development
Social capital and the quality of institutions	Capacity for collective action present but institutions lack quality and the state suffers from lack of capacity	Considerable uncertainty regarding the stability and strength of civil society as well as state capacity

Tanzania's NAPA

In its NAPA, Tanzania lists what it perceives to be its own most pressing vulnerabilities to the impacts of climate change. Food production and access to water are vulnerable to drought. A severe drought could cause food shortages, food insecurity, water scarcity, hunger, and power shortages. The economy, particularly agriculture, energy, and forestry, is vulnerable to changes in rainfall – different from drought, since rainfall is predicted to decrease in some parts of the country but increase in others. The agricultural sector is extremely vulnerable, because increased temperatures, altered rainfall, climatic variability, erosion, and environmental degradation all affect crop

¹³⁵ Adger et al. Fairness in Adaptation to Climate Change, p. 211

production.¹³⁶ Tanzania cites its top four climate-related hazards as epidemics, drought, plant diseases/pests/vermin, and floods.

Interestingly, Tanzania incorporates the responses of the stakeholders consulted by the NAPA team in its vulnerability assessment. Nearly half of those surveyed attributed the outbreak of epidemics to prolonged rainfall or drought, 30% to climatic variability, 41% simply to human health, and 10% to poverty. An overwhelming majority thought that drought was a problem because of prolonged periods of low rainfall, 60% because of the effects of the variability of rainfall onset on crops, and 53% because of increased desertification. Thirty-one percent of the stakeholders who believed pests to be a significant problem thought that climate change was the main problem (prolonged rainfall/dryness) and 14% blamed poverty. Eighty-three percent of stakeholders attributed floods to prolonged rainfall, and 19% to climate change.¹³⁷ Perhaps the natural science focus of the country's NAPA team results from the physical environment leanings of the participating stakeholders.

NAPA Content and Adequacy

Tanzania appears to have adhered fairly well to the NAPA structure put forth by the UNFCCC. The document begins with an introduction containing country-specific background information, then follows by presenting an overview of the adverse impacts of climate change both experienced in the present and predicted for the future. The NAPA also includes links to existing national development plans, vital adaptation needs (expressed in a section on vulnerability to climate change and sectoral analyses), criteria for selecting adaptation priority activities, profiles of the proposed activities, and barriers

¹³⁶ Tanzania NAPA, pp. 27-32

¹³⁷ Tanzania NAPA, p. 14

to implementation.¹³⁸ At the surface level, no NAPA component seems to be missing from the document.

The main goals of Tanzania's NAPA vary from immediate action to long-term, from community-based actions to national policy, from improving natural resource use to educating the public. The goals are listed as followed: (1) identify and develop immediate and urgent NAPA activities in order to adapt to climate change and climate variability; (2) protect life and livelihoods of people, infrastructure, biodiversity and environment; (3) mainstream adaptation activities into national and sectoral development policies and strategies, development goals, visions, and objectives; (4) increase public awareness (in communities, civil society, and government officials) to the impacts of climate change and adaptation strategies; (5) assist communities to improve and sustain human and technological capacity for environmentally friendly natural resource use; (6) complement national and community development activities hampered by adverse effects of climate change; and (7) create long-term sustainable livelihoods and development activities at both the community and national levels in light of changing climatic conditions.¹³⁹

The NAPA is intended to address a country's immediate adaptation needs, which stem from the country's primary climate-related vulnerabilities. Tanzania ranks what it perceives to be its most vulnerable sectors in terms of the negative affects of climate change. These sectors include agriculture and food security, water, energy, forestry, health, wildlife, tourism, industry, coastal and marine resources, human settlements, and wetlands.¹⁴⁰ The NAPA then presents a ranking of project activities within each sector. For agriculture and food security, including livestock, the project activities were as

¹³⁸ Tanzania NAPA

¹³⁹ Tanzania NAPA, p. 2

¹⁴⁰ Tanzania NAPA, p. 33

follows (in order of highest to lowest priority): increasing irrigation to boost maize production; implementing alternative farming systems; making better use of climate and weather data and other management tools; creating awareness of the negative effects of climate change; increasing the use of manure as fertilizer; developing range management for livestock production; changing land use patterns; implementing drip irrigation; controlling pests, weeds, diseases; implementing biological control of the tsetse fly; and promoting indigenous knowledge.¹⁴¹ For this sector, technical fixes were the most highly prioritized adaptation activities. Less tangible measures, such as awareness and indigenous knowledge, were ranked lower.

Project activities for the water sector were: the development of alternative water storage programs and technology for communities; promoting water harvesting and storage facilities; developing reservoirs; implementing community based catchments conservation and management; employing new water serving technologies in irrigation; installing early warning systems for droughts and floods; and developing recycle and reuse facilities in the industrial sector.¹⁴² Again, the NAPA focuses on the “tech fixes” and does not consider adaptation strategies that address the country’s institutional/societal situation.

The activities listed in the energy sector and forestry sector also fail to go beyond the technical/physical level. In the energy sector, prioritized activities included: exploring and investing in alternative clean energy sources; the use of community based mini-hydropower; improving the efficiency of using biomass for energy; geo-thermal power generation; harnessing proven coal reserves; the promotion of cogeneration in the

¹⁴¹ Tanzania NAPA, p. 34

¹⁴² Tanzania NAPA, p. 35

industry sector; and enhancing natural gas utilization.¹⁴³ Some of these proposed solutions, such as coal and natural gas, are not environmentally sustainable. Forestry activities consisted of afforestation programs in degraded lands using adaptive and fast-growing trees; community forest fire prevention programs; strengthening community-based forest management practices; the promotion of alternative sources of energy for domestic and industrial uses; promoting efficient technologies to reduce the use of wood; and enhancing the development of buffer zones and wildlife migratory routes.¹⁴⁴

Priority activities for the health sector involved the establishment or strengthening of community awareness programs on preventable major health hazards; ensuring the availability of sufficient trained staff at health facilities; strengthening malaria control programs; implementing early warning systems and emergency measures; establishing health and climate collaboration; employing efficient and coordinated early warning systems in all districts; and utilizing efficient communication equipment to assist early diagnoses.¹⁴⁵

Adaptation activities relating to the wildlife sector included providing assistance to rural communities in managing wildlife resources; supporting the implementation of community based management programs; combating illegal hunting and forest fires; creating a wildlife information database; protecting migratory corridors and buffer zones; developing and implementing management plans for protected/conserved areas; and improving wildlife/ecological surveillance systems.¹⁴⁶

¹⁴³ Tanzania NAPA, p. 35

¹⁴⁴ Tanzania NAPA, p. 35

¹⁴⁵ Tanzania NAPA, p. 35

¹⁴⁶ Tanzania NAPA, p. 36

In the tourism sector, activities consisted of establishing alternative source of income for community in tourist area; developing a community based fire protection and control program; creating and protecting buffer zones around national parks and game reserves; sustainable tourism activities; and the relocation of people residing in wildlife corridors.¹⁴⁷

For the industrial sector, Tanzania's NAPA proposes improving energy efficiency in industrial energy consumption; improving the efficiency of raw materials use; developing alternative uses of raw materials; water harvesting and recycling; installing or improving permanent drainage systems; and the implementation of renewable energy sources.¹⁴⁸

Adaptation activities recommended for coastal and marine resources were the construction of artificial structures for beaches; restoring degraded habitats; the reduction or elimination of non-climate stresses (ex. elimination of over-fishing, pollution reduction); relocation of small island communities as a result of sea-level rise; establishing protected areas; and desalinization of seawater.¹⁴⁹

Priority adaptation plans for human settlements included implementing a new land tenure system; relocating vulnerable communities; devising a database for hazard-prone areas; sensitizing communities to climate change related hazards; a rural area improvement plan; a framework for dealing with disasters; improved zoning planning; and improved building codes.¹⁵⁰

¹⁴⁷ Tanzania NAPA, p. 36

¹⁴⁸ Tanzania NAPA, p. 36

¹⁴⁹ Tanzania NAPA, p. 37

¹⁵⁰ Tanzania NAPA, p. 37

Finally, adaptation activities for the wetlands sector consisted of an inventory of wetland ecosystem types, an inventory of the spatial distribution of wetland ecosystems; wetlands monitoring programs; establishing Ramsar sites for sustainable management; and generating adequate capacity-building, awareness, and education on wetland management issues related to climate change.¹⁵¹ The fact the only mention of capacity-building occurs in the last priority of the last priority sector is significant because it indicates an awareness of the need for capacity on the part of Tanzania's NAPA team. Therefore, perhaps capacity-building plans are not included in the final list of prioritized activities because Tanzania does not perceive capacity-building to be as urgent as the other activities.

The end product of a NAPA is a prioritized list of feasible adaptation plans that respond to the country's most urgent climate change vulnerabilities. The NAPA team selects priority adaptation activities according to a set of criteria. The UNFCCC lets the LDC determine the criteria it will use for the selection and prioritization of adaptation activities, but it does provide a number of suggestions. According to the UNFCCC, selection criteria should include considerations of the "level or degree of adverse effects of climate change; poverty reduction to enhance adaptive capacity; synergy with other multilateral environmental agreements; and cost-effectiveness" and should apply to a variety of sectors such as health, agriculture, water, infrastructure, land use management, and coastal zones.¹⁵² Tanzania's criteria for ranking adaptation programs adhere faithfully to the UNFCCC's recommendations. Additional criteria included in the NAPA, though not specifically stated by the UNFCCC, include the improvement of the

¹⁵¹ All lists of prioritized adaptation activities from the Tanzania NAPA, pp. 34-37

¹⁵² UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 12

livelihood of rural communities; the effect of the adaptation plan on the most vulnerable groups within communities (specifically the rural poor); “locally-driven criteria”; and the overriding goal of responding to the immediate and urgent adaptation needs as argued by the stakeholders.¹⁵³ As well as adhering to the UNFCCC’s suggestions, Tanzania’s criteria seem to be fair and just, with a focus on helping the most vulnerable groups.¹⁵⁴

Tanzania’s finalized, prioritized list of adaptation strategies is as follows: “(1) Water efficiency in irrigation for crop production (to boost yield and to conserve water); (2) Development of alternative farming systems and water harvesting; (3) Development of alternative water storage programs and technology for communities; (4) Community based catchments conservation and management programs; (5) Exploration and investment in alternative clean energy sources (wind, solar, bio-diesel, etc.) to compensate for lost hydropower potential; (6) Promotion of cogeneration in industry sector to compensate for lost hydropower potential; (7) Afforestation programs in degraded lands, using more adaptive and fast growing tree species; (8) Development of community-based forest fire prevention programs; (9) Establishment and strengthening of community awareness programs on preventable major health hazards; (10) Implementation of sustainable tourism activities in coastal areas, and relocation of vulnerable communities from low-lying areas; (11) Enhancement of wildlife protection services and assistance to rural communities in managing wildlife resources; (12) Water harvesting and recycling; (13) Construction of artificial structures (ex. sea walls, putting sand on beaches, coastal drain beach management systems); and finally (14) Establishment of a land tenure system, and the promotion of sustainable human

¹⁵³ Tanzania NAPA, p. 4

¹⁵⁴ See Adger et al. Fairness in Adaptation to Climate Change, chapter 10

settlements.”¹⁵⁵ Overall, Tanzania’s adaptation priorities consist of tangible solutions with a focus on the physical environment, and do not include measures for increasing the state capacity that scholars such as Connolly, Keohane, Levy, and Haas believe to be important for effective adaptation. A number of Tanzania’s adaptation strategies require a certain amount of existing capacity for implementation, but none are designed to increase state capacity.

NAPA Development Process

Like the prioritization criteria, the process of developing the NAPA seems to be consistent with the UNFCCC’s recommendations. The country’s Vice President’s Office – Division of Environment created a National Climate Change Focal Point body, which was responsible for the formation of a NAPA team. The NAPA team consisted of 20 experts from various sectors, including energy and industry, livestock, agriculture, forest, land use, wildlife and wetland, marine and freshwater resources, tourism, and health. The NAPA team was then divided into four groups. The groups consulted a range of stakeholders in different parts of the country, then compiled their findings and analyzed the impacts of climate change throughout the whole of Tanzania.

Overall, the NAPA team conducted consultations in 13 districts and 52 villages, and developed a synthesis report “based on past and present studies, on climate change and coping strategies.”¹⁵⁶ A public consultation, involving interviews and questionnaires administered to various stakeholders (government officials, private sectors, industries, communities) followed the synthesis report. According to the explanatory section in the NAPA document, Tanzania’s NAPA team had employed sound scientific research in its

¹⁵⁵ Tanzania NAPA

¹⁵⁶ Tanzania NAPA, p. 51

assessment of climate vulnerability. The Minister of State, Vice President's Office – Environment endorsed the final draft of the NAPA. Tanzania appears to have closely followed the NAPA development procedure proposed by the UNFCCC.

The UNFCCC's least-developed country expert group (LEG) played a significant role in shaping the NAPA development.¹⁵⁷ The following principles were determined by the LEG: (1) The development of the NAPA should be a participatory process, including a sectoral participatory approach; a multi-disciplinary, multi-sectoral NAPA team should be established; consultations should involve the participation of stakeholders from public sector and private sector organizations, including government ministries and departments, academic/research institutions, NGOs, the media; (2) The NAPA should follow a multidisciplinary approach, meaning that the NAPA team should include experts from both government institutions, such as ministries, universities, agencies, and private institutions/NGOs; (3) The NAPA should take on a complementary approach, in order to be compatible with existing national environment and development programs, such as poverty reduction, agricultural sector development, rural development, and the National Action Plan to Combat Desertification; (4) The NAPA should promote sustainable development; (5) NAPA development should be a country-driven process; (6) The NAPA should strive for cost-effectiveness; (7) The NAPA should aim for simplicity, so that the document can be easily understood by communities; and (8) The NAPA should be flexible, so that a range of actors (private sector, NGOs, individuals, and government institutions) will be able to implement NAPA activities.¹⁵⁸

¹⁵⁷ Refer to the sections on NAPAs in the first two chapters of this study

¹⁵⁸ Tanzania NAPA, pp. 3-4

As mentioned previously, the NAPA was drafted after conducting a number of sectoral consultations. Farmers proved influential actors in the community sector, as they were able to share with the NAPA team their firsthand experience regarding the effects of climate change and their coping strategies. The farmers have been dealing with climate change by using both indigenous knowledge and modern science and technology.¹⁵⁹ The NAPA team hoped that the participatory approach would ensure transparency and would increase the likelihood that “proposed activities are implemented and adopted by target vulnerable communities.”¹⁶⁰

Hypotheses and Analyses

While the UNFCCC provides specific guidelines for the development and structure of the NAPA, individual LDCs are responsible for coming up with the content of their NAPAs. This country-driven approach is designed to ensure that the resulting adaptation plans address each LDC’s own climate vulnerabilities.¹⁶¹ One of the main ways in which the UNFCCC influences an LDC is by suggesting which types of adaptation priorities would be most appropriate. Therefore, while the content of Tanzania’s NAPA is country-specific, the type of content has been pre-determined by a large international body.

Tanzania states that its NAPA was influenced by the objectives of the country’s “National Development Vision 2025 for high and shared growth, quality livelihood, peace, stability and unity, good governance, high quality education and international competitiveness.”¹⁶² This declaration abides by the UNFCCC’s recommendation that the

¹⁵⁹ Tanzania NAPA, p. 2

¹⁶⁰ Tanzania NAPA, p. 2

¹⁶¹ Refer to the section on NAPAs in the introductory chapter of this study

¹⁶² Tanzania NAPA, p. 1

NAPA relate to existing national development plans. Consistent with the goals of the National Development Vision, Tanzania’s NAPA also sets forth its own overall vision: “to identify immediate and urgent Climate Change Adaptation Actions that are robust enough to lead to long-term sustainable development in a changing climate,” and to “identify climate change adaptation activities that most effectively reduce the risks that a changing climate poses to sustainable development.”¹⁶³ In order to realize this vision, the NAPA is designed to address the climate-related vulnerabilities of principal economic sectors and is intended to be “action oriented towards priority on the ground activities.”¹⁶⁴

At first glance, the contents of Tanzania’s NAPA seem perfectly matched to the UNFCCC’s recommendations and therefore sufficient for achieving the overall goal of reducing climate-related vulnerabilities and adapting to climate change. However, a closer examination suggests that what Tanzania has come up with might not be enough in order to effectively adapt to the adverse effects of climate change. Do action-oriented, on-the-ground activities really lead to long-term sustainable development? What about increasing state capacity – a more passive means of adaptation, but viewed as essential by many scholars?

I had initially hypothesized that the UNFCCC-designed process for creating NAPAs was too action-oriented to include relatively passive adaptation strategies such as capacity-building. This hypothesis seemed plausible given the content of Tanzania’s NAPA, but as it turns out, the UNFCCC does include the enhancement of capacity in its recommendations.¹⁶⁵ The UNFCCC certainly encourages an action-oriented focus for the

¹⁶³ Tanzania NAPA, p. 2

¹⁶⁴ Tanzania NAPA, p. 1

¹⁶⁵ UNFCCC Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV, Decision 28/CP.7, p. 12

NAPA, but it is not the fault of the UNFCCC that Tanzania's NAPA does not include capacity-building plans. This initial hypothesis was not explored in the second two case studies.

The next hypothesis suggests that African LDCs might be more concerned about responding to the immediate impacts of climate change, via adaptation strategies that vulnerable groups are able to implement, than about longer-term capacity-building strategies. Tanzania's priority adaptation activities do address the vulnerabilities mentioned in the country's NAPA; however, Tanzania's NAPA does not incorporate all of the vulnerabilities presented by Paavola. While Paavola considers the big picture, including both social factors and the physical impacts of climate change, Tanzania's NAPA team approaches the issue of climate vulnerability with a narrower focus. Given the country's extensive consultative and participatory NAPA development process, it seems that the majority of Tanzanians believe that physical adaptation plans are higher priority than capacity-building. It is apparent that the NAPA team was aware of the need for capacity; capacity-building plans may have been out-ranked by the 14 adaptation plans that made it onto the NAPA's final priority list. The hypothesis that the NAPA does not contain capacity-building as a result of the Tanzanians' prioritization of urgent adaptation needs appears to be valid.

Is it plausible that Tanzania does not include capacity-building plans in its NAPA because LDCs lack the capacity to design and implement such plans? The UNFCCC's and the GEF's country-driven approach, described in the introductory chapter of this study, suggests that the content of a NAPA should be left to the country itself. The reasoning is that a country's NAPA will better reflect the needs of the LDC and will have

a higher chance of implementation if domestic stakeholders have an influential role in the development process. Tanzania acknowledges the fact that its under-developed condition might hinder the implementation of its adaptation strategies, but what about hindrances to the ability to even come up with certain types of adaptation plans? The Tanzanian NAPA team was aware of the challenges faced by the country in terms of carrying out the priority activities, and included a “barriers to implementation” section in the NAPA document. These barriers include limited internal capacity to fund adaptation activities; extreme poverty of most vulnerable groups; poor infrastructure, especially rural roads with limited access; limited credit opportunities for rural communities; the impact of HIV/AIDS; poor health conditions and resource-poor rural communities; and, significantly, the “limited analytical capability of local personnel to effectively analyze the threats and potential impacts of climate change, so as to develop viable adaptation solutions.”¹⁶⁶

Tanzania’s difficult past, similar to that of many other African LDCs, helps explain the country’s barriers to implementing its NAPA. Numerous African countries have weak political systems and public administrations. Sometimes a weak state is the main explanation for a country’s underdevelopment.¹⁶⁷ Tanzania has experienced periods of turmoil as pre-colonial, colonial, and post-independence regimes demolished “traditional authority structures.”¹⁶⁸ Tanzania gained independence from the United Kingdom in 1964. The country inherited a certain degree of central public administration from the colonial period; in 1962, for example, local governments were formed under British guidance. However, these local authorities disrupted existing hierarchical

¹⁶⁶ Tanzania NAPA, p. 20

¹⁶⁷ Adger et al. Fairness in Adaptation to Climate Change, p. 214

¹⁶⁸ Adger et al. Fairness in Adaptation to Climate Change, p. 214

structures. In the late 1960s and early 1970s, the young Tanzanian government created organized villages in order to facilitate the provision of water, transport, healthcare, and education. These new villages destroyed traditional ways of life. Chama Cha Mapinduzi (CCM), the ruling political party, exerted its influence by further dismantling the Tanzanians' established authority structures. Authority conflicts occurred between the public administration and the party organization.¹⁶⁹ Government corruption also occurred during the first several years of Tanzania's independence, when heightened state control over the economy inadvertently gave public sector employees a dangerous amount of economic influence, until the 1967 Arusha Declaration prevented party involvement in economic activities.¹⁷⁰

In its early days of independence, participation in politics was only possible through involvement with the CCM party. In 1992, the country transitioned to a multiparty political system. Nevertheless, Tanzania still faces numerous state-related problems. The country is considered only "partially free" in terms of rights and civil liberties scores.¹⁷¹ The opposition party, the Civic United Front, has experienced violence, and the Islamic Awareness Society has been responsible for small scale terrorism.¹⁷² In 2002, Tanzania achieved a score of 2.7 in Transparency International's *Perceived Corruption Index*. A score of 0 means extremely high corruption, whereas 10 signifies no corruption, so Tanzania's score indicates that the country's level of corruption is quite high. One possible explanation for the corruption occurring in Tanzania is that real earnings are decreasing, thus providing incentives for side income

¹⁶⁹ Adger et al. Fairness in Adaptation to Climate Change, p. 214

¹⁷⁰ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷¹ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷² Adger et al. Fairness in Adaptation to Climate Change, p. 215

and dishonesty.¹⁷³ There have also been suspicious linkages between party organization and public administration, and incidents in which government members have misused their political power.¹⁷⁴

However, corruption is not the biggest obstacle faced by Tanzanians. According to a survey conducted by the World Bank, inadequate infrastructure, the level and complexity of taxes, and export and import regulations constitute greater barriers to business than corruption.¹⁷⁵ Barriers to business are significant, because Tanzania might not be able to achieve its development and adaptation goals without reaching some level of economic success. The Tanzanian state often has difficulty carrying out its tasks. Public administration frequently lacks the capacity to perform various duties, such as collecting local poll taxes.¹⁷⁶ Problems with the public administration system are being addressed by a number of ongoing reforms, but the success of these programs has been doubtful. For example, public sector pay reforms led to increased salaries, yet the new salaries remain inadequate for subsistence.¹⁷⁷

While the national government struggles, lower-level governments face challenges as well. Rural governments have the least capacity, since they lack many of the resources common to urban governments.¹⁷⁸ Likewise, rural populations have the toughest time coping on a daily basis and also have a hard time making their voices heard. Vulnerable groups face obstacles to participation in consultations and to access to markets and public services, and often lack resources for articulating their concerns.¹⁷⁹ As

¹⁷³ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷⁴ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷⁵ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷⁶ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷⁷ Adger et al. Fairness in Adaptation to Climate Change, p. 215

¹⁷⁸ Adger et al. Fairness in Adaptation to Climate Change, p. 216

¹⁷⁹ Adger et al. Fairness in Adaptation to Climate Change, p. 217

mentioned earlier, women and children constitute particularly vulnerable rural groups. When compared to men's daily activities, women's tasks typically have much more to do with the land. Therefore, women are more affected by climate change, and have less time for non-climate-dependent activities that generate income. Children frequently drop out of school in order to take part in household chores or economic activities. Sometimes a child will go to work in a city and send money back home.¹⁸⁰ This type of life could mean that a number of Tanzanians simply do not have the education necessary to develop the most appropriate strategies for adapting to the negative effects of climate change.

In terms of education, social and institutional capacity, and science and technology, Tanzania fares better than Burkina Faso and Senegal, the other case studies in this report. According to the Human Development Index, Tanzania's adult literacy rate is 69.4% – much higher than that of Burkina Faso or Senegal, but the fact remains that roughly 30% of Tanzanian adults cannot read.¹⁸¹ The Environmental Sustainability Index indicators show that Tanzania has relatively high female primary education completion rate when compared with other African LDCs. Tanzania also has a greater level social and institutional capacity than Burkina Faso or Senegal, a higher score for science and technology, and a higher level of eco-efficiency (especially hydropower and renewable energy production as percentage of total energy consumption).¹⁸² Regardless, it appears as though Tanzania may lack the government capacity and domestic expertise required to develop the most appropriate NAPA, including capacity-building adaptation activities. Tanzania's poorly-functioning government is significant; the hypothesis that a country's

¹⁸⁰ Adger et al. *Fairness in Adaptation to Climate Change*, pp. 216-217

¹⁸¹ Human Development Report 2007/2008, Country Fact Sheets – Tanzania

¹⁸² Esty et al. *2005 Environmental Sustainability Index*

NAPA lacks capacity-building plans as a result of the country's weak domestic capacity is compelling.

Conclusion

A close examination of Tanzania's NAPA, including both the development process and the document's content, a study of the country's perceived vulnerabilities to climate change, and an investigation of Tanzania's historical and governmental context leads to the conclusion that the country's weak state capacity is the principal explanation for the NAPA's lack of capacity-building plans. Vulnerable groups, particularly the rural poor, are particularly lacking in capacity; state capacity tends to be lower for local, small-scale governments. Tanzania's poorly-functioning government can be attributed in part to the legacy of colonization. My initial hypothesis, that the UNFCCC played a role in the omission of capacity-building in the NAPAs, did not turn out to be useful, because it does not appear that the UNFCCC's guidance deters capacity-building.

My second hypothesis, regarding the LDC's own perceptions of vulnerability, does relate to the lack of capacity-building in Tanzania. The NAPA might not include capacity-building plans partially because Tanzanians do not consider capacity to be an urgent adaptation need, since the groups the most vulnerable to climate change are unlikely to be able to implement capacity-building plans. However, the third hypothesis holds the most weight. The colonial legacy has left Tanzania in a condition of disarray. The country lacks the capability to maintain a functioning economy and to reform public policy, thus impeding the ability to develop – never mind implement – comprehensive capacity-building plans. The state is unable to successfully reform its administration; it is no surprise that capacity-building has been overlooked or excluded.

IV. Burkina Faso

Vulnerabilities to Climate Change in Burkina Faso

Burkina Faso is a landlocked country in the center of sub-Saharan West Africa. Mali lies to the northwest of Burkina Faso, Côte d'Ivoire to the southwest, Ghana and Togo directly to the south, Benin to the southeast, and Niger to the east.¹⁸³ Burkina Faso's geographic location renders the country especially vulnerable to the negative impacts of climate change and climatic variability.¹⁸⁴ Currently, Burkina Faso has a population of 11,849,520. The majority of the population is young, and 51.1% of Burkinabés are female. Nearly 90% of the population is rural, and the country has a low population density with 43.2 inhabitants per square kilometer. Life expectancy is roughly 53 years,¹⁸⁵ and only 23.5% of Burkinabé adults are literate.¹⁸⁶ The country's low level of development intensifies its vulnerabilities to climate change. In this chapter, I investigate Burkina Faso's perceptions of vulnerability and the country's developmental situation, including colonial legacy, education, and economy, as explanations for why its NAPA does not include plans to build state capacity.

Burkina Faso's climate is tropical with sub-Saharan dominance, meaning that arid conditions prevail throughout most of the territory.¹⁸⁷ The rainy season is short and the dry season long. There is some amount of climatic differentiation across the country: the Saharan zone in the north receives the least amount of precipitation, the northern sub-Saharan zone in the center of the country receives slightly more rainfall, while the sub-

¹⁸³ Everything is Possible, "Map of West Africa"

¹⁸⁴ Burkina Faso NAPA, p. iv

¹⁸⁵ Demographics from Burkina Faso NAPA, pp. 1-2

¹⁸⁶ Human Development Report 2007/2008, Country Fact Sheet – Burkina Faso

¹⁸⁷ Burkina Faso NAPA, p. 8

Saharan zone in the south experiences a rainy season that lasts nearly half the year.¹⁸⁸ The principal effects of climate change on Burkina Faso include drought, flooding, heat waves, dust storms, and an increase in the frequency and severity of extreme weather events.¹⁸⁹ The most vulnerable sectors and societal groups in Burkina Faso, according to the country's NAPA, are strongly dependent on the state of the environment. Climate-related disruptions in the water sector, agricultural sector, and forestry sector strongly affect rural populations, particularly small-scale growers, women, and children.¹⁹⁰

Like most other countries in sub-Saharan Africa, Burkina Faso views a net reduction of water availability and a drastic drop in agricultural productivity as significant consequences of climate change. Water resources in Burkina Faso almost exclusively consist of tributaries and underground reservoirs fed by rainfall.¹⁹¹ Scientists state that it is the variability of rainfall – not simply a decrease in net rainfall average – that causes most water-related challenges associated with climate change in West Africa. Rainfall unreliability and seasonality affects agriculture, economy, and livelihoods.¹⁹² Dry years and droughts are typically caused by the inter-annual variability of rainfall, rather than a low average level of rainfall. The distinction between drought and an arid climate is important. Aridity, the result of a low average rainfall, is an enduring feature of a region's climate. Drought, “the temporary deficiency in rainfall significantly below the normal or expected amount in a year, season, or month,” is affected by rainfall variability.¹⁹³

¹⁸⁸ Burkina Faso NAPA, p. 8

¹⁸⁹ Burkina Faso NAPA, p. 1

¹⁹⁰ Burkina Faso NAPA, Table IV, p. 13

¹⁹¹ Burkina Faso NAPA, p. 2

¹⁹² Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p. 117

¹⁹³ Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p. 117

Rainfall variability occurs in different forms. Spatial variability is the difference in rainfall received between places, either structurally or proximately, within a given year. On the one hand, this type of variability can render mechanisms such as early warning systems less effective, since spatial variability is localized, and thus increases vulnerability to drought. On the other had, spatial rainfall variability does not necessarily compromise an entire region's food supply, since there is a good chance that a neighboring village has escaped the drought.¹⁹⁴ Inter-annual variability explains the difference in rainfall between years, the annual deviation from a longer-term average. This type of variability is not particularly noteworthy, unless the distribution of monthly rainfall is also taken into account (since changes in monthly distribution can greatly impact agriculture). Intra-annual variability has to do with the seasonal concentration of rainfall, the distribution of rainfall within a year. Intra-annual variability has especially significant implications for sub-Saharan West Africa, since yearly rainfall in this region is typically concentrated in one wet season (a "uni-modal" rainfall pattern). The duration of the rainy season increases as one moves from north to south in sub-Saharan West Africa.¹⁹⁵ Farming activities take place predominantly in the wet season. Food often becomes scarce in the months leading up to the start of this season. Seasonality in the agricultural cycle, influenced by rainfall, affects nearly all aspects of life in countries such as Burkina Faso: food availability, food prices, prices of consumer goods and labor, labor demands, migration patterns, health, births, and deaths are all linked to seasons and rainfall patterns.¹⁹⁶ Although intra-annual rainfall variability can lead to uncertainty and

¹⁹⁴ Van der Geest and Dietz, in The Impact of Climate Change on Drylands, pp. 119-120

¹⁹⁵ Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p.120

¹⁹⁶ Rainfall variability information from Van der Geest and Dietz, in The Impact of Climate Change on Drylands, pp. 119-120

agricultural problems, the seasonal concentration of rainfall is essential for crop production in many areas, since “an even distribution would mean that the monthly rainfall throughout the year would not be sufficient to sustain plant growth in any period.”¹⁹⁷

Ecologically, Burkina Faso’s territory is divided in two: the Sahelian region in the north, and the *soudanien* region in the south. Drylands comprise most of the northern region, while the larger southern region is marked by savannas and agro-forestry parks.¹⁹⁸ According to Burkina Faso’s NAPA, the over-exploitation of vegetal resources, a consequence of livestock and agriculture, is a human contribution to environmental degradation that should be addressed, because this type of degradation is augmented by the impacts of climate change.¹⁹⁹ The country’s predominant crops include sorghum, corn, rice, and cotton. Ruminants and poultry are Burkina Faso’s most common fauna. Burinkabé soils are of poor quality,²⁰⁰ which makes agriculture particularly challenging.

The Kaya Region

A study on the Kaya Region illustrates the difficult conditions in Burkina Faso’s drylands. The Kaya Region is semi-arid, mostly rural, and has a relatively high population density.²⁰¹ The city of Kaya is the only urban area in the region. The vegetation resembles a savannah, with thorn bushes in the north and dispersed trees in the south. Soils are sandy, have a low organic matter content, a low water retention capacity, and often undergo considerable amounts of degradation – in short, the soils are not

¹⁹⁷ Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p. 120

¹⁹⁸ Burkina Faso NAPA, p. 2

¹⁹⁹ Burkina Faso NAPA, p. 5

²⁰⁰ Burkina Faso NAPA, p. 2

²⁰¹ Breusers, in The Impact of Climate Change on Drylands, p. 207

conducive to cultivation.²⁰² For approximately 90% of households in the region, the main activities are crop cultivation and animal husbandry. Millet and sorghum are the primary crops, and cattle are the most common livestock. Trade and off-farm activities are not a significant contribution to income, but many households engage artisan activities such as weaving, cloth-dying, and pottery. Many of the region's inhabitants are also bicycle repairmen, butchers, tanners, teachers. The region has practically no industry, and seasonal labor migration to the Côte d'Ivoire has become an important part of Kaya inhabitants' livelihood.²⁰³

The climate in northern Burkina Faso is hostile, even without the predicted negative effects of climate change. The dry season in the Kaya Region lasts roughly 8 months. The 4-month rainy season starts in June. July and August are the most humid months in the Kaya, and the only months during which rainfall exceeds evapotranspiration.²⁰⁴ Total rainfall fluctuates considerably from one year to the next, and rainfall distribution varies throughout each season. 80% of rain "falls in high intensity showers," meaning that the amount of water falling from the sky often exceeds the soil's infiltration capacity. Runoff and erosion are common problems. Rain showers in the Kaya Region are localized; one village may receive a torrential downpour while a neighboring village experiences a prolonged dry spell.²⁰⁵

A severe drought in the early 1970s prompted Burkinabés to wonder if a change of climate was occurring. A brutal drying trend spread through the entire Sahelian region

²⁰² Breusers, in The Impact of Climate Change on Drylands, pp. 207-208

²⁰³ Breusers, in The Impact of Climate Change on Drylands, p. 208

²⁰⁴ Breusers, in The Impact of Climate Change on Drylands, p. 209

²⁰⁵ Information in paragraph from Breusers, in The Impact of Climate Change on Drylands, p. 209

of Africa, and led to 100,000 deaths.²⁰⁶ Scientists across the world have since come to the consensus that anthropogenic climate change is, in fact, an ongoing situation that must be addressed. However, drought and environmental degradation in the Kaya Region cannot be solely attributed to a changing climate. The complex relationship between drought, climatic variability, and environmental degradation is affected by factors such as population growth, land use, and urbanization.²⁰⁷ Livestock grazing and cultivation of woodlands often leads to the degradation of vegetation, which in turn intensifies erosion and runoff. It is estimated that, under favorable conditions, 30 years is the minimum amount of time required for soils to recover their fertility;²⁰⁸ however, it would be impossible for inhabitants to stop using the land in the meantime, since agriculture and livestock are the basis for Burkinabé livelihood.

Food production has been a constant challenge in the Kaya region. Food shortages and famine have been recurring problems since pre-colonial times. For example, the Zogoré hunger of the 1830s killed tens of thousands of people over the course of its 6-year duration.²⁰⁹ In the 1970s drought, Burkinabés depended heavily on exterior food aid. During the 1970s and 1980s, rainfall strongly affected food production. Food security, on the other hand, was influenced by a variety of factors, including yield, food reserves from previous years, possibilities of food imports and aid, prices and availability of food in markets, and the population's purchasing power.²¹⁰

The food production system in Burkina Faso has evolved over the decades. Agriculture used to be an activity for large social groups. The kin group (*yiiri*) grew crops

²⁰⁶ Magrath and Simms, p. 8

²⁰⁷ Breusers, in The Impact of Climate Change on Drylands, p. 211

²⁰⁸ Breusers, in The Impact of Climate Change on Drylands, p. 211

²⁰⁹ Breusers, in The Impact of Climate Change on Drylands, p. 212

²¹⁰ Breusers, in The Impact of Climate Change on Drylands, p. 213

on a collective field (*puugasenga*). The monetization of local economies during the colonial regime eventually led to the “individualization” of agriculture, and food production became less of a community effort.²¹¹ The quality of agricultural techniques diminished, as did crop diversity, though cultivated areas extended into previously unexploited land.²¹² Furthermore, for reasons outside of human control, the agricultural season started later and became shorter,²¹³ thus contributing to the worsening of the Kaya region’s food situation. Farmers attempted to rectify the state of affairs by using mechanized plows, cultivating vegetables, and growing rice in the lowlands, but these small-scale efforts had little effect.²¹⁴

Animal husbandry in the Kaya region has been considered the specialization of the FulBe ethnic group. The FulBe are particularly known for raising cattle. However, a different ethnic group, the Moose, hold political control over most of the territories, water resources, and soils. The Moose prefer cultivation to animal husbandry, and practice a different style of livestock rearing than the FulBe. The Moose’s strict control of the land limits the mobility of FulBe herdsmen, impoverishing the ethnic minority. The “extensive use of pastures [for livestock grazing] is considered impossible to reconcile with the extension of cultivated areas.”²¹⁵ Tensions between farmers and herders are common in other African LDCs as well.

Seno, Soum, Oudalan Provinces

Historically, the provinces of Seno, Soum, and Oudalan in northeastern Burkina Faso have been known for their livestock production. This region of Burkina Faso differs

²¹¹ Breusers, in The Impact of Climate Change on Drylands, p. 215

²¹² Breusers, in The Impact of Climate Change on Drylands, pp. 216-217

²¹³ Breusers, in The Impact of Climate Change on Drylands, p. 217

²¹⁴ Breusers, in The Impact of Climate Change on Drylands, p. 217

²¹⁵ Breusers, in The Impact of Climate Change on Drylands, p. 217

from the Kaya in that it is less arid, has fairly low levels of land degradation, and a low population density. Seno, Soum, and Oudalan have longtime been home to transhumant livestock producers, mostly the FulBe ethnic group. However, in the drought of the 1970s and 1980s, a number of FulBe, Tamachek, and Mossi immigrated to this more arable region;²¹⁶ the diversity of ethnicities and languages is still evident. The new populations grew millet instead of raising cattle. Although livestock is still important in this region, it is no longer the principal occupation for most households. Interestingly, households shift their livelihood strategy depending on precipitation. Though cultivation is the dominant occupation, livestock becomes a more important source of income and sustenance during periods of low precipitation.²¹⁷ Too much rather than too little water has been the predominant problem in this northern region as of late; in wet years, the area has seen increasing damage caused by flooding.²¹⁸

Over the past several decades, the Seno/Soum/Oudalan region has experienced urbanization and a growing market economy. The extraction of mineral resources, such as manganese, iron, calcite, and gold, has led to the development of infrastructure. A network of roads connects the region to bigger markets; the markets in turn lead to new technology that increases extraction efficiency.²¹⁹ However, the quality and reach of infrastructure remains limited. Better infrastructure would facilitate economic development, which would in turn provide more resources for climate change adaptation.

²¹⁶ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 243

²¹⁷ Information in paragraph from Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 243

²¹⁸ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 265

²¹⁹ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 253

NAPA Content

The content of Burkina Faso's NAPA reflects the recommendations of the UNFCCC. The report is straightforward and begins with a table of contents, followed by a summary and then an introduction. The introduction includes a definition of vulnerability: the susceptibility of a natural or human system to be affected by the negative effects of climate change, climatic variability, and climatic extremes.²²⁰ Burkina Faso's NAPA team also defines adaptation: all adjustment in natural systems or human activities in response to current or predicted impacts of climate change, including anticipative and reactionary adjustments.²²¹ After declaring that the NAPA was developed according to a participative process that implicated various actors (decision-makers, experts, technicians, agricultural producers, communities, etc.), the NAPA document states its objective: to identify priority actions based on the urgent and immediate adaptation needs of vulnerable populations.²²²

The NAPA then provides an overview of Burkina Faso's environmental resources, economic context, NAPA methodology, and current climate situation. Consistent with the UNFCCC's proposed structure, Burkina Faso links its NAPA to its existing national development strategies. Overlapping goals include research on self-sufficiency and food security; protection of the environment in terms of natural resource sustainability; increased revenues for the population; and improved management of water resources.²²³ Burkina Faso explains how its approach to NAPA formulation is multidisciplinary (the expert group was comprised of people with various specialties,

²²⁰ Burkina Faso NAPA, p. 1

²²¹ Burkina Faso NAPA, p. 1

²²² Burkina Faso NAPA, p. 1

²²³ Burkina Faso NAPA, p. 17

which ensures the representation of diverse sectors and activities), participative (regional studies played a role in the NAPA preparation process), complementary (the NAPA reflects existing policies, plans, and programs), profitable (aware of the costs of implementation and the expected impacts on vulnerable sectors and groups), and straightforward (effective and comprehensible for a variety of actors).²²⁴ Furthermore, the NAPA strives to take into account the needs of different societal groups, including men, women, children, the elderly, and farmers.

What Burkina Faso perceives as its potential barriers to NAPA implementation are particularly interesting, because they differ from the other two case study countries. Burkina Faso cites its obstacles as a low degree of effective participation, the slowness of administrative procedures, insufficient financing, and social instability.²²⁵ Another aspect that makes Burkina Faso's NAPA unique is the inclusion of a section acknowledging both traditional coping strategies and current adaptation practices. These practices deal with the water sector (the obtainment of potable water, pastoral and agricultural hydrology, and general flora and fauna needs), the agricultural sector (growing techniques, crop diversification, and the harvesting system), and the forestry and biodiversity sector (addressing forestry, fauna, fishing, and energy, since, like other African countries, Burkina Faso obtains a great deal of its energy from biomass).²²⁶ One example of the difference between traditional versus current adaptation strategies involves the forestry sector: an indigenous coping strategy is practicing selective cutting of woods, while a current adaptation practice is reforestation using local plant species.²²⁷

²²⁴ Burkina Faso NAPA, p. 18

²²⁵ Burkina Faso NAPA, p. 19

²²⁶ Burkina Faso NAPA, pp. 19-21

²²⁷ Burkina Faso NAPA, p. 21

An important section in the NAPA is the explanation of the selection of priority activities. Burkina Faso's NAPA team states that the most negative effects of climate change are rainfall variability, temperature rise, violent winds, and air pollution. The most vulnerable activity sectors are water resources, agriculture, and forestry and biodiversity, because they all depend directly on rainfall and temperature.²²⁸ Poor rural populations are the most vulnerable groups. Pre-selection and selection criteria were developed in light these climate change impacts and vulnerabilities. The pre-selection criteria for priority activities include the degree of vulnerability of involved sectors and social groups; the link between climate variability and climate change; and local capacities for implementing adaptation activities. This last criterion is significant, as it may suggest that possible adaptation activities were cut from the final list because of the low level of local capacity. The criteria used for evaluating adaptation activities that passed the pre-selection round include the reduction of the gravity of the negative effects of climate change/reduction of the risk of vulnerability; poverty reduction; synergy with other multilateral environmental agreements; and a cost/benefit analysis.²²⁹ For each proposed adaptation activity, each expert on the NAPA team assigned a mark from 0-3 regarding each criterion. 0 corresponds with no impact, 1 implies weak impact, 2 signifies average impact, and 3 stands for strong impact. The urgent priority actions determined by Burkina Faso's NAPA team are as follows, in order of highest to lowest priority: famine early warning system; promotion of complementary irrigation; water management; feed production; natural resource conservation; fight against desertification;

²²⁸ Effects and vulnerabilities all from Burkina Faso NAPA, p. 22

²²⁹ Criteria from Burkina Faso NAPA, p. 23

optimization of irrigation; securitization of pastoral zones; promotion of CES/DRS; fauna habitat management; and promotion of renewable energy, particularly in households.²³⁰

The NAPA team then elaborates on the urgent priority actions, and lays out a list of corresponding priority projects accompanied by the estimated cost for each project in US dollars. The first project on the list is the reducing climate change vulnerability by improving food crisis prevention, followed by the promotion of complementary irrigation in order to secure grain production; management of the *mare d'Oursi* (a large body of water); feed production and reserve feed stocks for cattle in the Burkinabé Sahel; the management of natural resources and certification of non-woody forest products in the eastern region of Burkina Faso; fight against desertification in certain areas; the development of irrigated corps in certain provinces; the securitization of pastoral zones in the Sahel and eastern regions; securing agricultural production by the implementation of various technologies; the promotion of fauna and habitat management; the implementation of protection perimeters and the fight against the pollution of surface water and groundwater; and the promotion of energy efficient equipment and renewable energy technology (cookers, water heaters, solar dryers, etc.). This last adaptation activity relates to the ESI “social and institutional capacity” indicator,²³¹ and happens to be the lowest ranking priority activity as well as the most expensive project on list.

Annexes at the end of the NAPA document explain the priority projects in greater detail. Each project includes a title, justification, description (specific objectives, activities), means of implementation, short term results, potential long term effects, and implementation logistics (institutional arrangements, risks and obstacles, monitoring and

²³⁰ Burkina Faso NAPA, Table VII, p. 25

²³¹ Burkina Faso NAPA, p. 26

evaluation, and financial resources).²³² Project 12 provides a clear example: The title is *Promotion des équipements à économie d'énergie (foyers améliorés) et des technologies à énergies renouvelables (auto-cuiseur, chauffe-eau et séchoirs solaires, etc.)*, the promotion of energy efficient equipment (improved households) and renewable energy technology (auto-cooker, water heater and solar dryers, etc.). The project's justification is the need to address Burkina Faso's current dependence on biomass for energy; over 90% of the country's energy needs are covered by traditional combustibles, mostly charcoal.²³³ This is a problem in part because of the rapid rate of urbanization; city-dwellers have restricted access to biomass.

The project description is divided into objectives and activities, and contributions. The objective is energy efficiency and renewable energy technology. Activities include supporting research on renewable energies; teaching women techniques for using energy efficient equipment; sensitizing and teaching artisans techniques for energy efficiency; facilitating the installation of energy efficient equipment in households; and subsidizing technology and equipment for efficient/renewable energy such as water heaters and cookers. Short term contributions of this project are lower utility expenses, reduced carbon dioxide emissions, and reduced time and effort for collecting biomass.

Contributions over the longer term are preserved vegetal cover, and improvement and growth of biodiversity. In terms of implementation, the *Ministère de l'Environnement et du Cadre de Vie* was named as the head of the project. Regional directives, women's associations, development project committees and NGOs are also expected to participate in the implementation of the project. Arrangements for evaluation and monitoring

²³² Burkina Faso NAPA, Annex

²³³ Burkina Faso NAPA, Annex

conform to the regulations for the management of similar projects. Finally, the estimated total cost of the project was 1,230,000 US dollars. An accompanying chart illustrates the expected yearly cost of each of the project's four main activities.²³⁴

NAPA Development Process

The methodology employed for the NAPA development started with the selection of sites for the vulnerability and adaptation study. Ten locations were initially selected, as representatives of vulnerability to climate change in each of the country's three agro-climatic zones. Socio-economic criteria were used as an indication of poverty in each of the representative zones, presumably with the idea that there is a correlation between poverty and vulnerability. Finally, a report was produced, and the evaluation of Burkina Faso's vulnerabilities and capacities to adapt became the foundation for the NAPA document. The report was validated at the regional and governmental levels.²³⁵

Burkina Faso's NAPA team refers to the country's NAPA development process as participative and iterative. A wide range of actors were implicated, from state authorities to local communities. At the governmental level, an inter-ministerial committee was formed in order to implement the UNFCCC, which Burkina Faso ratified in September of 2003.²³⁶ Before the start of the NAPA process, the *Conseil National pour l'Environnement et le Développement Durable* (CONEDD) was established by the Burkinabé government in order to ensure that the country's development actions would preserve the environment and incorporate a vision of sustainability. The *Conseil National de Secours d'Urgence et de Réhabilitation* (CONASUR) had already been set in place in

²³⁴ All Project 12 information from Burkina Faso NAPA, pp. 67-68

²³⁵ Methodology from Burkina Faso NAPA, pp. 6-8

²³⁶ Burkina Faso NAPA, p. 28

order to deal with calamities such as floods and famines, and to provide affected populations with immediate aid.

The *Secrétariat Permanent* of the CONEDD was charged with the responsibility of supervising the entire NAPA development process.²³⁷ The preparation of the NAPA document was coordinated by the *Ministère de l'Environnement et du Cadre de Vie*, a branch of the CONEDD.²³⁸ The actors responsible for the development of the NAPA kept in mind existing international environmental agreements such as the Millennium Development Goals and the Kyoto Protocol, ratified by Burkina Faso in March of 2005.²³⁹ A pilot committee for the development of the NAPA consisted of representatives of technical services, international and inter-African organizations such as the United Nations Development Program and *Comité Permanent Inter-Etats de Lutte contre la Secheresse dans le Sahel* (CILSS), various socio-professional organizations, and civil society (including NGOs and other associations). The pilot committee decided on the methodology for the NAPA. The NAPA team, in charge of putting the NAPA together, also had a multi-disciplinary quality and consisted of experts from a range of fields. Workshops were organized in order to conduct the selection of experts for the NAPA team and then to facilitate the selection of study sites.

Participation at the regional and local levels was ensured through several different organizational strategies. The NAPA team conducted studies in five representative zones across the country. Each zone provided a sample of different types of administrative authorities, personnel responsible for decentralized technical services, NGOs and other

²³⁷ Burkina Faso NAPA, p. 27

²³⁸ Burkina Faso NAPA, p. 29

²³⁹ Burkina Faso NAPA, pp. 28-29

associations, and communities.²⁴⁰ Five regional workshops were organized for the identification of the sectors and groups that are particularly vulnerable to climate change. Furthermore, exchanges were organized between villages, to provide a range of communities with opportunities to recount their own perceptions of the impacts of climate change as well as the adaptation options that they identify as highest priority. Different societal groups were represented in the intra-village gatherings, including women, youth, the elderly, and farmers.²⁴¹ After the conclusion of the regional studies, the pilot committee reviewed the NAPA team's work and then passed the document along to the government.²⁴² Burkina Faso officially adopted its climate change strategy in 2006 during a counsel with government ministers. According to the NAPA document itself, transparency was maintained throughout all phases of the development process.²⁴³

Colonial Legacy

Like Tanzania, Burkina Faso's history includes a period of coercive colonial rule. The French colonial administration held control in Burkina Faso from 1897 to 1946. The French limited options for Burkinabés, often imposed military participation and labor, and demanded the production of cotton – a crop that would be useful for France, but that did little in terms of providing sustenance for the Africans. Agricultural policy under the colonial regime encouraged the expansion of commercial crops, sped up the clearing of new areas, contributed to land scarcity, and also uprooted individuals and broke up villages and compounds.²⁴⁴ Conflicts broke out during a dry decade, as people rushed for the lowlands. Eventually, peace and security improved in the regulated areas, but pockets

²⁴⁰ Burkina Faso NAPA, p. 27

²⁴¹ Burkina Faso NAPA, p. 28

²⁴² Burkina Faso NAPA, p. 29

²⁴³ Burkina Faso NAPA, p. 28

²⁴⁴ Zaal and Diallo, in The Impact of Climate Change on Drylands, pp. 220-221

of no-man's land had escaped the notice of the French. Many inhabitants hid in these unsupervised areas in order to escape the colonial rule.²⁴⁵

Post-World War II, Burkina Faso enjoyed both a freedom from the colonial administration and a period of relatively abundant rainfall. Young men began to migrate to the Côte d'Ivoire and Ghana, in order to work in the cocoa industry and make money to bring home.²⁴⁶ Unfortunately, the decade of sufficient rainfall was succeeded by twenty years of recurring droughts. Again, inhabitants rushed to the more-arable lowlands, and violent conflicts broke out. Land-related tensions were intensified after the Revolution of 1983 and the land reform of 1984 turned all land in Burkina Faso into state property.²⁴⁷ The government regime of Thomas Sankara "condemned 'traditional' systems of land management as feudal and created a network of revolutionary defense committees (CDRs) in villages... which undermined the [local] authority regarding land issues."²⁴⁸

A period of stabilization followed the twenty years of droughts. It became more common for women to accompany their husbands in their seasonal migrations to the Côte d'Ivoire. Cooperation between the Moose and the FulBe increased, and was manifested through cattle entrustments, gifts of milk and cereals, lending of money, and similar signs of trust. However, ethnic tensions began to resurface after 1997, between the Moose and the FulBe and also between the Moose that migrated and the populations in their destination areas. These renewed tensions can be attributed to pressure on natural

²⁴⁵ Zaal and Diallo, in The Impact of Climate Change on Drylands, pp. 220-221

²⁴⁶ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 222

²⁴⁷ Zaal and Diallo, in The Impact of Climate Change on Drylands, pp. 224-226

²⁴⁸ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 226

resources in addition to the confusion caused by democratization, decentralization, and privatization.²⁴⁹

The economic situation in Burkina Faso exacerbates the country's vulnerability to climate change. Burkina Faso's economy is heavily dependent on the primary sector; agro-pastoral and forestry activities occupy 86% of the population and account for a significant percentage of the nation's GDP.²⁵⁰ Unfavorable climatic conditions, including poor soils and insufficient rainfall, make primary sector activities a challenge. In addition to the climate-related stresses, Burkinabés struggle with technological and financial constraints. As a result, the country often has trouble ensuring food security.

Analysis

The underlying reason for which the impacts of climate change are so problematic for sub-Saharan Africa has to do with the vulnerability of the populations. Natural hazards – flooding, drought, erosion, land degradation, and other effects of climate change – do not directly cause problems such as food shortages and other calamities. The effects of climate change and environmental degradation simply act as trigger events, and turn into disasters when they hit vulnerable people.²⁵¹ The causes of vulnerability to climate change are often economic and political; many scholars believe that inequality is the major basis for vulnerability.²⁵² Poverty and vulnerability are not synonymous, though there is a correlation between the two terms; poor people are often exposed to more risks than the wealthy. Exposure to risk is the external side of vulnerability, while the internal aspect consists of limited resilience and the inability to

²⁴⁹ Zaal and Diallo, in The Impact of Climate Change on Drylands, p. 239

²⁵⁰ Burkina Faso NAPA, p. 3

²⁵¹ Van der Geest and Dietz, in The Impact of Climate Change on Drylands p. 121

²⁵² Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p. 121

cope.²⁵³ Therefore, if a country truly wants to tackle the root causes of vulnerability to the negative impacts of climate change, its NAPA should address the big picture. Rather than limit priority adaptation activities to “tech fixes,” countries should expand their focus to include social, political, and economic considerations – in short, state capacity. Why, then, have countries such as Burkina Faso neglected to do this?

Like Tanzania, Burkina Faso’s NAPA lacks adaptation plans that are designed to build state capacity. It appears as though Burkina Faso faces the same challenge as Tanzania: ironically, it might not have the capacity to build capacity. The government is weak, unable to maintain stability and to ensure security, including food security, for its citizens, and the literacy and education levels are extremely low among Burkinabés. Burkina Faso’s NAPA team seems at least somewhat aware of this problem, as it cited lack of capacity as one of the potential barriers to NAPA implementation, and since capacity was one of the criteria for the selection of priority activities. The actors responsible for the development of the NAPA might have purposely selected adaptation programs that do not focus on capacity, because it was apparent that the capacity to implement such programs was missing at both the local and governmental levels. This desire to provide adaptation strategies that do not require a great deal of capacity for implementation relates to my hypothesis regarding the LDC’s own perception of vulnerability. The NAPA objective specifies adaptation plans that address the immediate needs of vulnerable populations. Women and farmers comprise some of the most vulnerable populations to climate change in Burkina Faso, and the aim of the NAPA team may have been to develop adaptation activities that are consistent with the existing capabilities of these vulnerable groups. Perhaps most capacity-building plans were cut

²⁵³ Van der Geest and Dietz, in The Impact of Climate Change on Drylands, p. 122

from the final prioritized list because of the low level of local capacity; vulnerable populations would have had difficulties in implementing capacity-building adaptation activities. The plan to improve energy efficiency in households, the only adaptation activity in the NAPA that directly relates to capacity-building,²⁵⁴ ranked last on the NAPA's priority list and also was the most expensive adaptation activity.

As was the case for Tanzania, it appears as though the most significant reason that Burkina Faso's NAPA does not include capacity-building plans relates to the country's low level of development and the government's low level of capacity. Land turnovers, new agricultural policy, crop changes, and "individualization" that took place during the colonial period disrupted the traditional functioning of Burkinabé society. The post-colonial Burkinabé government then mandated an additional change to land management practices. It appears that Burkina Faso has yet to recover from these adjustments, as Burkinabés continue to struggle with land degradation, land-related ethnic conflicts, and food security issues. A weak economy requires Burkinabés to depend on the land for a source of livelihood. The government's low capacity to provide for Burkinabé citizens is reflected in the country's poor infrastructure. Burkina Faso's government is not likely to focus on capacity-building for climate change adaptation when it faces more pressing challenges, such as providing for the day-to-day needs of the population.

Conclusion

Burkina Faso's geography and dependence on the land for livelihood greatly contribute to the country's vulnerability to climate change. The study on the Kaya Region reveals some of the climate-related challenges associated with living in an arid region, including rainfall variability, soil degradation, drought, and famine. The Seno, Soum, and

²⁵⁴ See Esty, 2005 Environmental Sustainability Index, "Social and Institutional Capacity" indicator

Oudalan Provinces illustrate how climatic variability can lead to conflicts between farmers and herders, with resulting ethnic tensions. This region, in contrast to the Kaya, also experiences damage from flooding, showing that the impacts of climate change are varied even within a relatively small, landlocked country.

The NAPA of Burkina Faso adheres to the UNFCCC's guidelines, in terms of development process, structure, and content. The NAPA team did appear to pay particular attention to the adaptation needs of poor rural populations, the country's most vulnerable groups. Most of the prioritized adaptation activities address agriculture and water issues. Interestingly, one criterion for the selection of priority activities concentrated on the capacity of local communities to implement the adaptation activities. This indicates that Burkina Faso wished to avoid adaptation plans that not everyone could implement, including the most vulnerable groups. Burkina Faso prioritizes adaptation strategies that poor rural populations are able to follow. Therefore, I suggest that one reason that capacity-building plans are excluded from the NAPA is that capacity-building is not perceived as one of the most urgent adaptation needs; the Burkinabés believe that they most urgently need adaptation plans that can be implemented by everyone.

Another significant explanation for the lack of capacity-building adaptation plans has to do with Burkina Faso's poorly-functioning government. Like Tanzania, the colonial regime left Burkina Faso in a state of disarray. It appears as though the country has yet to fully recover. The country is extremely underdeveloped, ranked 176th out of the 177 countries evaluated by the Human Development Report,²⁵⁵ and the government struggles to provide its people with basic necessities such as peace and food. Therefore,

²⁵⁵ Human Development Report 2007/2008, Country Fact Sheets – Burkina Faso

the Burkina Faso's weak state capacity limits the country's ability to implement capacity-building plans as a part of its NAPA.

V. Senegal

Overview of Senegal's Vulnerabilities to Climate Change

Senegal is located on the western coast of Africa. Mauritania borders Senegal on the north, Mali on the east, and Guinea and Guinea-Bissau on the south.²⁵⁶ Similar to the previous two case study countries, Senegal is characterized by an arid climate, vulnerability to rainfall variation, and a heavy dependence on natural resources. The Senegalese realized the necessity of protecting the natural environment well before the start of the NAPA process. According to Senegal's strategic framework for NAPA implementation, the NAPA has been designed to be compatible with existing national environment and development plans. Senegal had already devised plans to combat desertification, protect ecological zones, fight against invasive species, improve coastal management, mitigate global warming, and achieve the Millennium Development Goals.²⁵⁷ The NAPA aspires to complement these efforts, to conserve natural resources, and to work towards sustainable development. Although the scholarly theories on capacity-building suggest that capacity-building is an essential component to climate change adaptation, Senegal's NAPA does not include capacity-building plans in its final prioritized list. I argue that the mention of capacity-building in Senegal's NAPA reflects the country's perceptions of most urgent adaptation activities as well as the country's governmental situation.

There are seven agro-ecological zones in Senegal: river, Niayes, northern groundnut basin, southern groundnut basin, sylvo-pastoral zone, Upper Casamance, and

²⁵⁶ Everything is Possible, "Map of West Africa"

²⁵⁷ Senegal NAPA, p. 35

Lower and Middle Casamance.²⁵⁸ The number of different zones suggests that Senegal's geographical diversity is just as extensive as Tanzania's. Population density in Senegal is somewhat higher than in Tanzania, with 48 people per square kilometer. The country is comprised of 10,165,314 inhabitants, and, as in Tanzania, the majority of the population is young; 58% of the population is under 20 years old.²⁵⁹ Over half of the population is educated, and nearly half is urban. Like many other African countries, Senegal experiences a great deal of poverty, especially in rural areas. Over 60% of the active population works as some type of farmer. This type of lifestyle is particularly vulnerable to the effects of climate change.

Resources and livelihood in Senegal are greatly affected by climate, as in Tanzania and Burkina Faso. Senegal's primary environmental resources include water, fish, wood, soil, and fauna. Climate change often results in rainfall variability and sea-level rise, which can lead to the degradation of marine ecosystems and soil quality. In turn, damaged ecosystems and poor soils compromise the availability of most natural resources. Water resources, agriculture, and coastal zones are the sectors the most heavily impacted by climate change in Senegal.²⁶⁰ The activities that take place in these sectors involve roughly 70% of the Senegalese population and strongly contribute to the country's GDP.²⁶¹ Fishing and tourism, two other significant sectors in the Senegalese economy, are impacted by climate change as well.

The majority of the Senegalese population depends heavily on natural resources for their livelihoods. Common activities consist of agriculture, fruit growing, market

²⁵⁸ Senegal NAPA, p. 3

²⁵⁹ Population characteristics from Senegal NAPA, p. 7 (source = UNDP's Millennium Development Goals)

²⁶⁰ Senegal NAPA, p. 3

²⁶¹ Senegal NAPA, p. 3

gardening, livestock, poultry farming, fishing, seaport activities, and tourism.²⁶² All of these activities depend on climatic conditions. The Senegalese the most vulnerable to climate change, therefore, are the people who partake in these activities.²⁶³ The category of most vulnerable groups also includes women, even though primary sector occupations are typically controlled by men. Women perform duties such as collecting water and wood; tasks that become increasingly difficult as the effects of climate change intensify. Climate change leads to a particular set of social, economic, and biophysical consequences in each vulnerable sector. A table from Senegal’s NAPA clearly presents these impacts:

Table 11: Risk and Vulnerable Zones²⁶⁴

	Social Consequence	Economic Consequence	Biophysical Consequence
Coastal Zones	Threats to populations and habitats	Economic losses (essentially coastal industries)	Coastal erosion, salinization, loss of biodiversity
Agriculture	Drops in agricultural yield, increasing food deficits (risk of food insecurity)	Drop in revenues for the majority of the population	Loss of agricultural land
Water Resources	Regression of water resources, problems of access	Disturbances of hydroelectric programs	Diminishment of water quality, loss of biodiversity
Tourism	Decline in GDP	Direct and indirect loss of jobs	Loss of beaches
Fishing	Disturbances in the exploitation of maritime resources	Loss of revenue for 15% of the population	Loss of marine biodiversity

²⁶² Senegal NAPA, p. 38

²⁶³ Senegal NAPA, p. 38

²⁶⁴ Senegal NAPA, p. 37

Prioritization of Activities

Criteria for the selection and prioritization of adaptation activities take into account access to revenue, access to infrastructure, synergy with existing strategies and plans, and cost.²⁶⁵ The NAPA team considers access to revenue and infrastructure as indicators of poverty, which has become a significant factor in both the causes of environmental degradation and vulnerability to environmental degradation. Senegal's NAPA classifies its priority adaptation plans by geographical zone, and ranks the plans according to the aforementioned criteria. For the *Zone Sud*, adaptation activities include: mangrove restoration (protecting, replanting); reforestation; utilizing crop varieties better able to adapt to the changing climatic conditions; and diffusing information.²⁶⁶ Adaptation activities for the *Zone Nord* consist of reforestation, forest renewal and maintenance; micro-irrigation; restoration of soil fertility; utilization of adaptive plant species; management of water retention basins; and, again, the diffusion of information.²⁶⁷ Activities for the *Bassin arachidier* involve reforestation; the preservation of coastal zones; education; and hydro-agricultural management.²⁶⁸ Lastly, the activities for the *Zone de Niayes* include dune fixation; reforestation; the protection of vulnerable sites; information sharing; the promotion of water saving techniques; and the restoration of underground water reserves.²⁶⁹ The NAPA provides a detailed list of specific adaptation plans, including for each the context, description of activities, justification, objectives, cost of activities (with totals in Senegalese currency and U.S. dollars), and the

²⁶⁵ Senegal NAPA, p. 40

²⁶⁶ Senegal NAPA, pp. 40-41

²⁶⁷ Senegal NAPA, p. 41

²⁶⁸ Senegal NAPA, pp. 41-42

²⁶⁹ Senegal NAPA, p. 42

organizations responsible for the execution of the project.²⁷⁰ It is worth noting that, like the adaptation activities in Tanzania's and Burkina Faso's NAPAs, these adaptation plans do not address the need to build state capacity. Senegal's adaptation strategies instead focus heavily on physical and technical fixes, such as improving irrigation and planting new crops.

Vulnerabilities and Adaptation Activities by Sector

As mentioned above, Senegal's three most vulnerable sectors are water resources, agriculture, and coastal zones. The vulnerabilities within the water sector are similar to the water-related vulnerabilities described by Tanzania and Burkina Faso: rainfall variability, droughts, flooding, and damage to agriculture and livestock. Senegal's NAPA team views its water problem in terms of development; for example, too much water is lost in the sea is a result of insufficient retention infrastructure. A great deal of rainwater reserves is lost as a consequence of ineffective water protection.²⁷¹ Adaptation activities, therefore, should focus on the improvement of water infrastructure and should include the introduction of new water protection measures. Small-scale infrastructure, such as hillside returns and retention basins, could replenish the hydrographic system.²⁷² The adaptation activities addressing the protection of available water reserves include: strict control of the use of chemical products such as pesticides; maintaining the equilibrium between the rate of extraction and the rate of water table renewal; improving the quality of water discharge; the treatment of water where pollution has been detected; the imposition of a sanitation plan on all habitation projects (graywater and blackwater currently are the primary sources of groundwater pollution, because many areas do not

²⁷⁰ Senegal NAPA, starting on p. 43

²⁷¹ Senegal NAPA, p. 17

²⁷² Senegal NAPA, p. 18

have adequate sanitation); improved compliance with the rules for the protection of hydraulic openings, the establishment of protection perimeters for water capture zones; education, information sharing, and the formation of collectives.²⁷³ Though not included in this section of Senegal's NAPA, biomass – Africa's most common energy source – also affects water resources. As LDCs develop, energy demand will increase. Extensive use of biomass exacerbates soil erosion and flooding.²⁷⁴ Tanzania and Burkina Faso have developed adaptation strategies that are designed to implement alternative and renewable energy sources in households. Senegal does not include this type of adaptation strategy in its NAPA.

Climate change is predicted to affect Senegal's agricultural sector in many of the same ways that it will affect agriculture in Tanzania and Burkina Faso. Agriculture constitutes the principal source of food, work, and income for rural communities in Africa, and directly relates to hunger and poverty.²⁷⁵ Agricultural vulnerabilities are strongly linked to precipitation, since agriculture depends heavily on rainfall. Desertification and the long-term rainfall reduction have greatly damaged crops and vegetation in the northern two-thirds of the country.²⁷⁶ Furthermore, an additional consequence of climate change in Senegal is inter-annual rainfall variability.²⁷⁷ Precipitation is becoming increasingly difficult to predict, and cultivation therefore becomes progressively more challenging.²⁷⁸

²⁷³ Senegal NAPA, p. 17

²⁷⁴ Davidson et al., p. S106

²⁷⁵ Davidson et al., p. S101

²⁷⁶ Senegal NAPA, p. 19

²⁷⁷ See descriptions of rainfall variability in Burkina Faso case study chapter

²⁷⁸ Senegal NAPA, p. 20

It is argued that, in terms of responding to climate change, Africa's most urgent priority is to reverse the decline of agricultural yields.²⁷⁹ So far, agricultural intensification has occurred mainly through territorial expansion instead of improved agricultural techniques. Developing techniques for coping with irregular rainfall and improving agricultural product distribution (currently hampered by the low purchasing power of small-scale farmers) could increase food production without contributing to environmental degradation.²⁸⁰ In Senegal, technology and research form the basis of the NAPA's adaptation strategies for the agricultural sector. Research-based adaptation options include the fight against desertification, the improvement of the efficiency of water usage in agriculture and industry, and the selection of plant species tolerant to adverse climate conditions.²⁸¹ Technological adaptation strategies consist of the diffusion of agro-forestry techniques; the diversification of crops; the utilization of short-cycle crop varieties; the utilization of salt-tolerant crops; water collection and management; the extension of community woods; brush fire prevention programs; the dissemination of fertilization techniques; the reorganization of growing systems, the implementation of rural early warning systems; and an institutional push. This last technology-based adaptation strategy aims to boost the consideration of climate change science in the formation of policy decisions and to reinforce analytical capacities.²⁸² Neither Burkina Faso nor Tanzania makes any direct reference to improving state capacity as part of an adaptation plan; Senegal's inclusion of such a plan is significant.

²⁷⁹ Davidson et al., pp. S105-S106

²⁸⁰ Davidson et al., pp. S105-S106

²⁸¹ Senegal NAPA, p. 21

²⁸² Senegal NAPA, p. 21

Like Tanzania, part of Senegal's geography is comprised of coastal areas that will be greatly impacted by climate change. One climate change scenario predicts a global mean sea level rise of 88 cm within this century.²⁸³ Most impacts of sea-level rise are likely to be indirect, such as changes in water supply, agricultural productivity, and human migration.²⁸⁴ Other indirect effects of sea-level rise are changes in erosion patterns; damage to coastal infrastructure; salinization of well-water; loss of coastal ecosystems and resources; and damage to the sewage systems of coastal cities, with adverse consequences for human health.²⁸⁵ According to the NAPA, vulnerabilities for Senegal's coastal zones include floods, erosion, salinization of waters and soils, and mangrove degradation. Floods are a recurring phenomenon, and can be particularly problematic in urban areas.²⁸⁶ Coastal erosion also threatens urban developments.²⁸⁷ Rates of retreating coastlines vary, but the average for sandy beaches is between 1 and 2 meters per year.²⁸⁸ Many cities in Senegal are located along the coast. One study ranked Senegal 45th most vulnerable to sea-level rise out of 181 countries.²⁸⁹

²⁸³ Gomme et al, in Climate Change in Africa, p. 191

²⁸⁴ Gomme et al., in Climate Change and Africa, p. 191

²⁸⁵ Gomme et al., in Climate Change and Africa, p. 195

²⁸⁶ In fact, urban areas are generally more vulnerable to the impacts of climate change no matter where they are situated. Vulnerability is, in part, a function of population density. See Gomme et al. in Climate Change and Africa, p. 198

²⁸⁷ Some urban settlements experience land subsidence as a consequence of groundwater withdrawal. This occurrence is not directly related to a coastal location, but it is worth taking note of this additional water issue that affects cities. Gomme et al. in Climate Change and Africa, p. 192

²⁸⁸ Senegal NAPA, p. 22

²⁸⁹ Senegal NAPA, p. 24

Table 6: Principal physical impacts and consequences of climate change on coastal and marine zones²⁹⁰

Principal physical impacts	Expected consequences
Sea-level rise	Increase in coastal erosion Flooding of low coastal zones Salinization of water and soils Risk of mangrove disappearance
Increase in wave heights	Increase in coastal erosion
Warming of ocean waters	Changes in the structure and composition of marine species (fish and water birds) Development of toxic agents in marine animals
Modification of upwellings	Changes in the structure and composition of marine communities

Senegal’s adaptation options for the coastal zone appear to be more sophisticated and comprehensive than Tanzania’s and Burkina Faso’s adaptation strategies. The NAPA includes technological options, natural resource options (the protection of certain ecosystems, such as mangroves), legal and institutional options, and capacity-based options.²⁹¹ Burkina Faso’s and Tanzania’s NAPAs do not characterize adaptation actions as institutional or capacity-based. Senegal’s NAPA team acknowledged that technology-based adaptation strategies are not always sufficient or appropriate. Legal and institutional options included a redefinition of the notion of public maritime domain; regulations concerning beach sands, permits, and environmental impact studies; and the formation of an institutional body to be in charge of the surveillance of coastal zones. The capacity-based options mentioned the need to strengthen the capacity of institutional actors (government ministries, decentralized structures, urban and rural communities), and the need for adequate information for decision-makers.²⁹²

²⁹⁰ Senegal NAPA, p. 24

²⁹¹ Senegal NAPA, p. 27

²⁹² Senegal NAPA, p. 27

NAPA Methodology

Senegal developed its NAPA in five phases and eight stages. The phases were: global organization, sectoral studies, public consultations, prioritization, and project formulation.²⁹³ The first two stages consisted of assembling the multidisciplinary NAPA team. The second two stages included a synthesis of impact studies, adaptation strategies, anterior consultations, and existing development frameworks; and a rapid participative evaluation of the current vulnerability and the potential intensification of climate-related risks. The fifth stage was a public consultation, with the goal of identifying potential adaptation activities. In stage six, priority criteria were developed in light of the outcome of the public consultation. The next stage a classification of adaptation activities and a demonstration of their integration with existing national development plans. The final stage included an elaboration of project profiles and, finally, the submission of the NAPA to the Senegalese government.²⁹⁴

In a sense, Senegal seems more conscious of its weaknesses concerning vulnerability assessment and adaptation than Tanzania. Senegal's NAPA team included a section on limitations of the methodology in the NAPA document. The main limitation perceived by the NAPA team involved the organization of the public consultations and the prioritization of adaptation strategies. The NAPA team felt that the results of the public consultation were strongly tied to the feelings and knowledge of the people present – perhaps suggesting that the biased views of the consultation's participants did not lead to the most accurate representation of the country's climate situation. In terms of prioritizing adaptation plans, the NAPA team reflected that decisions were based on

²⁹³ Senegal NAPA, p. 10

²⁹⁴ Senegal NAPA, p. 10

people, subject to human limitations, rather than scientific models. The outcome of the prioritization decisions, then, depended on the preferences, experiences, and knowledge of the involved actors. The selection of priority activities was the result of achieving consensus, not optimization.²⁹⁵

Analysis

Overall, Senegal’s NAPA seems more advanced than the NAPAs of Tanzania and Burkina Faso. Senegal elected to organize its entire NAPA by sector, and then presented vulnerabilities and adaptation options within each sector. Senegal’s document includes more scientific data, graphs, charts, and tables. The Senegalese NAPA team recognizes the importance of institutions and capacities. The adaptation plans appear to be more comprehensive and detailed when compared to the NAPAs of Tanzania and Burkina Faso. While the Senegalese NAPA, like the others studied, does not include adaptation strategies that specifically focus on capacity-building, capacity is clearly taken into consideration by the NAPA team. Senegal’s NAPA team distinguishes between different types of capacity, states that technical capacity is not always sufficient, and recognizes the importance of institutions having the capacity to carry out their tasks.

Some scientists argue that African climate change strategies should take a “development first” approach.²⁹⁶ Low levels of development are often cited as barriers to effective adaptation to climate change impacts. Furthermore, it is perceived that climate change will hinder the achievement of many of the Millennium Development Goals. Proponents of the “development first” approach believe that future climate strategies should emphasize development plans with subsidiary climate benefits, and should work

²⁹⁵ Senegal NAPA, p. 13

²⁹⁶ Davidson et al.

to increase the country's capacity to implement these plans.²⁹⁷ Development is particularly important in terms of capacity, since a country's ability to increase its capacity to deal with the impacts of climate change strongly depends on the country's overall ability to develop.²⁹⁸ The capability to develop refers to carrying out the general tasks of the nation state, including problem-solving, and setting and realizing objectives.²⁹⁹ Common barriers to development consist of inappropriate infrastructure, poorly-functioning markets, and weak institutions.³⁰⁰ The agricultural sector provides an example of the link between poor markets and underdevelopment: thanks to agricultural research, technologies exist to enhance agricultural production levels. However, farmers have not been able to implement these technologies due to a lack of markets and economic incentives.³⁰¹

The market system may be one reason why LDCs lack comprehensive climate change strategies. Many African developing countries and LDCs are in the midst of an economic transition. The role of the state becomes less and less significant as countries liberalize state enterprises and open markets to international investments.³⁰² Consequently, governments are finding that their reach has diminished in an increasingly market-oriented context. As governments are obliged to focus their attention on a smaller number of priority issues, climate change often takes the back seat.³⁰³

A "Development and Climate" project, involving Senegal and other West African countries, was started in 2002. The goals of this project focused on policies that

²⁹⁷ Davidson et al.

²⁹⁸ Davidson et al., p. S100

²⁹⁹ Davidson et al., p. S100

³⁰⁰ Davidson et al., p. S100

³⁰¹ Davidson et al., p. S101

³⁰² Davidson et al., p. S101

³⁰³ Davidson et al., p. S101

simultaneously meet development priorities and address climate change issues; long-term sustainable development; and integrated development and climate strategies.³⁰⁴ The NAPA teams of Tanzania, Burkina Faso, and Senegal do attempt to demonstrate the NAPA's compatibility with existing national development plans. Senegal's NAPA addresses capacity more than the other two, and even proposes capacity-building plans as a response to climate-related vulnerabilities in the agricultural and coastal sectors. However, as I have demonstrated throughout this study, none of the three NAPAs contain priority adaptation strategies that include capacity-building plans. It is encouraging, though, that Senegal's NAPA team has so clearly stated the need to increase capacity.

Senegal is the site of an innovative project with encouraging implications for African agriculture. From the 1970s onward, sub-Saharan Africa has undergone severe droughts, a 30-40% reduction in rainfall, falling groundwater tables, and soil degradation. The Sebikotane region of Senegal experiences the added stress of strong coastal winds that blow away topsoil.³⁰⁵ A pilot farm in the Sebikotane has demonstrated that it is possible to "produce" a new environment that is more hospitable to agriculture. New agroforestry techniques on the pilot farm have become models for the reversal of desertification, the increase of agricultural production, and the subsequent increase of revenue. Trees are planted in dense perennial hedges, so that they serve as windbreaks. It is easier for crops to grow when they are planted in soils that are protected from the wind. The use of trees as windbreaks also provides a readily-available source of wood for cooking, and thus decreases the fuel-collection time and effort for women and girls. Drip irrigation replaces water-intensive and rain-fed agricultural practices. The pilot farm has

³⁰⁴ Davidson et al.

³⁰⁵ Magrath and Simms, p. 12

experienced a great deal of success. Farmers who have passed through the pilot farm have introduced many of the farm's techniques in their own communities.³⁰⁶

Long-term strategies such as the transition to sustainable farming are promoted by Moussa Seck of the Senegalese NGO *Environnement et Developpement du Tiers-Monde* (EDNA-TM). Seck asserts that it is essential to think in the long-term, and that the three- to five-year duration of most adaptation programs is insufficient.³⁰⁷ The time frame of projects is often a point of contention. The development and adaptation efforts of many LDCs tend to be focused on the short-term; long-term impacts of climate change are not priorities when people are concerned with their ability to sustain themselves on a day-to-day basis.³⁰⁸

As well as integration with development plans, a climate change response should give considerable attention to food production, water scarcity, wood demand, and electricity. Because of population growth, food production will need to double over the next quarter century; however, climate change decreases agricultural productivity. Within 30 years, populations facing water scarcity will double, yet climate change decreases water availability. Wood demand is also expected to double in the foreseeable future, but climate change makes forest management increasingly difficult as a consequence of pests and fires. Finally, electricity demand in developing countries will increase three to five times over the next several decades.³⁰⁹ Since burning fossil fuel exacerbates climate change, clean energy alternatives will need to be developed and implemented.

³⁰⁶ Information on Sebikotane pilot farm from Magrath and Simms, p. 12

³⁰⁷ Magrath and Simms, p. 12

³⁰⁸ Davidson et al., p. S105

³⁰⁹ Information from Davidson et al., p. S100

A country's government, typically the ministry of the environment or a meteorological services department, ultimately holds the responsibility for the development and implementation national climate change activities. A lack of state capacity, therefore, can significantly hinder the country's ability to come up with an effective adaptation plan. The group in charge of developing the adaptation plan – in this case, the NAPA team – must conduct research, modeling, and analysis, and must coordinate between different government ministries.³¹⁰ Often, government personnel struggle to find the time to participate in climate change studies. Furthermore, the multi-disciplinary nature of climate change can mean that an adaptation study implicates several different government ministries, each with different perceptions and priorities. The need to cooperate across ministries makes it “difficult to collect data, perform analysis and build meaningful capacity across ministerial borders... The realities of government departments can inhibit the process of carrying out the study and building capacity among staff.”³¹¹

Examination of Hypotheses

Does Senegal's NAPA truly reflect the country's vulnerabilities to climate change? If the NAPA team did not identify the lack of capacity as a vulnerability, there would be no reason for the NAPA to include capacity-building strategies. I argue that the NAPA does adequately reflect Senegal's climate-related vulnerabilities, as identified by both the NAPA team and other scholars. Senegal's NAPA clearly recognizes the country's need for capacity, and goes so far as to propose adaptation strategies with a

³¹⁰ Mackenzie, in *Climate Change and Africa*, p. 243

³¹¹ Mackenzie, in *Climate Change and Africa*, p. 243

capacity-building focus for the agriculture and coastal zone sectors, even though these plans do not make it onto the final prioritized list.

Does Senegal have the capacity to develop capacity-building adaptation plans? Ironically, many LDCs lack the capacity to build capacity. Since their independence, Tanzania and Burkina Faso have struggled to maintain peace and order; it is likely that the governments of these countries are so preoccupied with the effort to perform basic duties that they are unable to build state capacity to address the impacts of climate change. As the case in Tanzania and Burkina Faso, none of Senegal's final priority adaptation plans focus on capacity-building. However, Senegal's NAPA does pay a remarkable amount of attention to the need for capacity, especially when compared with the other two countries. Also in contrast to Tanzania and Burkina Faso, Senegal's transition to independence occurred unusually smoothly. I argue that the correlation between government stability and capacity helps to explain the absence of capacity-building plans in the NAPAs of these LDCs; Senegal's NAPA addresses capacity more than the other countries, and Senegal's government has also been more stable.

Tony Chafer argues that since its independence from the French colonial rule, "Senegal's close ties to France have contributed to its political stability."³¹² Senegal was among France's oldest colonies, and has enjoyed a mutually profitable relationship with its former colonizer. Leopold Sédar Senghor, who became president when Senegal gained its independence in 1960, was a devout Francophile and ensured that his country had a smooth, successful start while maintaining cooperation with France. Senghor "earned a reputation as an enlightened African leader who bequeathed to his country stability, a relatively open society with a vigorous free press, and a functioning

³¹² Chafer, online

democracy.”³¹³ Senegal’s ongoing bond with France helped to ensure this stability. France’s military aided the Senegalese government in a time when nationalist groups showed signs of uprising. Additionally, the fact that Senegal continued to use the French franc as its currency encouraged French educators and government advisors to take posts in the former colony.³¹⁴

By the time Senegal’s third president came to power, the special rapport with France had begun to deteriorate. France experienced problems dealing with illegal Senegalese immigrants, and Senegal’s President Abdoulaye Wade worked to expand foreign relations to the United Kingdom, the United States, and other countries in Africa.³¹⁵ However, the close ties with France immediately following decolonization allowed Senegal to commence its independence with a stable economy, and a relatively peaceful population, and a remarkably well-functioning government.

As a result of its historical/governmental situation, Senegal fares better than Tanzania and Burkina Faso in terms of having the capacity to develop capacity-building adaptation strategies. However, it is important to note that while capacity-building plans were initially proposed in Senegal’s NAPA, the plans did not make it to the final list of priority activities. This indicates that, while the Senegalese recognized their need for improved capacity, they viewed other types of adaptation strategies as more appropriate for the NAPA. Therefore, even though Senegal’s government appears to have more extant capacity than the other two governments, Senegal would still benefit from capacity-building.

³¹³ Information in paragraph from Chafer, online

³¹⁴ Chafer, online

³¹⁵ Information in paragraph from Chafer, online

According to the Environmental Sustainability Index, Senegal has higher levels of environmental health and environmental governance than Tanzania and Burkina Faso. However, in the broad category of social and institutional capacity, Tanzania fared slightly better than Senegal, though Senegal did achieve a higher score than Burkina Faso. Senegal's score for the science and technology indicator is also somewhere between the scores for Tanzania and Burkina Faso.³¹⁶ Clearly, none of the three countries excels in terms of environmental sustainability and climate change adaptation. Although Senegal has achieved better government stability than either Tanzania or Burkina Faso, it is still an LDC, and is ranked 156th out of the 177 countries investigated by the Human Development Report.³¹⁷ Furthermore, Senegal's adult literacy rate is only 39.3%³¹⁸ (hence the great number of proposed adaptation projects that include an educational/information-sharing component). The fact that Senegal's HDR ranking and overall ESI scores are comparable to the other two countries suggests that, despite its better functioning government, Senegal still has a great deal of room for progress.

Conclusion

Overall, Senegal's situation supports the hypotheses that the NAPAs of LDCs in sub-Saharan Africa do not include capacity-building plans because of the countries' own perceptions of vulnerability and, more importantly, because of the low levels of existing state capacity. Unlike Tanzania and Burkina Faso, Senegal includes a significant amount of capacity-related information in its NAPA. Although capacity-building plans did not make it onto the final prioritized list of activities, it is apparent that Senegal's NAPA team was fully aware of the need for capacity, as well as the distinction between

³¹⁶ Esty et al. 2005 *Environmental Sustainability Index: Appendix B*, p. 219

³¹⁷ Human Development Report 2007/2008, Country Fact Sheets – Senegal

³¹⁸ Human Development Report 2007/2008, Country Fact Sheets – Senegal

technology-based and capacity-based adaptation plans. The NAPA team was also cognizant of the country's limitations in both developing and implementing its NAPA. This increased awareness of capacity, in comparison to the other two countries examined in this report, can be attributed to Senegal's relatively higher development status. The Human Development Report ranked Senegal 20 countries higher than Burkina Faso, and 3 countries higher than Tanzania.³¹⁹ Furthermore, unlike the other countries, Senegal's colonial experience and subsequent transition to independence resulted in stability and a well-functioning democracy. As a result, the Senegalese government has more capacity to provide for the basic needs of the Senegalese population, and the country is several steps closer to developing capacity-building for adaptation to climate change. Even though Senegal would still benefit from capacity-building activities as part of a response to climate change, the fact that Senegal at least explores capacity-building in its NAPA demonstrates that the country is closer to implementing capacity-building activities than the other two countries.

I argue that, ultimately, the omission of capacity-building in the NAPA's final list of priority activities can be attributed to Senegal's perceptions of urgency and local feasibility. The NAPA team clearly demonstrates an awareness of capacity-building strategies, and the country appears to have a higher degree of existing capacity than either Burkina Faso or Tanzania. Therefore, it seems as though Senegal would be able to develop effective capacity-building strategies if need be, and has elected instead to put forth adaptation strategies that are more technology-based, designed for implementation directly by the groups the most vulnerable to climate change.

³¹⁹ Human Development Report 2007/2008, Country Fact Sheets – Senegal

VI. Conclusion

This thesis addressed the lack of capacity-building in the climate change adaptation plans of sub-Saharan African least-developed countries. My focus was on state capacity, the technical and intellectual capability of governments to develop and implement adaptation strategies. I opened the study with a background on the impacts of climate change on sub-Saharan Africa. I also presented an explanation of the National Adaptation Program of Action (NAPA) rationale and development process, and an overview of theories on capacity-building. In order to ascertain why the NAPAs of African LDCs did not include prioritized adaptation activities that emphasized capacity-building, I analyzed the climate-related vulnerabilities and NAPA content of three case study countries, investigated the countries' current levels of state capacity, and sought explanations for my findings in the countries' historical backgrounds. The Environmental Sustainability Index and the Human Development Report provided useful indicators of existing capacity, including science and technology, institutions, education and literacy rates, and economic situations.

I have demonstrated that capacity-building adaptation plans are missing from the NAPAs of three least-developed countries in sub-Saharan Africa. I selected Tanzania, Burkina Faso, and Senegal as case studies because each has a slightly varied set of climate-related vulnerabilities and a different level of existing state capacity. According to the theories of Connolly, Keohane, Levy, and Haas, capacity is an important component of adaptation to climate change. Countries require state capacity in order to identify adaptation needs, to obtain and evaluate information necessary for the formulation of an adaptation strategy, and to develop and implement the strategy itself.

LDCs typically lack state capacity; oftentimes, governments barely have the capacity to perform the basic tasks expected of a nation-state. Most African LDCs have “not yet succeeded in bringing either stability or coherent development to the region.”³²⁰ The fact that these countries experience a deficiency in state capacity, an element so valuable in terms of adaptation to climate change, led me to seek an explanation for why capacity-building plans are not included in the NAPAs.

My hypotheses addressed the question of why the NAPAs of African LDCs have generally failed to include capacity-building in their lists of prioritized adaptation activities. I argued that two major factors help to explain the lack of capacity-building plans in the NAPAs of sub-Saharan Africa. First of all, it could be that the countries simply – and ironically – lack the capacity to build capacity. Tanzania, Burkina Faso, and Senegal all recognized the value of capacity at some point in their NAPAs; yet, in all three NAPAs, the prioritized lists of adaptation activities do not lead to an increase in state capacity. The adaptation activities appear to be designed for implementation at all levels of society, including the groups the most vulnerable to the impacts of climate change. The most vulnerable groups consist of poor, rural populations that, incidentally, have the least amount of capacity to implement adaptation programs. Since NAPAs are intended to respond to a country’s immediate and urgent adaptation needs, and since the NAPAs of Tanzania, Burkina Faso, and Senegal demonstrated an awareness of the importance of capacity, it appears that the LDCs did not consider capacity-building to be as high a priority as other adaptation activities that the most vulnerable groups would be able to implement. The fact that rural groups in particular have such low levels of

³²⁰ Davidson et al., p. S104

capacity reflects the weak state capacity of the LDCs in general. This leads to my next hypothesis.

In my second hypothesis, I argued that LDCs' low levels of existing state capacity correspond in part to the countries' colonial legacies. All three countries examined in this report are former European colonies. The United Kingdom controlled Tanzania until 1964, Burkina Faso was a colony of France until 1946, and Senegal gained independence from the French colonial authorities in 1960. Since their independence, Tanzania and Burkina Faso have suffered from instability, corruption, and poorly-functioning governments – conditions that simultaneously contribute to and are exacerbated by environmental degradation. Tanzania and Burkina Faso do not explore capacity-building issues in any type of depth in their NAPAs, and both countries cite lack of capacity as a barrier to NAPA implementation. Senegal, on the other hand, experienced a remarkably smooth transition to independence, and managed to sustain close ties with France. The former colonizer helped the Senegalese government to ensure stability during threats of uprising, and also provided expertise in the form of teachers and military and technical advisors. This helps to explain why Senegal's government has more existing state capacity than the governments of Tanzania and Burkina Faso. Senegal's government is better able to provide for its population and to execute institutional reforms, and therefore better equipped to develop capacity-building adaptation plans. Senegal's NAPA differentiates between the capacity to strengthen institutional actors and the capacity of decision-makers to procure and interpret relevant information, and includes proposals to increase these types of capacity.

The absence of capacity-building plans in the NAPAs is significant; the UNFCCC intended the NAPAs to be the major mechanism for adaptation to climate change in LDCs, and if state capacity is necessary for effective adaptation, then additional adaptation procedures must be devised. Because a number of LDCs lack the capacity to build capacity, outside assistance may be required. Sub-Saharan Africa will be particularly affected by climate change, and LDCs in this region are especially vulnerable to climate change's impacts. It is essential that all adaptation requirements of LDCs be addressed, as the world has committed itself to a changing climate well into the future.

Sources Consulted

- Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahashi. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Editors. Cambridge University Press, Cambridge, UK, 2007.
- Adger, W. Neil, Jouni Paavola, Saleemul Huq, M.J. Mace. Fairness in Adaptation to Climate Change. The MIT Press, Cambridge, Massachusetts, 2006.
- Basher, Reid and Sálvano Briceño. Climate and Disaster Risk Reduction in Africa. United Nations Secretariat of the International Strategy for Disaster Reduction, Geneva, Switzerland. From Pak Sum Low, Editor. Climate Change and Africa. Cambridge University Press, Cambridge, UK, 2005. (Chapter 25)
- Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M. L. Parry
- Breusers, Mark. Responses to Climate Variability in the Kaya Region, Burkina Faso. From Dietz, A.J., R. Ruben and A. Verhagen, Editors. The Impact of Climate Change on Drylands, With a Focus on West Africa. Springer, 2004. (Chapter 14)
- Central Intelligence Agency. The World Factbook: Tanzania. April, 2009. Online. <<https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html>>.
- Chafer, Tony. "France and Senegal: The End of the Affair?" SAIS Review, The Johns Hopkins University Press, 2003. <http://muse.jhu.edu/journals/sais-_review/v023/23.2chafer.html>.
- Davidson, O., Kirsten Halsnaes, Saleemul Huq, Marcel Kok, Bert Metz, Youba Sokona, Jan Verhagen. The development and climate nexus: the case of sub-Saharan Africa. Climate Policy 3S1, 2003. Available online. <www.sciencedirect.com>.
- Dietz, A.J., R. Ruben and A. Verhagen, editors. The Impact of Climate Change on Drylands, With a Focus on West Africa. Kluwer Academic Publishers, Dordrecht, The Netherlands, 2004.
- Esty, Daniel C.; Levy, Marc; Srebotnjak, Tanja; and de Sherbinin, Alexander. 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. Yale Center for Environmental Law and Policy, New Haven, Connecticut, 2005. Available online. <www.yale.edu/esi>.

- Everything is Possible. <<http://everythingpossible.files.wordpress.com/2008/03/map-west-africa.jpg>>. Google search engine, "Map of West Africa," March 2009.
- Global Environment Facility. "What is the GEF?" 2007, Online. <http://www.gefweb.org/interior_right.aspx?id=50>.
- Global Environment Facility. Strategic Approach to Enhance Capacity Building. December, 2003. Online. <http://www.gefweb.org/documents/enabling_activity_projects/CDI/documents/Strategic_Approach_to_Enhance_Capacity_Building_FINAL.doc>.
- The Global Development Research Center. Defining Capacity Building. Online. <<http://www.gdrc.org/uem/capacity-define.html>>.
- Gommes, René, Jacques du Guerny, Freddy O. Nachtergaele and Robert Brinkman. Potential Impacts of Sea-Level Rise on Populations and Agriculture. United Nations Food and Agriculture Organization, Rome, Italy. From Pak Sum Low, Editor. Climate Change and Africa. Cambridge University Press, Cambridge, UK, 2005. (Chapter 18)
- Haas, Peter M., Robert O. Keohane and Marc A. Levy, editors. Institutions for the Earth. The MIT Press, Cambridge, Massachusetts, 1993.
- Intergovernmental Panel on Climate Change. Glossary, 2007. Online. <<http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>>.
- Keohane, Robert O. and Marc A. Levy, editors. Institutions for Environmental Aid. The MIT Press, Cambridge, Massachusetts, 1996.
- Low, Pak Sum, editor. Climate Change and Africa. Cambridge University Press, Cambridge, UK, 2005.
- Mackenzie, Gordon A. Capacity Enhancement in Climate Change Mitigation Analysis. From Pak Sum Low, Editor. Climate Change and Africa. Cambridge University Press, Cambridge, UK, 2005. (Chapter 26)
- Magrath, John, and Andrew Simms, Working Group on Climate Change and Development (Great Britain), New Economics Foundation, International Institute for Environment and Development. Africa – Up in Smoke 2, The Second Report on Africa and Global Warming from the Working Group on Climate Change and Development. Oxfam, 2006.
- Manful, George. Capacity-Building Initiatives to Implement the Climate Change Convention in Africa. United Nations Framework Convention on Climate Change Secretariat, Bonn, Germany. From Pak Sum Low, Editor. Climate Change and Africa. Cambridge University Press, Cambridge, UK, 2005. (Chapter 27)

Ministère de l'Environnement et de la Protection de la Nature, République du Sénégal. Plan d'Action National pour l'Adaptation aux Changements Climatiques. Senegal, 2006. Available online. <<http://unfccc.int/resource/docs/napa/sen01f.pdf>>.

Ministère de l'Environnement et du Cadre de Vie, Secrétariat Permanent du Conseil National pour l'Environnement et le Développement Durable, Burkina Faso. Programme d'Action National d'Adaptation à la Variabilité et aux Changements Climatiques. Burkina Faso, November, 2007. Available online. <<http://unfccc.int/resource/docs/napa/bfa01f.pdf>>.

Mugabe, John, Shakespeare Maya, Thomas Tata and Simeon Imbaba. Capacity Development Initiative: Country Capacity Development Needs and Priorities, Regional Report for Africa. United Nations Development Programme, October 2000.

Ndiang'ui, Ndegwa and Mannava V.K. Sivakumar, editors. Climate and Land Degradation. Springer-Verlag Berlin Heidelberg, New York, 2007.

Roberts, J. Timmons and Bradley C. Parks. A Climate of Injustice: Global Inequality, North-South Politics, and Climate Policy. The MIT Press, Cambridge, Massachusetts, 2007.

United Nations Development Programme. Human Development Report 2007/2008 – Country Fact Sheets – Burkina Faso. Online. <http://hdrstats.undp.org/countries/country_fact_sheets/cyt_fs_BFA.html>.

United Nations Development Programme. Human Development Report 2007/2008 – Country Fact Sheets – Senegal. Online. <http://hdrstats.undp.org/countries/country_fact_sheets/cyt_fs_SEN.html>.

United Nations Development Programme. Human Development Report 2007/2008 – Country Fact Sheets – Tanzania. Online. <http://hdrstats.undp.org/countries/country_fact_sheets/cyt_fs_TZA.html>.

United Nations Development Programme. Human Development Report 2007/2008, Fighting Climate Change: Human Solidarity in a Divided World. Palgrave Macmillan, New York, 2007. Available online. <<http://hdr.undp.org/en/reports/global/hdr2007-2008/>>.

United Nations Framework Convention on Climate Change. “Essential Background: Convention.” Online. <http://unfccc.int/essential_background/convention/items/2627.php>.

- United Nations Framework Convention on Climate Change. “Frequently Asked Questions about LDCs, NAPAs and the LEG.” Online. <http://unfccc.int/cooperation_support/least_developed_countries_portal/frequently_asked_questions/items/4743.php>.
- United Nations Framework Convention on Climate Change. Framework Convention on Climate Change, Article 4: Commitments. March, 1994. Available online. <http://unfccc.int/essential_background/convention/background/items/1362.php>.
- United Nations Framework Convention on Climate Change. Report of the Conference of the Parties on its seventh session, held at Marrakesh from 29 October to 10 November 2001. Addendum, Part Two: Action taken by the Conference of the Parties, Volume I. FCCC/CP/2001/13/Add.I, 2002. Available online. <<http://unfccc.int>>.
- United Nations Framework Convention on Climate Change. Report of the Conference of the Parties on its seventh session, held at Marrakesh from 29 October to 10 November 2001. Addendum, Part Two: Action taken by the Conference of the Parties, Volume IV. FCCC/CP/2001/13/Add.4, 2002. Available online. <<http://unfccc.int>>.
- United Nations Framework Convention on Climate Change. Report on the Conference of the Parties on its tenth session, held at Buenos Aires from 6 to 18 December 2004. Addendum, Part Two: Action taken by the Conference of the Parties at its tenth session. FCCC/CP/2004/10/Add.1, 2005. Available online. <<http://unfccc.int/resource/docs/cop10/10a01.pdf>>.
- United Republic of Tanzania, Vice President’s Office, Division of Environment. National Adaptation Programme of Action (NAPA). Tanzania, January, 2007. Available online. <<http://unfccc.int/resource/docs/napa/tza01.pdf>>.
- Van der Geest, Kees and Ton Dietz. A Literature Survey About Risk and Vulnerability in Drylands, With a Focus on the Sahel. From Dietz, A.J., R. Ruben and A. Verhagen, Editors. The Impact of Climate Change on Drylands, With a Focus on West Africa. Springer, 2004. (Chapter 11)
- World Bank. Burkina Faso Country Brief. The World Bank Group, October, 2008. Online. <<http://go.worldbank.org/U6XAAQ44R0>>.
- World Bank. Senegal Country Brief. The World Bank Group, September, 2008. Online. <<http://go.worldbank.org/PO6JPCB5P0>>.
- World Bank. Tanzania Country Brief. The World Bank Group, March, 2008. Online. <<http://go.worldbank.org/7SUHE823V0>>.

Zaal, Fred and Asaïta Diallo. Change and Adaptation in a Livestock Producing Region: Northeastern Burkina Faso. From Dietz, A.J., R. Ruben and A. Verhagen, Editors. The Impact of Climate Change on Drylands, With a Focus on West Africa. Springer, 2004. (Chapter 15)