

A Review of Climate Change Adaptation Initiatives within the Africa Biodiversity Collaborative Group Members



September 2011

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- Conservation International, 2011 Crystal Drive, Suite 500, Arlington, VA 22202 and its affiliate, Conservation South Africa, Cape Town, South Africa
- the Jane Goodall Institute, 4245 North Fairfax Drive, Suite 600, Arlington VA 22203
- The Nature Conservancy, 4245 North Fairfax Drive, Suite 100, Arlington, VA 22203
- Wildlife Conservation Society, 2300 Southern Boulevard, Bronx NY 10460
- World Resources Institute, 10 G Street, NE Suite 800, Washington, DC 20002
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Executive Summary

The Africa Biodiversity Collaborative Group (ABCG) comprises seven international conservation NGOs (African Wildlife Foundation, Conservation International and its affiliate Conservation South Africa, the Jane Goodall Institute, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute, and World Wildlife Fund-US) who share the goal of working collaboratively, efficiently and effectively to further a sustainable future for the African continent. Across Africa, ABCG members are actively working to promote adaptation to climate change. However, until recently, there has been little communication among ABCG members to share approaches, early results and lessons learned.

To overcome this, ABCG members conducted a review of member organizations' principal climate change adaptation activities underway within the region. The review used a survey of ABCG members to compare approaches and tools for adaptation used in project work in Africa. The methodology was designed to be both iterative and adaptive, reflecting inputs and feedback received from ABCG members as the project developed. Preliminary findings of this work were presented at a Washington, DC workshop in July 2011 that brought together key climate change adaptation staff from each ABCG member organization, as well as representatives from other key organizations and donors. Feedback from the workshop has been incorporated into this report. This process has identified key lessons to be shared among the partners, and has generated recommendations for both ABCG members and the wider conservation and donor communities.

Comprehensive overviews of ABCG member programs presented in the report's appendix demonstrate that climate change adaptation has become a central component in conservation activities being conducted by ABCG members in Africa. The report examines ten of the most significant projects in the ABCG members' collective portfolio. These projects vary widely in scale, geographic and thematic focus, methodology and objectives. The summaries show adaptation programs in various stages of development that are serving as test cases for methodologies that may be applied in the future in other regions, by ABCG members and other organizations.

The results developed from the analyses presented in this report – representing the first such analysis of a set of projects in Africa with biodiversity conservation as a primary focus – provide a comprehensive set of lessons learned that can be used to shape recommendations for future work on climate change adaptation in Africa. The survey reveals that project work largely follows adaptation-planning frameworks – if not always by design – but that most work falls short of implementation of on-the-ground actions to adapt conservation management to accommodate climate change. Project work is strongly focused around themes of ecosystems, livelihoods and landscape/seascape conservation and, to a lesser degree on species, whereas disease and human population are largely not considered. Project objectives vary considerably, but demonstrate a fairly universal embrace of crosscutting, interdisciplinary approaches consistent with the broadening of NGO work on conservation in Africa from species- to people-based initiatives. Funding support provided for the highlighted projects suggest that donor attention to adaptation in Africa is increasing, but with five of the ten projects funded wholly or in part by a single donor (the John D. and Catherine T. MacArthur Foundation), there is much need for other donors to step forward in Africa. The tools and methods utilized in ABCG member projects show extensive use of applied modeling developed from projections of future climatic conditions generated by the global Intergovernmental Panel on Climate Change (IPCC) suite of models, but bring to light several key issues and challenges regarding its application.

Monitoring and evaluation (M&E) was examined in a special session at the Washington workshop, as it presents particular challenges within the context of the projects examined. M&E is particularly relevant given the uncertainties associated with the timeframe of climate change impacts and the added necessity of ensuring adaptive management for project implementation. On policy and outreach to decision-making bodies, the ABCG members all have activities across a range of scales from local communities to international conventions, though these generally complement on-the-ground conservation efforts rather than serve as objectives themselves.

Key recommendations derived from the analysis include:

On project design and execution:

- Utilize an adaptation framework to help conceptualize project design, tailored as needed to explicitly include the role of people in project activities when conducting adaptation work in Africa.
- Incorporate Ecosystem-based Adaptation (EbA) and Community-Based Adaptation (CBA) approaches into existing climate adaptation field projects where applicable, and conduct monitoring of such approaches in order to adaptively manage and refine them over time.

-
- Develop educational forums for local decision makers, donors and ABCG member organizations and their partners to identify strategies for designing actions that ensure effective implementation.

On data, analysis and modeling:

- Support the financing and installation of appropriately sited, research-grade, automatic weather stations in protected areas and other sites of primary concern for biodiversity conservation.
- Establish new monitoring sites in current data-void regions where climate monitoring is already ongoing but with inadequate systems.
- Centralize and share climatological data among national governments, conservation, development, climate monitoring and climate change communities – essential for filling in data voids.
- Use scenario building exercises with scientists, stakeholders and others as an alternative and/or complement to deterministic modeling to consider how outcomes may vary and what actions would be appropriate for different combinations of factors driving environmental responses to climate change.
- Critically assess all model projections developed for conservation planning purposes for plausibility by persons with relevant knowledge of the species or ecosystems under consideration.
- Take into account the diminished value of downscaling coarse resolution global climate models beyond recommended limits of the climate modeling community when project teams utilize modeling of climate change impacts on biodiversity and environments at high spatial resolution.
- Hold forums to share lessons learned on models and modeling results that would help to improve their application in climate change adaptation initiatives.

On project monitoring and evaluation:

- Develop a set of guidance recommendations for conservation practitioners focusing on, among other aspects, how to integrate information from monitoring into a program for adaptive management.
- Develop specific recommendations for policymakers and donors on the support needed by partners to ensure that adaptation genuinely is a process of learning from actions, and develop improved but realistic data gathering and knowledge management.

-
- Collaboratively raise the issue of implementing and ensuring sustained funding for long-term monitoring beyond the duration of normal funding periods (< 5 years).

On working with donors:

- Utilize the findings of this report to inform key funders with programs in Africa of priorities through outreach activities such as workshops and consultations.
- Elevate the importance of climate change adaptation within the donor community. By working together and communicating our shared experiences, ABCG has the potential to increase its role in informing donors of on-the-ground needs and opportunities for adapting to climate change in Africa.

Other recommendations for ABCG and broader interests:

- Incorporate comprehensive consideration of the implications of population growth in current project activities on climate change adaptation in Africa.
- Increase research attention, funding and training on the critical issue of disease dynamics and epidemiology under a changing climate in Africa.

Finally, the report concludes by recommending that ABCG members continue joint efforts on climate change adaptation begun with this review by working collaboratively on a series of steps to develop an adaptation toolkit, and to share results and lessons learned with key constituencies in Africa and elsewhere.

1. Introduction

1.1 What is ABCG?

The Africa Biodiversity Collaborative Group (ABCG) comprises seven international conservation NGOs (African Wildlife Foundation (AWF), Conservation International (CI) and its affiliate Conservation South Africa (CSA), the Jane Goodall Institute (JGI), The Nature Conservancy (TNC), Wildlife Conservation Society (WCS), World Resources Institute (WRI), and World Wildlife Fund-US (WWF-US) who share the goal of working collaboratively, efficiently and effectively to further a sustainable future for the African continent. ABCG's mission is to tackle complex and changing conservation challenges by catalyzing and strengthening collaboration, drawing on the best resources from a continuum of conservation organizations. ABCG strives for an African continent where natural resources and biodiversity are securely conserved in balance with sustained human livelihoods.

Across a wide variety of conservation landscapes in Africa, the ABCG member organizations are working actively to promote adaptation to climate changes anticipated for the future, as well as for climatic hazards and other aspects of climate variability in the present. Until now, there has been little communication among ABCG partners to share approaches, early results and lessons learned from adaptation work in Africa. In addition, monitoring of the impacts of climate change and the effectiveness of adaptation efforts to date has been inconsistently developed, hindering assessment and validation to those conducting adaptation activities. More generally, despite widespread recognition of the intensifying threats presented by climate change, conservation planning that takes into account climate change adaptation principles is a newly emerging field: as yet there is no conventionally accepted framework to guide the design and implementation of adaptation measures. Therefore, the ABCG partners have for the most part been developing their respective initiatives relatively autonomously or in small partnerships and coalitions with other conservation, research and/or development organizations.

1.2 Climate change and Africa

The progress achieved by conservation efforts in Africa over the course of many decades is increasingly threatened by climatic changes forced by increasing greenhouse gas concentrations and land surface changes. According to the Intergovernmental Panel on Climate Change (IPCC, 2007), many parts of the African continent have high vulnerability to climate change-related stresses, and yet have a very low adaptive capacity. It is now widely recognized that climate change will exacerbate existing environmental degradation in Africa, threatening the rich diversity of plant and animal species as well as the livelihoods of large populations of subsistence farmers, pastoralists, and even urban dwellers who rely on rural ecosystem-derived ecosystem services for their water, electricity, and sustenance.

As described in the IPCC Fourth Assessment Report (2007), global climate models based on a range of greenhouse gas emissions scenarios predict a 2-5 degree Celsius rise in temperature throughout tropical Africa over the next 50-100 years. The warming climate will be attended by changing rainfall patterns, changes in seasonality and an increase in the frequency of severe storm events, setting up further obstacles to the challenges of conserving biodiversity and the ecosystem services that people depend upon. On the human side, failing rains, increased flooding, and shifting conditions for key subsistence crops (e.g., coffee and cocoa), natural resource species, and ecosystem services are expected to have profound impacts on many of Africa's people, with the poor and marginalized being particularly vulnerable (e.g. Ehrhart, 2009). The number of climate refugees will increase significantly over the next decade; this in turn is likely to exacerbate pressures on biodiversity and accelerate environmental degradation (e.g. Warner et al., 2009).

The growing certainty over the seriousness of climate change threats to Africa has prompted responses across a spectrum of interests in conservation and development. These concern both mitigation efforts to slow the rate of change through actions such as reducing greenhouse gas emitting practices like deforestation; and adaptation efforts to change existing practices and planning to produce more sustainable outcomes in the face of increasing climatic stress.

1.3 Aim of report

This report reviews current projects and programs on climate change adaptation in Africa being conducted by ABCG members, and uses the findings to generate recommendations from lessons learned for both ABCG and wider audiences. The motivation for this work is recognition by ABCG that a lack of communication and effective coordination may be introducing inefficiencies into climate change adaptation project design, planning and execution among our members. There is need for information sharing since the climate change

adaptation challenge to biodiversity conservation lacks precedent: there is no “roadmap” to follow based on prior experience. The past decade has nevertheless been a valuable incubation period in the development of climate change adaptation studies, strategies and field initiatives. However, continued innovation performed independently, without searching for commonalities and complementarities in work by others, enhances the likelihood for redundancies. In some cases, the failure to achieve project objectives might be avoided by lessons learned, both positive and negative, being communicated by others who have performed similar work. Conversely, sharing experiences has the potential to quickly reveal complementarities and other opportunities for improved and more effective and rapid climate change adaptation initiatives. This is all the more important in light of how fast climate change is advancing, and Africa’s high vulnerability.

The primary objective of this study is to review the state of knowledge, approaches and tools currently in use or under development by ABCG members to implement adaptation activities in sub-Saharan Africa, with an emphasis on sharing lessons learned, generating recommendations, and promoting synergies. It records the different approaches currently (i.e. in 2011) being used by ABCG members in Africa to facilitate species, ecosystem, and livelihoods adaptation aimed at building the resilience of natural systems and people to the impacts of climate change in rural biodiverse landscapes. In doing so, we aim for this review to serve as a first step towards bridging a communications gap that exists among ABCG members regarding the variety of approaches and tools being used, and lessons learned derived to date on climate change adaptation.

We utilized an iterative methodological approach to survey the major adaptation projects underway by ABCG member organizations, identify key thematic areas for comparison, and assess lessons learned for the collective experience. We then used this as the basis for recommendations in future work both within and outside of ABCG. A preliminary version of the report provided the foundation for a Washington, DC workshop in July 2011, which brought together lead persons working on climate change adaptation in sub-Saharan Africa from each of the ABCG member organizations, as well as representatives from some non-ABCG organizations and donors. The present version of the report incorporates feedback from the workshop and is designed to inform two audiences in particular. Fundamentally, this is a progress report written for the ABCG members about what we are doing and what has been learned from our respective experiences in climate change adaptation in Africa. At the same time, we hope to reach other audiences in the conservation and development communities, particularly key stakeholder groups in Africa and donor organizations in developed countries, and share findings from this synoptic overview on adaptation shaped by on-the-ground experience.

1.4 Report structure

The report is structured as follows: Section 2 defines climate change adaptation as applied in conservation contexts, and introduces existing surveys of adaptation practice in conservation. Section 3 presents the methodology used to compile data and generate results. Section 4 introduces the principal projects on climate change adaptation underway in Africa by ABCG member organizations. Section 5 collectively assesses these projects in an ABCG-wide project analysis. Section 6 presents lessons learned and recommendations derived from them for the ABCG community; Section 7 offers these for broader conservation interests in Africa. Section 8 identifies opportunities for collaborative work within ABCG incorporating best practices and targeting identified geographic and thematic gaps, along with a series of proposed steps on how this might be initiated.

The content is augmented by a set of appendices that provide supporting information and reference materials. Appendix 1 is a glossary of terms frequently associated with climate change adaptation. A list of the people interviewed and their ABCG affiliations and the questionnaires used are presented in Appendix 2 and Appendix 3 respectively. The agenda for the July 2011 ABCG workshop in Washington DC is provided in Appendix 4. Finally--and most importantly--comprehensive overviews of the climate change adaptation programs of the ABCG members are presented in Appendix 5.

2. Defining Climate Change Adaptation

2.1 Climate adaptation and conservation planning

Adaptation to climate change, as defined by the IPCC (2007), is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Accordingly, a key aspect of integrating adaptation into conservation is trying to ascertain what the future will look like (and accepting the uncertainties around this), and integrating and applying this knowledge into current conservation activities and plans currently in place. Critical to adaptation planning is integrating knowledge on how species and ecosystems (and the services they provide humanity) will be affected by climate change, with knowledge of how humans will be affected by (and are adapting to) climate change. In other words, adaptation is proactive; it emphasizes specific management decisions taken to achieve specific objectives. Planned adaptation involves societal intervention to manage systems based on the knowledge that conditions will change; actions must be undertaken in order to reduce any risks that may arise from that change, particularly within vulnerable systems (Julius and West, 2008). However, acting proactively to confront threats only expected to develop beyond the present time involves some degree of reliance on projections of conditions in the future, often numerically derived through environmental modeling and/or scenario planning. Such projections involve considerable degrees of uncertainty that increase in relation to the length of the time frame considered.

Another fundamental problem hindering effective planning and action on climate adaptation is the absence of precedence and universally accepted approaches to guide new initiatives. The practice of conservation planning was developed in a relatively stationary environment, whereas we are now entering a period of rapid climatic change (Watson et al., 2011). Climate change not only impacts biodiversity but also affects people, whose responses may be constrained by existing environmental degradation or existing conservation efforts. Their responses may also utilize ecosystem services in new ways, or may place further pressure on natural systems. The time scales of change, and the response to this change, are at issue as well: it will be decades before cur-

rent adaptation actions can be demonstrated to have been successful or not. In consequence, many adaptation actions are designed to increase resistance to change, rather than more substantial changes in practice that might be required as adaptive responses to threats driven by changing climatic conditions (Poiani et al., 2010).

2.2 Previous surveys of adaptation work in conservation

The field of adaptation is evolving rapidly, but still is in its formative stages (Poiani et al., 2010; Watson et al. 2011). Some of the projects being undertaken by ABCG partner organizations in Africa count among the pioneering efforts that will shape the field for years to come. Efforts are now underway to survey existing initiatives and develop frameworks to guide the planning and implementation of new initiatives. Several organizations have made efforts to consolidate approaches and identify best-practice recommendations for climate change adaptation strategies and implementation. For example, a survey by the National Wildlife Federation identified several general principles of adaptation in conservation: (1) reduce non-climate stressors; (2) manage for ecological function and protection of biological diversity; (3) establish buffer zones and connectivity; (4) implement proactive management strategies; and (5) increase monitoring and facilitate management under uncertainty (Glick et al., 2009). Three ABCG members—WWF-US, TNC and WRI—have also published comprehensive reports focusing on different aspects of climate change adaptation in conservation:

WWF-US: [Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems](#) (Hansen et al., 2003). This compilation offers comprehensive reviews by expert authors on climate change impacts on a series of key ecosystems (grasslands, forests, mountains, arctic, temperate marine, tropical marine, freshwater), as well as sections on climate change implications for protected areas and biodiversity impact assessments.

TNC: (1) [Climate change and conservation: a primer for assessing impacts and advancing ecosystem-based adaptation in The Nature Conservancy](#) (Groves et al., 2010) – includes introductions to many of the key computational tools available to conservation interests for climate change adaptation planning; (2) [Incorporating climate change adaptation into regional conservation assessments](#) (Game et al., 2010) – includes descriptions of adaptive strategies linked to planning; and (3) [Redesigning biodiversity conservation projects for climate change: examples from the field](#) (Poiani et al., 2010) – assessed ways in which consideration of potential climate impacts changed conservation strategies in 20 TNC projects around the globe.

WRI: The 2011 [World Resources Report](#), a collaborative effort of WRI with the United Nations Environment Program (UNEP), United Nations Development Program (UNDP), and the World Bank has climate change adaptation as its central theme. The material covers many aspects of environmental conservation, and while biodiversity conservation is among those considered, it is not central to this effort. This report and its constituent studies are discussed further in Appendix 5.

Taken collectively, the reports listed above have potentially high value to conservation interests in Africa by providing expertly informed assessments of the state of the science of climate change adaptation and its practice across a range of ecosystems and geographic contexts. However, African landscapes, seascapes and biodiversity are not examined in any systematic manner in any of these reports. By examining the portfolio of projects currently in progress by ABCG members, the present study aims to begin to address this gap by generating the first Africa-focused assessment of climate change adaptation programs concerned primarily with biodiversity conservation. We must note that this is not a comprehensive review – the scope is restricted to major projects of ABCG members in progress in Africa.

2.3 Ecosystem-based Adaptation and Community-Based Adaptation

As mentioned above, the linkages between the impacts and responses of people and biodiversity to climate change are very strong. In recent years Ecosystem-based Adaptation (EbA) has been developed by members of the conservation community, with the International Union for the Conservation of Nature (IUCN) playing an active role in its promotion (Colls et al, 2009). EbA aims to use biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change (Secretariat of the CBD, 2009). At the same time, a strong Community-Based Adaptation (CBA) approach has been developed by the development sector. CBA has been defined as a community-led process, based on communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change (Reid et al., 2009).

There is growing recognition of a substantial overlap between these two approaches, and in fact an integrated approach that combines essential elements of the two will be very important for successful adaptation in many vulnerable places and communities. Such an approach takes into account the role that ecosystem services can play in human adaptation, while at the same time helping people to adapt in equitable and participatory ways that avoid bringing short-term benefits that over the longer term place additional pressures

on natural systems, threatening the very systems that people depend on. In addition, an integrated approach recognizes that natural systems are changing with climate change, including natural resource species, pollinators, and other elements that work in complex and often poorly understood ways to provide ecosystem services, and helps to facilitate adaptation of natural systems. Such an integrated approach can also be used to find optimum solutions to balance the use of hard infrastructure (e.g., dams and sea walls), and soft infrastructure (e.g., mangroves, restoration of floodplain functions), in a way that takes into account the needs of local people as well as larger scale interests.

3. Methods

3.1 Methodological approach for this report

This study applied a two-part methodology to assess adaptation programs by the ABCG members. The methodology was designed to be both iterative and adaptive, reflecting inputs and feedback received from ABCG members as the project has developed.

The first part was direct consultation by WCS with climate change adaptation program leads in each of the organizations to compile material on program structure, current project activities, tools used and the like. Content was obtained through interviews, and in written responses to questionnaires circulated to each of the partner organizations (see Appendix 2 and 3). The material collected provides the basis for the descriptions of Africa-focused climate change adaptation programs of each ABCG member organization introduced in Section 4, and detailed in Appendix 5.

The second part was the assessment of partner projects in Africa that provides the basis for lessons learned and recommendations. The July 2011 workshop in Washington DC provided an opportunity for staff involved in adaptation work from all of the ABCG member organizations to evaluate early project results. This process generated a multitude of recommendations, which subsequently were compiled into a unified set that was circulated among the lead representatives of each ABCG organization for validation and correction.

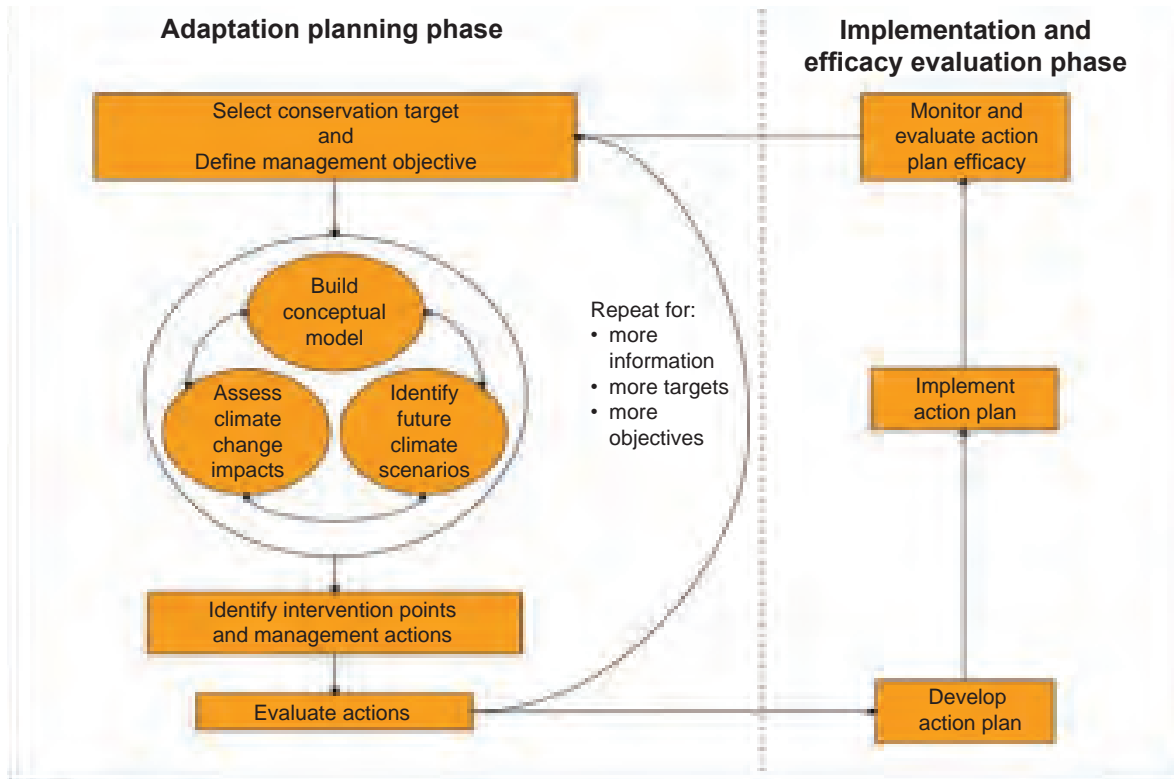
The evaluation provided in Section 5 offers a qualitative assessment across a variety of themes in climate change adaptation for conservation. The recommendations were developed for ABCG audiences (section 6) and broader audiences in the conservation and donor community concerned with biodiversity conservation in Africa (section 7).

3.2 Framework evaluation

There are now a number of tools aimed at tackling the considerable uncertainty and complexity of climate change by tailoring adaptation strategies to particular species, ecosystems, communities and geographies (e.g. Groves et al. 2010; Cross et al, in review). For the initial analysis in the evaluation we compared the stages of development of the primary projects in the ABCG mem-

bers portfolio using a newly developed project planning tool, the Adaptation for Conservation Targets (ACT) Framework (Cross et al., in review) (Figure 3.1).

Figure 3.1. The structure of the Adaptation for Conservation Targets (ACT) framework as presented in Cross et al. (in review). An online description of this framework can be found at <http://www.cakex.org/virtual-library/2285>



The six stages of the ACT Framework are outlined as the following:

- **Identify features targeted for conservation** (e.g., species, ecological processes, ecosystem services, ecosystems, or social communities) and specify explicit, measurable management objectives for each feature.
- **Build a conceptual model** that illustrates the climatic, ecological, social, and economic drivers of each feature.
- **Examine how the feature(s) may be affected by multiple plausible climate change scenarios.** This can be a threats-based analysis of current and future states, and often takes the form of a vulnerability assessment.
- **Identify intervention points and potential actions required to achieve objectives** for each feature under each scenario.

-
- **Evaluate potential actions for feasibility and tradeoffs.** Apply on-the-ground actions or shift conservation strategies as adaptive responses towards improving outcomes under future climatic conditions.
 - **Implement priority actions.** Monitor the efficacy of actions and progress toward objectives, and reevaluate to address system changes or ineffective actions.

In the July 2011 Washington DC workshop, participants suggested some modifications to the framework that would make it more inclusive of actual projects in their climate adaptation programs in Africa. In particular, it was recommended that an additional step be inserted covering stakeholder consultation performed before the setting of objectives, including the identification of which stakeholders should be involved in each of the steps to follow. We therefore revised and tailored the ACT framework accordingly to accommodate this recommendation for the analysis presented in section 5.1.

4. ABCG member programs on climate change adaptation

This section briefly outlines the programs on climate change adaptation of each ABCG member organization and their signature projects in Africa, to provide the basis for the collective evaluations that follow. Complete summaries of these programs and projects on climate change adaptation are presented in Appendix 5. The principal projects on adaptation being conducted within the ABCG consortium evaluated in this report are as follows:

- **AWF: Mountain gorilla climate change vulnerability assessment**, performed in close collaboration with the International Gorilla Conservation Program (IGCP) and with the assistance of EcoAdapt, an NGO providing expertise in adaptation project facilitation and design.
- **CI: a project in Madagascar in two phases; (1) vulnerability assessment**, an island-wide assessment of climate change threats to Madagascar's unique biodiversity and ecosystems; (2) follow-on project to test the **feasibility of implementing recommendations** emerging from the assessment. These projects have been performed in partnership with WWF and other project partners including WCS.
- **CSA: Climate Action Partnership**: a multi-partner program pioneered by CSA to promote an enabling environment for adaptation (and mitigation) and to conduct on-the-ground EbA with farmers and other communities/stakeholders.

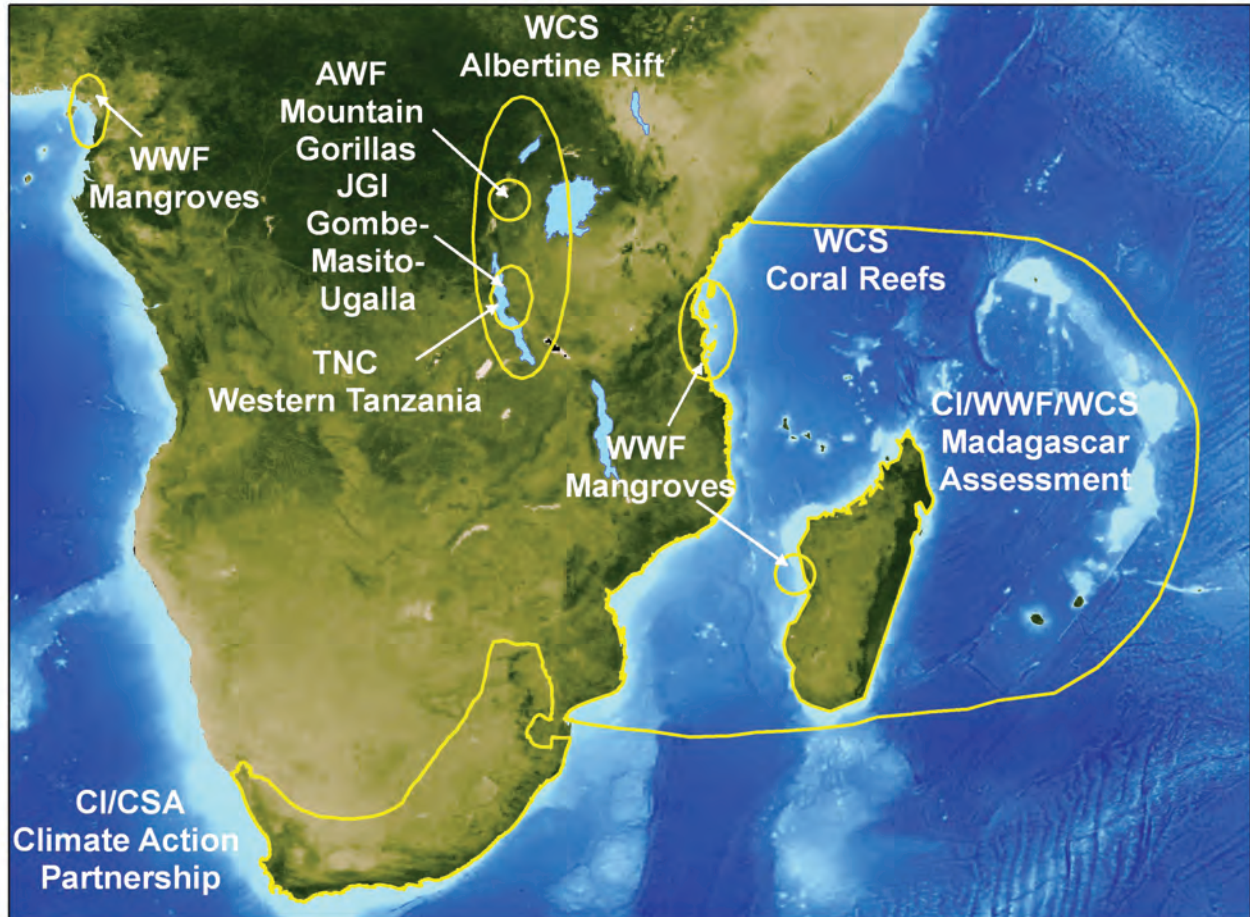
-
- **JGI: Gombe-Masito-Ugalla Project**, a project in western Tanzania conducted in partnership with The Nature Conservancy (TNC) and the Frankfurt Zoological Society (FZS) to develop adaptation strategies for on-the-ground implementation in the Gombe-Masito-Ugalla ecosystem.
 - **TNC: Western Tanzania Project**, a project in western Tanzania conducted in partnership with the Jane Goodall Institute, the Frankfurt Zoological Society and others to develop adaptation strategies for on the ground implementation across western Tanzania. Note that this project includes the geographic area covered by JGI's Gombe-Masito-Ugalla project.
 - **WCS: Albertine Rift Climate Assessment**, a project to assess current and future climatic conditions and apply this knowledge to understand and plan for climate change impacts on regional wildlife conservation and protected area management.
 - **WCS: Western Indian Ocean Coral Reef Program**, a project to develop guidelines for policy makers and tools for marine resource managers and fisher communities to understand the management approaches that will be most effective given a particular site's reef ecology, exposure to climate change disturbances, socioeconomic or human context, and governance.
 - **WRI: World Resources Report**, which features case studies on climate change adaptation in several countries in Africa; and **ARIA Policy Assessment**, which aims to enhance government capacity to plan for and respond to the impacts of climate change.
 - **WWF-US: Mangrove Resilience to Climate Change project in Tanzania and Cameroon**, focused on vulnerability assessments and adaptation strategies for mangrove ecosystems in relation to the impacts of sea level rise.
 - **WWF-US (with the WWF Network): Madagascar vulnerability assessments** of natural ecosystems, landscapes/seascapes and protected areas in the face of synergetic effects of climate change and non-climatic factors; and **testing of adaptation measures** to enhance natural and human systems resilience, including capacity building.

The ABCG members are summarized in tabular form and the spatial domains of their major projects on adaptation in Africa are shown in Table 4.1 and Figure 4.1, respectively.

Table 4.1 Summary of ABCG member organizations and projects on climate change adaptation evaluated in this report.

ABCG Member Organization	Major Thematic Concerns in Africa	Major Adaptation Initiatives in Africa	Project Partners
African Wildlife Foundation (AWF)	species, landscapes	Mountain gorilla vulnerability assessment	EcoAdapt, International Gorilla Conservation Program, University of California-Davis
Conservation International (CI)	species, landscapes, and Ecosystem-based Adaptation	(1) Madagascar Vulnerability Assessment (2) Madagascar Feasibility Tests for Adaptation Actions	WWF, WCS, Missouri Botanical Garden, Kew Botanical Garden,
Conservation International / Conservation South Africa (CI/CSA)	Ecosystem-based Adaptation, enabling environment support and public-private partnerships	Climate Action Partnership	BirdLife South Africa, Botanical Society of South Africa, Endangered Wildlife Trust, Wilderness Foundation, Wildlands Conservation Trust, Wildlife and Environment Society of South Africa, World Wide Fund for Nature-South Africa (WWF-SA).
Jane Goodall Institute (JGI)	species, landscapes, communities	Gombe-Masito-Ugallo Project	TNC, Frankfurt Zoological Society
The Nature Conservancy (TNC)	Ecosystem-based Adaptation	Western Tanzania Project	JGI, Frankfurt Zoological Society, TANAPA, Kigoma and Mpanda Districts
Wildlife Conservation Society (WCS)	species, ecosystems, landscapes, conservation planning	Albertine Rift Climate Assessment	Institute for Tropical Forest Conservation, Rwanda Development Board, Uganda Wildlife Authority, Trento Museum of Natural History, TNC
		Western Indian Ocean Coral Reef Project	Kenya Wildlife Service, Kenya's Fisheries Department, Beach Management Units
World Resources Institute (WRI)	policy, development	World Resources Report case studies and decision-making simulation; ARIA policy assessment	World Bank, United Nations Environment Program, United Nations Development Program
World Wildlife Fund (WWF-US)	Ecosystem-based Adaptation; Community-Based Adaptation	Mangrove Resilience to Climate Change project (WWF-US)	Forestry Department (Tanzania), Cameroon Wildlife Conservation Society (CWCS)
		Capacity building, vulnerability assessment and adaptation projects (WWF-US with WWF-Network)	CI, WCS, Madagascar National Parks, The Peregrine Fund, Durrell Wildlife Conservation Trust, National Meteorological Authority, Madagascar environment and protected areas authorities, Madagascar climate change authority, Environment and Development platforms in Diana Region, Protected area system in Madagascar

Figure 4.1. The geographic foci of major projects on climate change adaptation being conducted in sub-Saharan Africa by the ABCG conservation NGO consortium. NGO names are as identified on the listing in Table 4.1. The terrestrial land cover shown is the NASA vegetation index based on measurements taken by the Moderate Resolution Imaging Spectroradiometer (MODIS) (Source: http://neo.sci.gsfc.nasa.gov/Search.html?datasetId=MOD13A2_M_NDVI)



5. Evaluation of the ABCG Members Project Portfolio

The ABCG member summaries detailed in Appendix 5 demonstrate that climate adaptation has become an important component in the conservation NGO agenda in Africa. They show that a variety of different approaches covering a broad range of objectives are actively being utilized by the ABCG member organizations to integrate climate adaptation strategies into conservation projects. The summaries also show that the adaptation programs are in various stages of development, and are serving as test cases for methodologies that may be applied in the future in other regions by the respective organizations. In this section we compare and contrast the ABCG member project portfolio through a range of structural and thematic lenses. The results developed from the analyses and discussion presented below – representing the first such analysis of a set of adaptation projects for biodiversity conservation in Africa - may offer ABCG member organizations, and others with similar concerns, new insights and a guide to best practices for achieving success in future work.

The assessment presented here is largely qualitative, since the projects tend to be quite dissimilar in scope, spatial scale, context and themes addressed. It is important to note that this represents a subjective assessment only, and characterizations of activity levels are provided for comparison rather than as indicators of diligence, success or failure.

5.1 A comparison of projects using a revised Adaptation for Conservation Targets (ACT) framework

As outlined in the Methods section, the principal projects being conducted by ABCG member organizations can be evaluated collectively through the lens of a revised ACT framework. An assessment of project development relative to the ACT steps is provided in Table 5.1. This analysis reveals several distinct patterns. The first is the clear evidence of a gradient from light to dark shades with progression from left to right across the ACT framework stages, indicating

Table 5.1. A qualitative assessment of ABCG member project structure and activities relative to the stages of the Adaptation for Conservation Targets (ACT) framework, modified to include an additional stage as recommended by ABCG members. WRI is not evaluated due to limited applicability of its program in the framework.

			STAGES IN ACT FRAMEWORK														
			Stakeholder identification and consultation on project objectives (additional step identified by ABCG)	Identify features targeted for conservation (e.g., species, ecological processes, or ecosystems) and specify explicit, measurable management objectives	Build a conceptual model that illustrates the climatic, ecological, social, and economic drivers of each feature	Examine how the feature may be affected by multiple plausible climate change scenarios	Identify intervention points and potential actions required to achieve objectives for each feature under each scenario	Evaluate potential actions for feasibility and tradeoffs	Implement priority actions, monitor the efficacy of actions and progress toward objectives, and reevaluate to address system changes or ineffective actions								
<p style="text-align: center;">KEY</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="background-color: black; width: 20px; height: 20px;"></td> <td>Developed or completed</td> </tr> <tr> <td style="background-color: #cccccc; width: 20px; height: 20px;"></td> <td>Partially developed or incomplete</td> </tr> <tr> <td style="background-color: #e0e0e0; width: 20px; height: 20px;"></td> <td>Not developed or included in objectives</td> </tr> </table>				Developed or completed		Partially developed or incomplete		Not developed or included in objectives	NGO	PROJECT	LOCATION						
	Developed or completed																
	Partially developed or incomplete																
	Not developed or included in objectives																
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo															
CI	Island-wide Vulnerability Assessment	Madagascar															
	Climate Action Partnership	South Africa															
JGI	Gombe-Masito-Ugalla	Tanzania															
TNC	Western Tanzania	Tanzania															
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, DR Congo, Burundi															
	West Indian Ocean Coral Reef	Kenya, Tanzania, Mozambique, Madagascar															
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A							
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon															
	Capacity building, vulnerability assessment and adaptation	Madagascar															

that all projects are well underway but have not yet achieved endpoints of full implementation of priority actions. This is not necessarily surprising since it largely reflects that most of these projects are relatively young initiatives in a new field of adapting conservation practices, and/or that the current projects have activities that are restricted to the early and middle stages only. However, the lack of projects achieving the stage of implementation and associated activities is in some cases indicative of the absence of this stage in the original adaptation project design. Of interest too is that despite the lack of coordination between these different initiatives, the data in Table 5.1 suggests that projects have been developing in parallel with relatively similar levels of achievement. This also implies that there may be important lessons being learned by each partner from their respective project experiences that should be shared with the wider group.

5.2 A comparison of projects against different conservation themes in climate adaptation

ABCG members' portfolios can be sorted according to major themes in climate adaptation as currently applied in biodiversity conservation. The themes considered are defined in Table 5.2 and assessed against member projects in Table 5.3. Again, some distinct patterns are evident in the resulting matrix. There is strong attention to people as a focus in all projects, reflecting the broadening of conservation from past species-centric approaches, and almost as strong attention to ecosystems. Climate change impacts on disease and related consequences to conservation are not considered in most initiatives. These patterns are not necessarily surprising given that the programmatic interests of each organization are predicated by agendas other than climate change, so the project foci are often closely aligned with these broader agendas.

The project portfolio can also be examined for the types of objectives on climate change adaptation motivating project work. We invited all ABCG groups to provide a self-assessment of their respective programs on adaptation for a range of adaptation objectives. The categories used to organize these objectives are those presented in a conservation and development continuum being developed by the Ecosystems and Livelihoods Adaptation Network (ELAN; www.elanadapt.org). (Table 5.4)

The results of this organizational self-reflection are shown in Table 5.5. The scale and scope of the various objective categories differ considerably. The graphical display in Table 5.5 suggests a far more considerable breadth of activity than suggested by the thematic foci alone shown in Table 5.3. This demonstrates a fairly universal embrace of crosscutting, interdisciplinary

Table 5.2: General adaptation themes in conservation related activities. These themes are evaluated against ABCG members in Table 5.3.

Conservation theme	Description
Species	Climate change impacts on individual species or species assemblages
Disease	Climate change impacts on the epidemiology of wildlife, livestock and/or humans
Population issues	The role of human population increase (numbers of people) in climate change outcomes
Livelihoods	Climate change impacts on livelihoods including food cropping systems (economic aspects)
Ecosystems	Climate change impacts on ecosystems and the services they provide to humanity
Landscape or seascape	Climate change impacts across geographic domains with common characteristics
National level planning	Climate change impacts in national frameworks and planning on adaptation
National level policy	Promoting climate change adaptation in national agendas
International policy	Promoting climate change adaptation in international agendas

Table 5.4: A listing of types of objectives in climate change adaptation for conservation and definitions as applied in the evaluation presented in Table 5.5.

Objective of adaptation work	Definition
Species adaptation	Promotes adaptation of individual plant or animal species
Protected area adaptation	Promotes adaptation of protected area with fixed boundaries, and species/ecosystems within it; may take into account human use
Large landscape/seascape adaptation	Promotes adaptation of ecological processes in a landscape, including river basins; may include human adaptation and use of ecosystems to help people to adapt
Ecosystem-based Adaptation (EbA)	Uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change (Secretariat of the CBD, 2009)
Community-Based Adaptation (CBA)	Uses a community-led process based on communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change (Reid et al., 2009)
Integrated ecosystem and community approached to adaptation	Combines EbA and CBA approaches. Takes a rights based approach to adaptation (bottom-up, participatory, equitable, accountable, empowering); may include use of ecosystem services/ natural resources
Large-scale infrastructure/ regional development	Promotes development of large scale infrastructure (e.g. dams, dikes), agriculture etc. to reduce human vulnerability to climate change

Table 5.3: A qualitative assessment of ABCG member project thematic foci.

<p>KEY</p> <table border="1"> <tr> <td style="background-color: black; width: 20px; height: 20px;"></td> <td>Primary focus</td> </tr> <tr> <td style="background-color: gray; width: 20px; height: 20px;"></td> <td>Secondary focus</td> </tr> <tr> <td style="background-color: lightgray; width: 20px; height: 20px;"></td> <td>Not a focus</td> </tr> </table>				Primary focus		Secondary focus		Not a focus	THEMATIC FOCI								
				Primary focus													
	Secondary focus																
	Not a focus																
NGO	PROJECT	LOCATION	Species	Disease	Population issues	Livelihoods	Ecosystems	Landscape or seascape	National-level planning	National level policy	International policy						
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo															
CI	Island-wide vulnerability assessment	Madagascar															
	Climate Action Partnership	South Africa															
JGI	Gombe-Masito-Ugalla	Tanzania															
TNC	Western Tanzania	Tanzania															
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, DR Congo															
	West Indian Ocean coral reefs	Kenya, Tanzania, Mozambique, Madagascar															
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana															
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon															
	Capacity building, vulnerability assessment and adaptation	Madagascar															

approaches to the suite of problems posed by climate change across the ABCG member portfolio. Almost all of the featured projects contain both biological and human-centered components on adaptation though the emphasis varies. It is therefore unlikely that any single methodological approach would be suitable to serve the broad range of adaptation objectives. Also evident in Table 5.5 is how the traditional focus of much NGO work on conservation in Africa has broadened from species to people-based initiatives.

5.3 A comparison of the spatial scales of ABCG member projects

Another important area of comparison is the spatial scale of the ABCG member projects (Table 5.6). This analysis shows most activities are being conducted at the landscape or protected area cluster scale. This probably reflects the fact that most conservation activity takes place at this spatial scale. It also might reflect an appreciation for one of the central tenets of adaptation: the importance of connectivity between protected areas in fragmented landscapes (Hannah et al., 2008; Mawdsley et al., 2009). Only the WCS coral reef project has a major biome as its target.

The Congo Basin rainforest biome, a focus of increasing conservation concern, is notably absent from ABCG partner attention in the adaptation arena. During the DC workshop in July 2011, participants discussed a likely reason for this: in recent years, donors have supported climate mitigation (e.g. REDD) in central Africa, rather than climate adaptation.

5.4 Current donor support and geographic preferences

For the current set of climate change adaptation initiatives, ABCG members have drawn upon both internal funds and grants from donor organizations. These are summarized in Table 5.7. Several interview respondents mentioned that their respective institutions recognized the need for institutional (unrestricted) funds to initiate programs on climate change, including the key investment of supporting staff salaries for the critical first steps leading to procurement of grants. The grants received to date are 12-48 months in duration; these timelines are common to granting periods in conservation and development, though in the ABCG adaptation workshop participants described the difficulty in ensuring that monitoring needed for change detection over the long-term begun during projects would be sustained after the grant period ends.

Table 5.5: Self-assessment by the ABCG members of the types of adaption objectives being in their major project work in Africa. WRI's program is not applicable in this evaluation.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">KEY</th> </tr> <tr> <td style="width: 20px; height: 20px; background-color: black;"></td> <td>Major activity</td> </tr> <tr> <td style="width: 20px; height: 20px; background-color: gray;"></td> <td>Minor activity</td> </tr> <tr> <td style="width: 20px; height: 20px; background-color: lightgray;"></td> <td>Not significant in program</td> </tr> </table>			KEY			Major activity		Minor activity		Not significant in program	OBJECTIVES						
			KEY														
	Major activity																
	Minor activity																
	Not significant in program																
NGO	PROJECT	LOCATION	Species Adaptation	Protected Area Adaptation	Landscape or Seascape Adaptation	Ecosystem-Based Adaptation	Integrated Ecosystem & Community Approaches to Adaptation	Community-Based Adaptation	Large-scale Infrastructure – Regional Development								
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo															
CI	Island-wide vulnerability assessment	Madagascar															
	Climate Action Partnership	South Africa															
JGI	Gombe-Masito-Ugalla	Tanzania															
TNC	Western Tanzania	Tanzania															
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, DR Congo, Burundi															
	West Indian Ocean coral reefs	Kenya, Tanzania, Mozambique, Madagascar															
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana	N/A	N/A	N/A	N/A	N/A	N/A	N/A								
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon															
	Capacity building, vulnerability assessment and adaptation	Madagascar															

Table 5.6: The spatial scales of ABCG member projects on adaptation in Africa ordered on a continuum from individual protected areas to global scale. Shading indicates scale applies to identified project.

			SCALE						
			Local Protected Area	Protected Area Clusters/ Landscape	National	Multi-nation Regional	Major Biome	Pan-African	Global
NGO	PROJECT	LOCATION							
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo							
CI	Island-wide vulnerability assessment	Madagascar							
	Climate Action Partnership	South Africa							
JGI	Gombe-Masito-Ugalla	Tanzania							
TNC	Western Tanzania	Tanzania							
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, Burundi, DR Congo							
	West Indian Ocean coral reef	Kenya, Tanzania, Mozambique, Madagascar							
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana							
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon							
	Capacity building, vulnerability assessment and adaptation	Madagascar							

Table 5.7: An overview of major grants awarded to ABCG member organizations to support the project work examined in this report.

			FUNDING SOURCES				
			Major Grant Sources	Granted Sums (US\$)	Period (months)	Institutional Funding Support	Other Sources
NGO	PROJECT	LOCATION					
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo	MacArthur Foundation	310,000 shared with IGCP and EcoAdapt	19	Yes	Netherlands – DGIS; USAID through SCAPES
CI	Island-wide vulnerability assessment	Madagascar	(1) MacArthur Foundation (2) MacArthur Foundation	(1) 200,000 (2) 650,000 (with WCS and WWF)	(1) 24 (2) 24		
	Climate Action Partnership	South Africa	Citigroup, Dev. Bank of South Africa, CEPF, Douglas Murray Trust	N.A - shared among several partners	36 (DM Trust funds)		
JGI	Gombe-Masito-Ugalla project	Tanzania	USAID	227,000 sub-award through TNC	24		Private donors
TNC	Western Tanzania	Tanzania	(1) USAID; (2) Govt of Finland through LifeWeb	(1) 227,000 (2) 84,500	(1) 24 (2) 24	Yes	
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, DR Congo, Burundi	MacArthur Foundation	(1) 250,000 (2) 650,000 (3) 150,000	(1) 24 (2) 36 (3) 12	Yes	
	West Indian Ocean coral reefs	Kenya, Tanzania, Mozambique, Madagascar	(1-2) MacArthur Foundation; (3-4) WIOMSA; (5) World Bank	(1) 400,000 (2) 400,000 (3) 150,000 (4) 150,000 (5) 180,000	(1) 36 (2) 36 (3) 24 (4) 24 (5) 15	Yes	
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana	World Res. Report supported by UNEP, UNDP, World Bank	–	–	Yes	SIDA, Irish Aid Netherlands DGIS, Norway Ministry of Foreign Affairs
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon	(1) GEF	(1) ~550,000	(1) 36	Yes	
	Capacity building, vulnerability assessment and adaptation	Madagascar	(1) NORAD to WWF-Norway (2-3) MacArthur Foundation; (4) European Commission	(1) ~750,000 (2) 350,000 (3) 210,000 (4) 700,000	(1) 36 (2) 36 (3) 36 (4) 48		

There is a clear link between how much money has been expended by donors (and the duration of this funding), and how developed the adaptation project is (compare Table 5.1 and Table 5.7). In total, approximately US\$6.6 million has been granted to the ABCG organizations within the past 5 years for project work on adaptation. This demonstrates the donor community's recognition that climate change is magnifying existing threats to ecosystems in Africa.

In terms of geographic extent, the current collection of ABCG member programs covers only a small fraction of sub-Saharan Africa's biodiverse landscapes and appears to reflect donor preferences to a considerable degree (refer to map, Figure 4.1). Effectively absent from the collective ABCG portfolio are initiatives in West Africa, the entire Congo Basin, Angola, the Ethiopia-Sudan-South Sudan region, the Sahelian region (although WWF is now working with the Green Wall project there), among others. Some of these areas have been identified as being likely to be the most impacted by climate change (Lenton et al., 2008; Giorgi, 2006). The current areas of attention are likely due to partner interests being steered by funding opportunities from donor calls for proposals tied to specific regions. In section 6.5, we address this issue again and offer recommendations for extending attention to other regions.

5.5 Modeling approaches employed by ABCG organizations in adaptation project work

Analytical and modeling approaches of various types are widely used to generate guidance and other outputs in ABCG member projects. Climate change projections inherently require the utilization of modeled simulations of climate; such modeling is not itself performed by any ABCG members, rather, the output generated by global climate models promoted and distributed by the IPCC is utilized through statistical downscaling into specific contexts. However, several ABCG members are leaders in developing and applying new tools that make climate model output more meaningful and applicable for conservation applications. For example, the joint TNC-JGI-FZS project in western Tanzania made extensive use of Climate Wizard as means of displaying projections of future changes that then fed into the analysis and consultation components of the project. The WCS Albertine Rift modeling approach provided products that served as the basis for informing stakeholder groups and receiving feedback from them in a multiday workshop, among other applications. Descriptions of some key analytical tools and modeling approaches being employed by ABCG member organizations in Africa and elsewhere are provided in Box 1.

Box 1: A selection of analytical approaches utilizing numerical modeling developed and applied by ABCG member organizations in climate change adaptation project work.

WWF - The Wallace Initiative is a collaboration of WWF-US, Tyndall Climate Change Centre (University of East Anglia), Center for Tropical Biodiversity and Climate Change and Research Center (James Cook University), National Climate Change Adaptation Research Facility, Global Biodiversity Information Facility, and Center for Tropical Agriculture. It models projections of species changes under different climate scenarios and maps refugia, range shifts and extinction risks. Around 50,000 species have been modeled globally, including crops and natural resource species. The web portal is in testing and guidance is being prepared; The Wallace Initiative will be fully launched late in 2011. WWF has started to pilot it in mainstreaming climate adaptation into conservation plans in the Amazon, Madagascar, and elsewhere.

WWF - ClimaScope is a tool that provides ready access to climate scenario projections, giving information on climate, and related uncertainty. It is designed for policy makers and practitioners, including in vulnerable developing countries. It provides access to data from 18 climate models, for the new IPCC representative concentration pathway (RCP) scenarios ranging from stabilization from 490 pp to >1300 ppm for six variables at a resolution of 0.5° latitude and longitude, as well as the older IPCC SRES scenarios. It will be launched in the last quarter of 2011. It will be possible to integrate other data layers into ClimaScope, including, for example, socio-economic data on poverty, health, disaster risk and food security, as well as project sites, river basins, vegetation types, etc.

WCS - Albertine Rift Climate Assessment applied an approach utilizing numerical modeling tools developed for other applications to provide insights into how regional ecological systems and human livelihoods might respond under changing climatic conditions. The first step was to downscale IPCC multi-model ensemble output of standard climate parameters under two SRES emissions scenarios (A2 and B1) for the entire Albertine Rift domain. This data was then used in two dynamic vegetation models: (1) The Lund-Potsdam-Jenna (LPJ) model is one of a number of Global Vegetation Models currently used to simulate changes in vegetation and associated bio-geochemical processes in response to climate change. The project utilized the LPJ model to develop an understanding of the potential impacts of climate change on the ecosystem function of the Albertine Rift, in addition to evaluating the potential impacts on major habitat (vegetation) types. (2) The Decision Support System for Agro-technology Transfer (DSSAT) is a global agricultural management model, which incorporates soil, climate, crop, phenotype and management data to determine agricultural productivity. In the model used in the project only the climate component changed, therefore predictions assume that management, soils and crop phenotypes will remain in their present state. These outputs were then compiled into spatially and temporally explicit products through GIS procedures. The products thus derived now offer a wealth of information that can aid in informing adaptation planning far beyond what the original inputs – temperature, precipitation and cloud cover variables – can offer.

TNC - Climate Wizard is a web-based analysis tool that uses state-of-the-art climate models and advanced statistical analysis to examine both the current and future climate conditions of any place on the Earth. Pre-calculated map products are viewable through a map interface where the user can easily toggle between a variety of climate conditions relating to different greenhouse gas emission scenarios for two future time periods. Additionally the user has the ability to examine the statistical variations of 16 different general circulation models used to generate these future climate projections by displaying individual model results or selected model combinations. Since the large climate datasets are stored and analyzed remotely on powerful computers, users of the tool do not need to have fast computers or expensive software, but simply need access to the internet. Using web technologies to develop tools makes climate change analysis more accessible to scientists, managers, and policy makers who now have the ability to assess the potential impacts of climate change and help guide decisions and actions to prepare for and mitigate those impacts to natural systems and the services they provide. Climate Wizard partners include The Nature Conservancy, Climate Central, University of Santa Clara, University of Southern Mississippi, ESRI and the University of Washington.

In addition to technological/analytical tools are methodological tools that are commonly utilized as well, for example, for communication with stakeholders in a project region. In interviews conducted for this survey, workshops were recognized as being particularly effective in this regard. Workshops reach diverse audiences and serve to both inform and generate feedback from these audiences, while at the same time offering training on climate change issues and helping to develop consensus positions on adaptation actions and concerns. Workshops have been fundamental components to the AWF-IGCP mountain gorilla program, the JGI-TNC-FZS program in western Tanzania, and the WCS Albertine Rift program, all focused in the Rift region, among others.

5.6 Monitoring for change detection and for project effectiveness

Monitoring, evaluating and integrating information into adaptive management practices are critical for successful adaptation to climate change. Long-term, systematic and quality controlled monitoring of indicative climate variables and responses of species, ecosystems and human communities are important in establishing data baselines and eventual validation of modeled projections. An overview of monitoring activities being implemented by ABCG member organizations in their major project work in Africa is presented in Table 5.8. Further explication on monitoring and evaluation is presented in Section 6.4.

WCS and AWF (in partnership with IGCP) in their respective work in the Albertine Rift are among the few organizations actively establishing monitoring stations to collect information on both climate variables and the response of species (See Table 5.8 for details). The TEAM (CI and partners) network of sites is in the initial stages of developing an Africa-wide monitoring network focused on ecosystem services important for agricultural livelihoods. TNC, JGI and FZS through their collaborative project in Tanzania are monitoring indicators such as fire frequencies, water temperatures, density of elephant populations near water sources, changes in phenology, etc. CI is initiating a program to assess in rural livelihoods risks driven by climate change and other threats in high biodiversity regions of Madagascar. In South Africa, CSA has developed its own monitoring programs for social, economic and environmental monitoring but also supported a long-term monitoring approach for ecosystem services use and provision through the Climate Action Partnership. CAP also produced a monitoring and evaluation report as a guideline to monitoring in adaptation corridor, which involved expert stakeholder workshops and an interactive GIS mapping exercise.

Table 5.8: Monitoring Activities Represented in Adaptation Projects (Shading indicates the degree of development. Approximate funding for M&E denotes percentage of total project funds devoted to M&E).

<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th colspan="2">KEY</th> </tr> <tr> <td style="background-color: #333333; width: 20px; height: 15px;"></td> <td>Primary focus</td> </tr> <tr> <td style="background-color: #666666; width: 20px; height: 15px;"></td> <td>Secondary focus</td> </tr> <tr> <td style="background-color: #cccccc; width: 20px; height: 15px;"></td> <td>Not covered</td> </tr> </table>			KEY			Primary focus		Secondary focus		Not covered	Monitoring Activities								
			KEY																
	Primary focus																		
	Secondary focus																		
	Not covered																		
NGO	Project	Location	Climate Monitoring	Vegetation Monitoring	Fauna Monitoring	Impacts on Biodiversity	Impacts on Ecosystem Services	Impacts on Resource-Dependent Livelihoods	Evaluate Effectiveness of Interventions	Capacity Building on Monitoring and Evaluation	Approximate Funding for Monitoring and Evaluation								
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo									5%								
CI	Island-wide vulnerability assessment & Feasibility Tests	Madagascar									10%								
	Climate Action Partnership	South Africa									10%								
JGI	Gombe-Masito-Ugalla	Tanzania									13%								
TNC	Western Tanzania	Tanzania									7%								
WCS	Albertine Rift	Uganda, Rwanda, Tanzania, DR Congo, Burundi									50%								
	West Indian Ocean coral reefs	Kenya, Tanzania, Mozambique, Madagascar									40%								
WRI	World Resources Reports & ARIA survey	N/A									100%								
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon									50%								
	Capacity building, vulnerability assessment and adaptation	Madagascar									3%								

A key area of focus is to monitor effectively the impacts of activities and adaptation interventions designed to reduce vulnerability, whether of local communities dependent upon natural resources or of the ecological system itself. WRI, through their work on developing a framework for adaptation monitoring, proposes a focus on the processes involved rather than on identification of generalizable indicators to track. This process emphasizes the iterative and learning-by-doing nature of adaptation. However, learning can conflict with accountability when meeting particular standards and these can prevent the identification of lessons learned for inclusion into practice. WRI proposes a process-based approach for adaptation based on understanding the context within which adaptation needs to happen, developing a hypothesis of adaptation, articulating theories of change and setting indicators and baselines before implementing monitoring. Limited resources will typically mean success can be measured by the quality and function of adaptation *processes*, or by the quality of the *results* of processes.

5.7 Policy

At the ABCG workshop in Washington DC the participants expressed interest in a comparison of activities on policy and associated levels of interaction. These categories are defined in Table 5.9, and the results of the survey are displayed in Table 5.10. The results reveal that ABCG members are engaged in a wide range of activities related to policy on climate change adaptation in Africa. The scale and scope of these interactions vary considerably, both within and among the organizations; some of the activities apply to the NGO as a whole, and others are focused in the specific projects assessed.

Table 5.9: Levels of policy interactions of ABCG member organizations and their programs on climate change adaptation in Africa

Type of policy	Description
International conventions	Active engagement with climate change policy processes (IPCC, UNFCCC-COP process, etc.)
Regional	Engagement in regional policy on adaptation (e.g. South African Development Community, Nile Basin initiative, African Union)
National government	Information sharing and advocacy with African governments on adaptation policy
Local/community	Providing inputs to local level policy
Donor governments	Advocacy with the US government and other donor governments abroad
Other donors	Providing information to major non-governmental donors on salient issues in adaptation

The survey suggests that ABCG member organizations provide a nexus between policy-making bodies and on-the-ground adaptation initiatives with conservation objectives in Africa. This is especially so for interactions with national governments. In the case of WRI, policy has primacy in its institutional agenda in Africa. For most of the other member organizations, actions on policy are complementary to field conservation efforts. In general, the breadth of involvement in policy issues identified in Table 5.10 reflects the scale of each NGO's activities in Africa.

Table 5.10: Self-assessment of activity on policy by ABCG member organizations across a range of scales in climate change adaptation in Africa.

<table border="1"> <thead> <tr> <th colspan="2">KEY</th> </tr> </thead> <tbody> <tr> <td style="background-color: black; width: 20px; height: 20px;"></td> <td>Major activity</td> </tr> <tr> <td style="background-color: gray; width: 20px; height: 20px;"></td> <td>Minor activity</td> </tr> <tr> <td style="background-color: lightgray; width: 20px; height: 20px;"></td> <td>Not significant in program</td> </tr> </tbody> </table>			KEY			Major activity		Minor activity		Not significant in program	LEVEL					
			KEY													
	Major activity															
	Minor activity															
	Not significant in program															
NGO	PROJECT	LOCATION	International Conventions	Regional	National Government	Local & Community	Donor Governments	Other donors								
AWF	Mountain Gorilla	Rwanda, Uganda, DR Congo														
CI	Island-wide vulnerability assessment	Madagascar														
	Climate Action Partnership	South Africa														
JGI	Gombe-Masito-Ugalla	Tanzania														
TNC	Western Tanzania	Tanzania														
WCS	Albertine Rift	Uganda, Rwanda, Burundi, Tanzania, DR Congo														
	West Indian Ocean coral reefs	Kenya, Tanzania, Mozambique, Madagascar														
WRI	World Resources Reports & ARIA survey	Mali, Namibia, Rwanda, S. Africa, Ghana														
WWF	Mangrove Resilience to Climate Change	Tanzania, Cameroon														
	Capacity building, vulnerability assessment and adaptation	Madagascar														

6. Lessons learned and recommendations for ABCG member organizations

6.1 Project design and execution

The survey of ABCG member projects and the subsequent meeting brought to light some valuable insights that may offer productive pathways for next steps and improvements in future work on climate change adaptation in Africa. In this section we summarize a number of lessons learned across a range of themes, and offer recommendations.

6.1.1 Lessons learned as reported at the Washington DC workshop

At the July 2011 workshop in Washington DC, field-based personnel shared experiences and lessons learned in ABCG members' respective projects on adaptation. Box 2 presents a selection of these lessons learned, with respect to conducting work on adaptation, working with people, and data and monitoring issues.

6.1.2 Working within conservation adaptation planning frameworks

Most of the ABCG member projects have been developed without clear guidelines based on best practices and proven methods. For example, the WCS Albertine Rift program has grown organically from initial efforts focused on modeling future projections to become a more comprehensive program incorporating monitoring network establishment and stakeholder consultation extending to national government levels. The overall result is a structure that aligns with most of the six stages in the ACT framework, yet this was realized through an ad hoc process rather than by deliberate design.

Box 2: Overarching lessons learned as reported by ABCG member organization field program staff at the July 2011 workshop in Washington DC.

Conducting work on adaptation:

- Many good climate adaptation strategies are modifications of what teams are already doing, so implementation may not require a major overhaul of activities on the ground
- The vulnerability assessment process must be conducted in a participatory manner with key stakeholders and sectors and should include capacity building
- A key lesson has been the importance of building and harnessing collaborative partnerships around projects
- It is exceptionally valuable to be able to draw on the resources of multiple organizations, allowing each other's tools, connections, and expertise to support one another
- Peer review strengthens the process and products - projects benefit when colleagues who have developed adaptation strategies in other geographies are included
- It is important to build an enabling environment that can support implementation through policy actions and research
- It is critical to monitor, evaluate and incorporate new information to adjust actions into the learning process of adaptive management, and include community monitoring

Working with people:

- Awareness about climate change remains a critical issue
- People are empowered by demystifying climate change
- Climate change adaptation work improves stakeholder buy-in, builds capacity, and puts climate change firmly on the agenda for many organizations and stakeholders
- Integrating indigenous/traditional knowledge through consultation with communities is critical to success of an adaptation approach
- Workshops are pivotal components of adaptation work, and are highly effective for building awareness for adaptation and monitoring needs and opportunities
- Adaptation processes must be conducted in a participatory manner with key stakeholders and sectors to ensure ownership and sustainability of adaptation work
- Adaptation programs benefit from using ecosystem-based approaches to adaptation that link to improving livelihoods and building resilience

Data issues

- While reliable trend data for key climate parameters often is not available for a given project area, data mining for informal records can reveal potentially useful climate resources to fill in gaps in baseline knowledge
- Adaptation project teams need to be familiar with the climate science, and particularly the available climate data
- Implementation efforts will be hindered by poor baseline knowledge and absence of comprehensive monitoring networks
- Adaptation work provides strong impetus to consolidate and analyze data resources distributed among different institutions

Lessons learned:

In designing new initiatives, ABCG members may benefit considerably from the utilization of planning tools—such as the revised ACT framework outlined in this report—to create more efficient and strategically developed programs that implicitly leverage the collective experience gained from previous work. Frameworks provide a consistent and structured approach that facilitate gap analysis at early stages of project design, increase efficiency during project execution, and aid in identifying pathways towards effective implementation and achieving meaningful results. An important caveat is that some tailoring of frameworks to fit project needs will often be necessary, since complex African contexts featuring multiple stressors and drivers of change require full consideration and incorporation of on-the-ground conditions that may not match idealized models.

Recommendation:

- Adaptation frameworks can help conceptualize project design. However, as adaptation frameworks are often generalized, they should be tailored to project contexts and explicitly include the role of people in project activities.

6.1.3 Project approaches – Ecosystem-based Adaptation and Community-Based Adaptation

EbA aims to use biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change (Secretariat of the CBD, 2009). It is important to plan human adaptation in light of changes that natural systems are undergoing and may undergo in the future, rather than assuming that they will be static. In order to do this, conservation organizations have to work with new partners across multiple sectors. EbA seeks to optimize win-win prospects for adaptation objectives for both biodiversity and humanity by using biodiversity as a basis for climate adaptation strategies rather than relying on structural based adaptation (e.g. cement levees and seawalls). This is demonstrated schematically in Figure 6.1, which outlines how mutual benefits to nature-focused and people-focused concerns can be yielded by targeting interventions that address both sets of needs.

CBA targets the most vulnerable populations and focuses on activities with the greatest direct impact. Adaptation strategies are generated through participatory processes that build on cultural norms and address underlying causes of poverty that make some people especially vulnerable to climate change. CBA projects typically involve a combination of livelihood resilience, disaster risk

reduction, capacity strengthening of local civil society and government institutions, and advocacy and social mobilization to address underlying causes of vulnerability (e.g. poor governance, inequitable control of resources, limited access to basic services, and discrimination). Although it is not a prerequisite, CBA projects often include aspects of ecosystem goods and services, when local people and livelihoods clearly depend on them, or when they reduce the risk of disasters (e.g. landslides, flooding).

Similarly, EbA projects often contain strong elements of CBA. In practice, while there are important differences between EbA and CBA, many organizations are increasingly recognizing the importance of taking an integrated approach to adaptation at the nexus of EbA and CBA, and the distinctions are blurring.

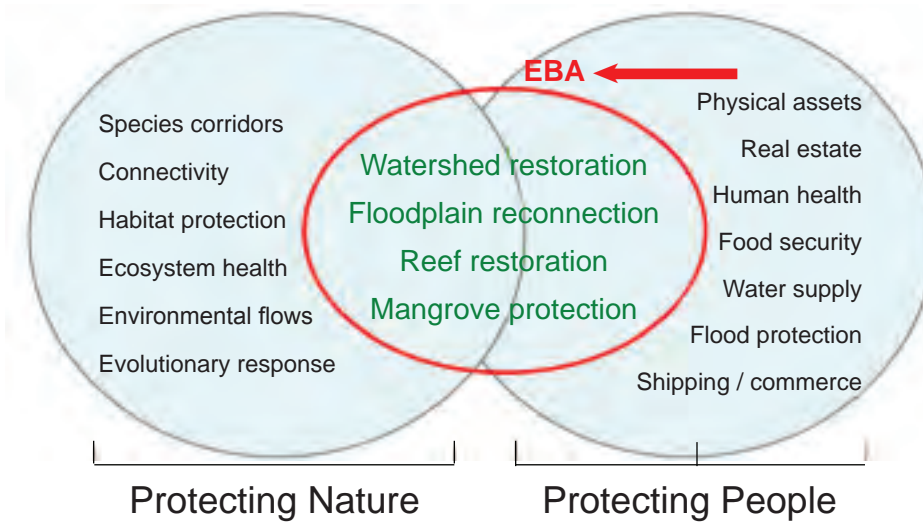
Lessons learned:

The functional aspects of ecosystems in the services they provide to humanity are already a growing focus of many conservation efforts with ABCG members in Africa. The joint TNC-JGI-FZS project in western Tanzania and CAP projects in South Africa offer good examples of integrating EbA into project design. Its application in community engagement has created strong interest among local communities for the need to incorporate adaptive practices into their livelihood strategies. A comprehensive understanding of how climate change will impact the long-term viability of both the ecosystems themselves and the services they provide is therefore of great interest. At the same time, knowledge of people's likely responses to climate variability and change is essential to understand the impacts that they may have on ecosystems, and the risk of maladaptation if they do not take ecosystem resilience and vulnerability into account adequately in designing their responses.

Recommendation:

- Incorporate EbA and CBA approaches into existing climate adaptation field projects where applicable, and conduct monitoring of such approaches in order to adaptively manage and refine them over time.

Figure 6.1 A schematic diagram demonstrating how Ecosystem-based Adaptation (EbA) objectives share benefits between human interests and ecosystems. Source: Sarene Marshall, TNC Global Climate Change Adaptation Program.



6.2 Data, analysis and modeling

Climate change adaptation work in Africa is made more challenging by inadequate observational data resources and archived records. Forward looking projections on climatic and associated environmental changes are dependent on numerical modeling output that compares parameter values at defined time steps in the future with contemporary baseline values. As modeling techniques increase rapidly in sophistication, resolution, and complexity, the products generated become ever more compelling and thus, apparently, useful. There is much less rapid growth in the other side of the picture – observational data required to derive the baseline values that provide the comparison and help identify the magnitude of change. This is an amply recognized problem with climatological data, where for much of Africa projects must rely on data interpolations rather than actual data. But data constraints can factor into modeling efforts in other ways as well. Examples from ABCG member projects elucidate several related issues and offer some useful lessons.

6.2.1 Filling gaps in climatological data networks

A well-developed understanding of the relationship of the present day climate system to ecological systems is fundamental to anticipating climate change impacts upon ecosystems, biodiversity and humanity. Part of the due diligence for effective programs on climate change adaptation is therefore to ensure that climate observations are collected within and close to protected areas throughout the biodiverse regions of Africa and other sites of conservation attention. Unfortunately, this need remains largely unaddressed to the present

throughout much of tropical and subtropical Africa. Climate monitoring performed by national meteorological services in Africa prioritizes data collection at airports and in large communities, and the low human population densities in most protected areas reduce their status among recognized priorities for climate monitoring. A map of currently active weather stations reporting into global climatological databases demonstrates that large data-free voids in climatological data collection exist, including much of the Congo forest region (Figure 6.2).

Figure 6.2. The present day climatological observation network in Africa as represented on the Global Summary of Day observation listing compiled by international meteorological organizations.
(Source: <http://moyhu.blogspot.com/2010/07/spatial-coverage-of-ghcn-and-gsod.html>)



Lessons learned:

The need to increase climate monitoring is frequently recognized as a pressing concern in ABCG project work on adaptation. CI's TEAM initiative already places priority on comprehensive climatological monitoring for their five sites in Africa, with additional sites now in planning. As part of their project work, AWF and WCS are involved in respective efforts with partners to install automatic weather stations in and around national parks in particularly data-poor areas of the Albertine Rift. The ABCG members can continue to promote such efforts both within and outside our NGO consortium to help fill data voids that national meteorological services and protected area authorities may be unable to address.

The current efforts are, however, uncoordinated. ABCG members would benefit individually and collectively by partnering with national meteorological agencies and protected area managers to expand and professionalize climate observation networks. Coordination would foster extension of weather station networks into national parks and other sites of high conservation priority that currently lack in climate monitoring capability. The data streams from the individual sites could be fed into a common data portal accessible to all research and conservation interests; this already exists for conventional meteorological observations through the Global Climate Observing System (GCOS). This would facilitate climate change trend detection at individual sites and broader regions, and help improve local climatic representation in gridded products that serve as baselines in modeling studies. It may also serve to increase attention within the climate change research and modeling communities to these centers of biodiversity conservation such as the Congo Basin that currently fall outside of the attention of researchers due to data absence issues.

Recommendations:

- Support the financing and installation of appropriately sited, research-grade, automatic weather stations in protected areas and other sites of primary concern for biodiversity conservation.
- Establish new monitoring sites in current data-void regions where climate monitoring is already ongoing but with inadequate systems.
- Centralize and share climatological data among national governments, conservation, development, climate monitoring and climate change communities – essential for filling in data voids.

6.2.2 Inclusion and exclusion of drivers of change

A challenge that commonly confronts teams working to generate projections of future conditions under climate change concerns the selection and weighting of identified drivers of change in model simulations. The modeling component of the WWF Mangrove project provides an example of such a data-related challenge to generating meaningful guidance for conservation applications. As related at the ABCG workshop in Washington DC, the project team decided to focus on sea level rise as the principal driver of ecosystem changes in their model, though in doing so they also elected to ignore precipitation changes and the consequences of projected increases in temperature and atmospheric carbon dioxide concentrations.

Lessons learned:

In this case outlined above, the choice of climate change drivers incorporated into models was steered by practical considerations, weighing the need to generate projections for the future to serve project objectives against the difficulties of less tractable complexity. Yet the overall value of the output derived is immediately at issue: what is the likelihood that the projections are representative of any coming reality if known key drivers of change are not considered? One consequence of this is that the project aim is downgraded somewhat to a heuristic activity rather less ambitious in scope than actual attempts to forecast change in contexts of real-world complexity. One effective approach being used by some conservation groups faced with an ambiguous or complex set of drivers is to conduct scenario-building exercises using a variety of input parameters to elucidate the range of responses that might be considered.

Recommendation:

- As an alternative and/or complement to deterministic modeling, scenario-building exercises can be used with groups comprising scientists, stakeholders including communities in the target areas, and others with relevant experience and local knowledge to consider how outcomes may vary and what actions would be appropriate for different combinations of factors driving environmental and social responses to climate change.

6.2.3 Rejection or consideration of implausible results

A second challenge that commonly confronts conservation teams working on vulnerability assessments involves how to interpret and use modeling products. The AWF-IGCP mountain gorilla vulnerability assessment, which has at its core a highly technical GIS mapping exercise, performed by request by an academic consulting group, aimed to identify potential mountain gorilla range under several future IPCC climate scenarios (Belfiore, 2010). The project modeled a range of scenarios under different selections and weightings of drivers of change using the best available information from the major players in mountain gorilla conservation, all presented in a compendium of results. Depending on inputs, modeled outcomes are highly divergent: among the simulations developed are some that indicate excellent prospects for long-term viability of mountain gorilla range across the current protected area domain, and others that show its total disappearance in just a few decades. The species distribution models (SDMs) that identified surrogates for plant productivity produced the highest level of suitable range under most IPCC scenarios. The SDMs that use the most basic, MaxEnt approach, produced the least, to no, suitable range under the driest of IPCC scenarios.

Lessons learned:

As related in the project report (Belfiore, 2010) and by AWF at the Washington workshop, in project meetings where these results were presented, expert primatologists dismissed the case where the entire current sub-species range becomes unviable over the course of the 21st century due to increased temperatures as highly implausible. The primatologists asserted that as these worst-case distribution models were driven by temperature and elevation, they are at odds with a large body of knowledge on the species' ecology and discount the gorilla's high adaptive capacity to a wide range of environments. However, there was considerable discussion, with no conclusion, about the inclination of gorillas to try new food sources, in the case that plant distributions would change in global warming; and to the question of behavioral changes that might accompany a general drying of the landscape and of succulent plants that currently supply mountain gorillas with water.

Discussion of the implausible results found that they are explained in part by data limitations: the current sub-species range is defined by gorilla observations from within protected area boundaries, giving a misleading representation of what the range would be without anthropogenic constraints across the landscape. The modeling approach utilized by the joint AWF-IGCP project could be considered relatively sophisticated and indeed primatologists found other modeled outcomes constructive to adaptation planning. Yet, the thorough evaluation of the range of modeled outcomes determined that the temperature-driven outcomes were of limited if not questionable value for adaptation planning and that future modeling efforts should attempt to include historic gorilla range data.

This case underscores the necessity of expert consultation for evaluating which model outputs might be considered constructive for adaptation planning, which outputs should be dismissed, and what new data might improve future modeling efforts.

Recommendation:

- All model projections developed for conservation planning purposes should be critically assessed for plausibility, utility, and opportunities for improvement by persons with relevant knowledge of the species or ecosystems under consideration.

6.2.4 Use of interpolated climate variables at high spatial resolution

Another challenge arising from the use of models for applications in climate change adaptation concerns the spatial resolution needed versus what is available for capturing climatic and ecological complexity. For the current suite of IPCC climate model output, downscaling to 0.5-degree (~50 km) latitude-longitude resolution for the tropics seems to be the crossover point where further downscaling becomes an increasingly questionable exercise (J. Price, WWF-US at the Washington meeting). As discussed by Heller and Zavaleta (2009), the scales of conservation management activities and global climate models are discordant, yet others (e.g. Hannah et al., 2007) identify that there can be considerable value to be derived from modeling at high spatial resolutions. To determine climate change impacts on species distributions, conservation practitioners need data downscaled at resolutions greater than 0.5-degrees. However, the widely used *WorldClim* (Hijmans et al., 2005) 1-km interpolated data surfaces are for the most part inappropriate for representing climatological conditions at high spatial resolution in African geographies, since they are based on simplistic assumptions on how climate varies across space without the requisite observational density required for proper representation. For example, topographic effects on rainfall such as augmentation on windward slopes and rain shadows on lee slopes (i.e. orographic effects) are absent in *WorldClim* in geographies lacking reliable climatological inputs.

Lessons Learned:

Until data interpolations and/or climate model output downscaled to high spatial resolution are able to better capture such real-world variations, scientists and conservation practitioners will have to use their best scientific judgment to determine whether high resolution (<0.5-degree) downscaled data are appropriate to use for modeling species distributions and the like.

Recommendation:

- Project teams utilizing modeling of climate change impacts on biodiversity and environments at high spatial resolution must take into account the assumptions inherent in any downscaling exercise.

Finally, in addition to the specific recommendations developed above, we offer a summary recommendation for the ABCG community on the use of models in climate adaptation in Africa:

Recommendation:

- ABCG should hold a workshop to share lessons learned on the use of models and modeling results to help improve their application in climate change adaptation initiatives.

6.3 Overcoming the implementation gap

Several of the projects evaluated in Section 5 can be considered to be at an advanced stage, having met all stated objectives. However, there remains a critical ‘implementation gap’, which reflects the major limitations of climate change adaptation programs at the present time. When examined closely, most work on adaptation in biodiversity conservation contexts falls short of taking actions that actually change on-the-ground conservation for a climatically changed future. Most of the ABCG member projects on adaptation center on vulnerability assessments designed to identify problems, issues and impacts, and rather tepidly approach, but do not cross the implementation gap (Table 5.1). Notwithstanding that some projects only recently produced recommendations for adaptation action, we believe this identifies one of the key limitations of current programs on adaptation: the projects mostly aim short of taking actions that fundamentally modify conservation strategy to account for climate change. Vulnerability assessments are among important first steps, but bolder objectives are needed to address the pressing concerns to biodiversity conservation that are laid bare by such analyses. A number of challenges have been identified by ABCG members that might collectively explain why the implementation gap exists, such as:

- Concern about taking action on long-term climate change when biodiversity is at risk from short-term threats such as illegal extraction
- A lack of understanding over what climate change means by governments and ABCG members
- Concerns over taking actions in the face of high degrees of uncertainty or need for more detailed science over the exact course that climate change will take
- The disconnect between the time horizons of donors and the time horizons of adaptation planning and implementation
- Inadequate local capacity to take on adaptation initiatives
- Concern about transaction costs and know-how to develop non-traditional partnerships in order to implement adaptation effectively, and
- A lack of funding to actually implement proposed activities.

As an example of moving forward towards crossing the implementation gap, the second phase of CI's Madagascar project was designed to test the feasibility of implementing some of the adaptation actions recommended as a result of the vulnerability assessment conducted in the first phase.

Lessons learned:

Overcoming the challenges associated with political will, funding issues, and a lack of suitable cost-effective actions (alternatives) should be regarded as high priorities in future work. We believe that these shortfalls can best be overcome through the development of a set of outreach activities and training tools aimed at raising the awareness around the implications of climate change for key stakeholders in Africa, including key bilateral, multilateral and government agencies that fund (or that may fund) adaptation initiatives on the ground. Training around climate adaptation should focus on actions required to proactively manage the challenges presented by climate change.

Recommendation:

- Development of educational forums for local decision makers, donors and ABCG member organizations and their partners to identify strategies for designing actions that ensure effective implementation.

6.4 Project monitoring and evaluation

Several challenges are inherent in monitoring for adaptation. These include uncertainty over the time period of impacts; the cross-cutting, cross-sectoral nature of adaptation; and the lack of adequate attention and funding to support monitoring and evaluation (M&E) within conventional and adaptation-specific projects. Discussions during the July 2011 ABCG members' workshop focused on three major themes for monitoring for climate change and adaptation: 1) monitoring climate change variables; 2) monitoring impacts of climate change on biodiversity and ecosystem services; and 3) monitoring and evaluating effectiveness of adaptation interventions for people and conservation strategies.

Lessons learned:

Breakout group discussions during the workshop focused on three main areas for further deliberation: (a) monitoring the achievement of adaptation goals; (b) identifying cultural shifts necessary for effective monitoring for adaptation; and (c) scoping the possibilities of developing common guidelines on monitoring needs.

The issue of the general lack of baseline climatological data for much of Africa has already been raised in section 6.2 above. Monitoring floral and faunal responses to changes in climate and tracking impacts on ecosystem services is the second major area in need of focus. In order to go beyond the precautionary approach and actively integrate climate risks into land use planning, such information is needed to guide strategies for adapting conservation actions and developing adaptation options for livelihood strategies.

The complexity of decoupling the risk and impact of climate change from those of other stressors sets up a challenging goal to monitor the effectiveness of adaptation project interventions. Additionally, information gathered from systematic monitoring should be actively evaluated in order to revise project activities as necessary. While project monitoring and evaluation is a normal component of most development projects and many conservation programs, there is little focus on how to use information gathered to revise adaptive management strategies. There is also significant ambiguity about which indicators are important for developing a monitoring program that can capture impacts or lack thereof on the adaptive capacity of social and ecological systems. While many efforts are ongoing to develop and/or identify indicators specifically for adaptation, one of the main lessons learned from this session is that it is significantly more useful to think of M&E for adaptation as a process.

Measuring Success Achieved

Definitions of successful adaptation over the long term range from maintenance of ecosystem services, to the establishment of functioning institutions that allow for the achievement of conservation and development goals. Success would also be demonstrated by positive deviation, no deviation or minimal deviation from the baseline. Rather than viewing adaptation as an outcome or an end point, participants felt that monitoring adaptation should reveal the process as one that: is participatory, results in minimizing negative impacts to vulnerable sections of society, and develops positive changes in policy, governance and practices. Monitoring and evaluation projects aimed at long-term benefits must be based on assessments of proxy measures or markers of progress toward vulnerability reduction and increased adaptive capacity (UNDP, 2007).

Cultural Shifts Needed

The cultural shifts required to effectively integrate monitoring into conservation and development practice include a greater emphasis on participatory monitoring with active engagement by communities. This entails integrating community-driven monitoring activities to the extent possible within projects and, crucially, a mindset shift in how information collected from monitor-

ing programs is utilized. Rather than monitoring for the sake of monitoring, social, economic and environmental data collected under this process should be examined and program activities evaluated and adapted as needed. Longer time frames, uncertainty in nature of impacts and responses require a cultural shift towards greater flexibility on the part of donors as well as policy makers. Managing expectations, creating an awareness of climate change locally and identifying measures of success that are relevant to local communities are also necessary elements of this cultural shift. Finally, linking development and conservation outcomes, and fostering communication links between practitioners, scientists and policy makers across sectors, are felt to be critical components of adaptation and a monitoring framework for adaptation. Participants felt that climate change adaptation provides an opportunity for experimentation and strengthens the process of learning-by-doing.

Feasibility of Common Guidance/Guidelines for M&E for Adaptation

General guidelines for monitoring are considered to be useful; however, since adaptation is a context-specific process, guidelines will need to remain sufficiently flexible and informative without being prescriptive. In addition, guidelines should build upon existing frameworks and monitoring systems. One of the gaps highlighted by several workshop participants was the need to implement data storing and sharing processes. From the analysis of the ABCG member experiences on M&E, four key challenges emerge:

1. Appropriating funds for monitoring already identified indicators needed to track climate change impacts and impacts of adaptation activities.
2. Accessing pre-intervention baseline information, including traditional knowledge on a range of social, ecological and biophysical indicators.
3. Integrating an active, periodic monitoring of impact effectiveness of interventions into program cycles.
4. Ensuring that resources and willingness exist to sustain data-gathering and check up on those benchmarks periodically after the project has ended.

Recommendations:

- Develop a set of guidance recommendations for conservation practitioners focusing on, among other aspects, how to integrate information from monitoring into a program for adaptive management.
- Develop specific recommendations for policymakers and donors on the support needed by partners to ensure that adaptation genuinely is a process of learning from actions, and developing improved but realistic data gathering and knowledge management.

-
- Collaboratively raise the issue of implementing and ensuring sustained funding for long-term monitoring beyond the duration of normal funding periods (< 5 years).

6.5 Working with donors

In marked contrast with climate change mitigation, the incorporation of climate change adaptation into donor-driven conservation agendas has been relatively slow to take root, although it has recently begun to build momentum. Over the past several years major foundations and multilateral donors have begun providing funding opportunities for adaptation tied to biodiversity conservation objectives. Generally these have been for exploratory studies or vulnerability assessment in landscapes and sites where the organizations already had programs ongoing.

6.5.1 Setting funding priorities

The MacArthur Foundation is particularly noteworthy for a major funding initiative on climate change adaptation begun in 2008 throughout its global portfolio of conservation landscapes. This program has provided major grants to several ABCG members and other groups for work focused in Madagascar and the Albertine Rift, with five of the ten projects shown in Table 6 funded either wholly or in part through the foundation. This visionary action by a leading donor has invigorated existing efforts through the infusion of funding, and otherwise increased attention and spawned several new initiatives and collaborative projects. It is therefore hoped that the Foundation will sustain adaptation as a funding priority for African biodiversity conservation, and that other donors will follow suit. But even this positive example comes with limitations: the MacArthur Foundation funding has been restricted to its two priority landscapes in Africa, Madagascar and the Albertine Rift. Some important geographic and thematic foci for climate change adaptation work, for example, the Congo Forest biome and the implications of disease, respectively, remain largely outside the attention of many leading donors to date, and are generally absent from the ABCG members' collective attention.

Lessons learned:

In the ABCG project portfolio donors have had an influential role in determining what gets funded and where, through declared programmatic agendas and geographic focal regions in their calls for proposals (Table 5.7). During the ABCG workshop in July 2011, participants expressed a desire for increased dialogue among conservation and development organizations and donors around adaptation in Africa. The importance of taking a holistic ecosystem-based approach to adaptation to assure that ecosystem considerations are

mainstreamed into the work of the development and disaster risk reduction communities, and that human needs are mainstreamed into work of conservation organizations was repeatedly highlighted. This is particularly important in Africa, where people are highly vulnerable to climate change, food security is threatened in many countries, and there is very high dependence on natural resources and ecosystem services.

Recommendation:

- Through outreach activities such as workshops and consultations, the ABCG should utilize the findings of this report to inform key funders with programs in Africa of priorities.

6.5.2 Mitigation and adaptation – competing or complementary agendas?

During the interview process for this report, representatives of several of the ABCG members expressed concern that both their organizations and the donor community have been overly attentive to climate change mitigation programs at the expense of investing in adaptation. The common sentiment expressed is that while it is acknowledged that adaptation and mitigation activities should be linked whenever possible, staff time and other resources for work on mitigation are often disproportional to the conservation value derived from these efforts in contexts of climate change.

To date, most major donors concerned with climate change in Africa have placed far greater emphasis on funding greenhouse gas mitigation initiatives, yet the expected payback remains a long-term prospect at best whereas the need for adaptation and opportunities to modify conservation practice accordingly are already present, and ever more urgently needed. As an example of this, at the Washington DC workshop, it was noted that the proposed program for the next phase of funding for the Central African Regional Program for the Environment (CARPE), a USAID initiative aimed at promoting sustainable natural resource management in the Congo Basin, makes only cursory mention of climate change adaptation, whereas carbon sequestration remains central to the programmatic agenda and funding allocations. Many of Africa's most important conservation landscapes—including almost the entire Congo Basin—remain outside of the collective attention for adaptation work by ABCG (though other non-ABCG groups have initiated some projects: e.g., CoFCCA project by CIFOR – the Center for International Forestry Research; COBAM project by the Stockholm Environmental Institute). In the case of the Congo, it seems likely that this situation will continue, unless major donors such as CARPE expand present funding initiatives beyond REDD+ focused mitigation schemes centered around forest preservation, to include adaptation

or develop new funding streams around the adaptation theme. Meanwhile, forest mitigation projects can be sited to stop encroachment of threatened wildlife corridors or preserve ecosystem services – measures that can complement adaptation programs. Completed vulnerability assessments and adaptation strategies can help conservationists capitalize on opportunities mitigation funding provides. The ABCG workshop participants stressed that awareness for the need to adapt needs to rise to the same level of attention that REDD/mitigation currently gets – at the national level by the countries where we all work, within the NGO community and ABCG, as well as by the donor community.

Lessons learned:

Mitigation programs, such as those centered on Reducing Emissions from Deforestation and Degradation (REDD/REDD+), should be directly linked within a wider adaptation framework centered on the tenets of ecosystem-based management.

Recommendation:

- Given its breadth of experience and influence in conservation agendas in Africa, the ABCG consortium should work to raise awareness of the need for national governments, NGOs, and the donor community to better address ways to collaboratively adapt to climate change.

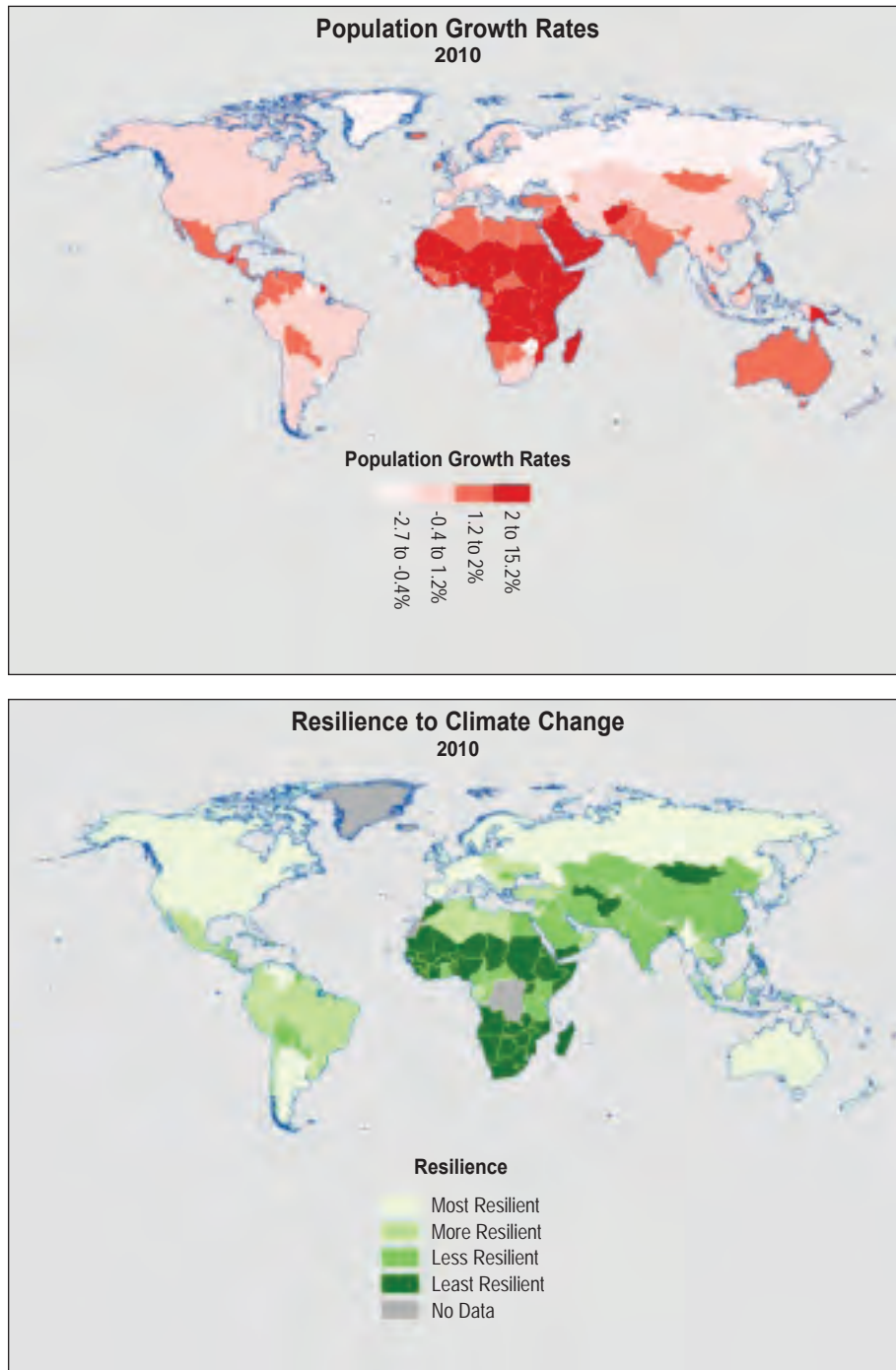
7. Other recommendations beyond ABCG for broader conservation interests in Africa

Two issues of great importance for biodiversity conservation in Africa, human population increase and disease, are notable by their relative absence from consideration in the ABCG member project portfolio on climate change adaptation. Both of these phenomena present the potential to upend the achievement of long-term objectives in adaptation. Their attendant stresses are likely to intensify over time. This will occur in parallel to, for population increase, and as a consequence of, for disease, the growing environmental stresses of climate change. We highlight these issues here as a call to action by both the ABCG consortium and the broader conservation community.

7.1 Human population growth and climate adaptation

With only a couple of exceptions, in the ABCG member project portfolio there is a general absence of activities that integrate the consequences of human population growth into climate change adaptation needs and outcomes. On the continent with the highest poverty, greatest vulnerability to climate change and the lowest capacity to respond to it, many people are especially dependent on natural resources and ecosystem services. Demand for resources, driven by both population growth and emerging economies in addition to the already developed economies, is going to be a major driver of change on the continent. Population growth will compound the impacts of climate change; this is recognized in the NAPA reports of several countries (Population Action International and WWF, in press). Sub-Saharan Africa records many of the highest population growth rates on earth today; the region's population is projected to double by 2050 (United Nations 2011) adding considerably to the non-climate stresses on natural resources and ecosystem services, which

Figure 7.1. The Vulnerability-Resilience Indicators Model (VRIM) index combines 17 physical, social and economic indicators that assess the resilience of a society to anticipated climate change impacts. The index measures countries' abilities to recover from occurrences of climate change according to indicators of current sensitivity (e.g., food security, human health, water resources) and adaptive capacity (economic, human and civic resources, environment) for the year 2000. Countries for which data are available are grouped into four categories (most, more, less and least resilient) and mapped according to these quartiles. (Source: United Nations, Department of Economic and Social Affairs, Population Division. 2011. *World Population Prospects: The 2010 Revision*. New York: United Nations.)



are themselves undergoing change due to climate change, with severe impacts on people and natural systems (Figure 7.1). This synergistic combination of trends was recognized by the ABCG in its review of the challenges facing biodiversity in the next 25 years in Africa (ABCG 2009, http://frameweb.org/adl/en-US/2447/file/550/FBIA_brochure_English.pdf).

Recommendation:

- Comprehensive consideration of the implications of population growth and demand for resources should be incorporated in current project activities, and included as much as possible in the design of new initiatives on climate change adaptation in Africa.

7.2 Consideration of disease in vulnerability assessments and future planning

The potential value derived from vulnerability assessments is also predicated by decisions over what to consider and what types of expertise are incorporated into assessments. It could be argued, for example, that over the multi-decadal timescales that are the focus of most work on adaptation, the greatest threat related to climate change in sub-Saharan Africa for biodiversity and humanity alike is disease: the emergence of novel pathogens, shifting vectors and disease distributions, and increasing vulnerability of affected populations. Yet as indicated in Table 5.1, disease remains outside the attention of most of the projects evaluated. This absence of attention is symptomatic of inattention by the broader research community.

The climate change-disease issue presents a conundrum to the nascent field of climate change adaptation in Africa. To fully incorporate disease into adaptation project design would greatly augment the complexity of the task; to ignore it diminishes the validity of the enterprise and the overall value of many project outputs. Tentative first steps at bridging this gap are being taken in some quarters. At WCS efforts are underway to design initiatives that integrate, biodiversity, human and wildlife health with climate change by linking the organization's Climate Adaptation Team and Global Health Program, which has field-based programs ongoing in several countries in sub-Saharan Africa.

Recommendation:

- There is a pressing need for increased research attention, funding and training around the critical issue of disease dynamics and epidemiology under climate change in Africa.

8. Future Pathways for ABCG

In all regions where the ABCG members work, the absence of precedent on how to proactively engage climate change, along with the uncertainties inherent in working for projections of future conditions produced by numerical models, are major impediments to taking strong action on climate change. At the same time, chronic threats related to human population pressures, natural resource extraction, and landscape conversion ensures that conservation attention is occupied with short-term needs and, frequently, crisis management. The current suite of efforts and activities in the ABCG project portfolio therefore mostly concern vulnerability assessments or initiatives to apply short-term measures in response to climate variability to existing conservation strategies. The widespread absence of comprehensive environmental monitoring for even the most basic suite of climate parameters (temperature, solar radiation and rainfall) across large regions of sub-Saharan Africa furthermore debilitates efforts since baseline conditions are difficult to know, making change detection especially problematic.

This report has provided a synopsis of the status of ABCG member efforts to date on climate change adaptation for conservation in Africa. It will hopefully also serve as a first step towards building consensus on effective strategies and methodologies for future work. In this concluding section we examine some opportunities for future work by the ABCG consortium as a group that will also benefit programs on climate change adaptation by the individual ABCG members.

8.1 Opportunities for collective action

Up until the start of the present effort, the ABCG members engaged climate change adaptation in their African conservation initiatives either autonomously or in small partnerships. The sharing of ideas and commonalities identified in this study now create the space for ABCG members to consider working collectively on new initiatives on adaptation for conservation in Africa, and if it so chooses, put to forth a unified voice for advocacy on adaptation related themes. With regard to shaping policy, if taken collectively the ABCG members represent an influential body both for informing and influencing policy

makers across a broad range of scales. To a large degree, however, our respective efforts are neither thematically focused nor coordinated, with the exception of several ABCG members' participation in coalitions of environmental NGOs that work to influence US government policy and funding allocations on conservation and on climate change. The sharing of experiences and strategies, buttressed by the publication of this report, could provide a backbone to further efforts at coordination on policy to serve biodiversity conservation objectives. If the collaborative work on adaptation begun with this survey, workshop and report is extended and expanded by ABCG in subsequent efforts, this might be considered among activities in future cooperative work.

One idea that is already being considered by ABCG members is to develop a set of adaptation training toolkits based on the findings of the July 2011 adaptation workshop and this report. This information could serve as the basis for multinational outreach workshops within different climatic regions in Africa. The workshops would be aimed at funding agencies and policymakers and have two distinct aims:

1. To raise awareness of what climate change is and what it will mean to the region, what adaptation approaches and tools are available, and the role of ecosystems within adaptation actions (i.e., EbA).
2. To work to identify with stakeholders a series of concrete adaptation activities that should be funded within the short term, but with a view for the long term.

Through the proposed training workshops, we would aim to overcome the challenges around lack of political will and increase implementation and local capacity, and focus on actions required to proactively manage the challenges presented by climate change. By bringing research insights and region-wide stakeholder concerns together, these workshops could highlight the importance of ecosystem-based approaches to mitigation and adaptation in regional strategies to address climate change. An overall objective would be to identify priority fundable actions to effectively, efficiently, and equitably respond to the profound challenges posed by climate change.

8.2 Next steps

The ABCG member organizations are active in a range of projects on climate change adaptation in Africa as they pursue new initiatives and expand agendas on climate change. Mainstreaming adaptation into conservation planning is increasingly recognized as becoming a necessity rather than an option, so adaptation is becoming a cornerstone component in conservation projects with long-term objectives. In response to the present study's findings, the

ABCG members recommend continuing to work collaboratively on a series of steps to develop an adaptation toolkit, and to share results and lessons learned with key constituencies in Africa and elsewhere.

1. Disseminate the results of this survey through publications, online access through the ABCG and member organizations' respective websites, and through presentations at major international gatherings of conservationists, climate change scientist and policy makers.
2. Build upon the efforts to date of ABCG members by developing an adaptation toolkit and monitoring guidance based on the findings of the July 2011 adaptation workshop and this report.
3. Communicate these findings and demonstrate these tools to key bilateral, multilateral and government agencies that fund (or should fund) adaptation initiatives through meetings and short workshops.
4. Disseminate the survey findings in Africa through major outreach workshops with key stakeholders, funders and decision makers. Objectives would include raising awareness of what climate change is and what it will mean to the region; identifying adaptation approaches and tools available; and stressing the importance of maintaining ecosystem resilience to increase the resilience of people (i.e., EbA). Such meetings will further help to identify a series of concrete adaptation activities that should be prioritized for funding within the short-term.

8.3 Conclusion

It has been less than a decade since the need for planning for climate change has been embraced as fundamental for biodiversity conservation by the global conservation community. This survey of ABCG members finds that all members have active programs underway across a wide range of geographic and thematic contexts, with an equally broad range of targets and objectives. The full power of collaborative work within ABCG to achieve adaptation objectives for the long-term benefit of Africa's people and biodiversity has yet to be realized. We therefore recommend initiating efforts to begin working together as a community, leveraging our respective institutional strengths and expertise, and developing a common voice to raise the profile of climate adaptation to decision-makers and the donor community. We hope that the findings of this report, and the recommendations generated, serve as a launching point for such collaborative work within our partnership for the future.

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Appendix 1:

List of Definitions

The Framing Paper from the World Resources Report offers a helpful selection of definitions of terms frequently associated with climate change adaptation. These are, in turn, adapted from the Intergovernmental Panel on Climate Change's Fourth Assessment Report's Glossary of Terms (2007). The World Resources Report selection is reproduced here for the benefit of readers of this report, with definition added for EbA and CBA as well.

DEFINITIONS

Adaptation

Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation.

Anthropogenic

Resulting from or produced by human beings.

Climate

Average weather in a narrow sense, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

Climate change

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate

change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that Article 1 of the Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.

Climate variability

Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability).

Climate scenario

A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate.

Community-Based Adaptation (CBA)

A community-led process, based on communities’ priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change.

(Source: Reid et al., 2009).

Ecosystem-based Adaptation (EbA)

Ecosystem-based Adaptation is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change.

(Source: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change under the Convention on Biological Diversity (CBD))

Ecosystem services

Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These include (i) supporting services such as productivity or biodiversity maintenance, (ii) provisioning services such as food, fiber, or fish, (iii) regulating services such as climate regulation or carbon sequestration, and (iv) cultural services such as tourism or spiritual and aesthetic appreciation.

Extreme weather event

A weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability density function. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense.

Greenhouse gas (GHG)

Those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol.

Impacts of (climate change)

The effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts.

Large-scale singularities

Abrupt and dramatic changes in the state of a system in response to gradual changes in driving forces. For example, a gradual increase in atmospheric greenhouse gas concentrations may lead to such large-scale singularities as slowdown or collapse of the thermohaline circulation or collapse of the West Antarctic ice sheet. The occurrence, magnitude, and timing of large-scale singularities are difficult to predict.

Mean state of the climate system

Long-term average state of annual and seasonal values of climatic components of the climate system including the atmosphere, oceans, cryosphere (ice sheets), biosphere (living organisms), and geosphere (rocks, soils, and sediments).

Non-linearity

A state in which there is no simple proportional relation between cause and effect.

Resilience

The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Uncertainty

An expression of the degree to which a value (e.g., the future state of the climate system) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may have many types of sources, ranging from quantifiable errors in the data to ambiguously defined concepts or terminology to uncertain projections of human behavior. Uncertainty can therefore be represented by quantitative measures, for example, a range of values calculated by various models, or by qualitative statements, for example, reflecting the judgment of a team of experts (see Moss and Schneider, 2000 and Manning et al., 2004).

Vulnerability

The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Appendix 2: Interviewees and respondents for the ABCG Survey

Persons providing input to the 2011 ABCG members survey		
ABCG partner	Interviews	Questionnaire
AWF	Jimmiel Mandima, Adam Henson, David Williams	Joanna Elliott, Jimmiel Mandima, David Williams
CI	Radhika Dave, David Hole, Sarshen Marais	Radhika Dave, Sarshen Marais, Lee Hannah
JGI	Lilian Pintea	Lilian Pintea, Alice Macharia
TNC	Kristen Patterson, Evan Girvetz, Anne Wallach Thomas, Elizabeth Gray	Elizabeth Gray, Kristen Patterson, Jeffrey Smith DeBlieu
WCS	Anton Seimon, James Watson	Anton Seimon, James Watson, Elizabeth Matthews, Tim McClanahan, Joan Kawaka
WRI	Peter Veit, Heather McGray	Heather McGray
WWF	Judy Oglethorpe, Jonathan Cook	Judy Oglethorpe, Shaun Martin, Judith Balint

Appendix 3:

Questionnaires used for the ABCG survey

A questionnaire on climate change adaptation activities was circulated among the ABCG members in April 2011 ahead of the Washington DC workshop, and a second survey was later sent out in August 2011 following the workshop. These were central components of the information gathering exercises so are reproduced here accordingly.

3.1. Questionnaire for ABCG members – climate change adaptation in your organization’s work in Africa

A) Organizational approach and objectives

- Does your organization have a formalized program on climate change adaptation? If so, when did it begin?
- In which department or division? Do you have an institutional statement or formalized plan?
- What is the thematic focus or foci of the climate change adaptation program? (e.g. ecosystem services, species, protected areas, communities...)
- Where are the regional foci and field implementation sites for climate change adaptation initiatives in Africa?
- What are the declared project objectives for your projects in Africa?

B) Project implementation

- What are the targeted levels of engagement? (international policy, national, regional, local, NGO, active in field conservation, etc)
- Who are the lead personnel? What types of skills and experience do they bring to the program?
- Are there existing partnerships with other organizations on climate change adaptation in Africa?

-
- Have your projects only focused on biodiversity or also included human adaptation?
 - How has climate change adaptation been mainstreamed into your programs in Africa? Has there been any special training of field personnel?

C) Tools used – measuring and monitoring, modeling, community level risk assessments and tools

- If applicable, are historical climatic baselines for assessing climate change available for your sites and are you using knowledge on historical climatic variability?
- Are climate change vulnerability assessments available for your sites?
- Is modeling central to climate change adaptation work? If so, is modeling performed in-house, outsourced, or is it derived from other resources (e.g. Climate Wizard)?
- What types of models are utilized?
- What measuring and monitoring tools are utilized?

D) Funding sources, project outputs and feedback for ABCG

- Which donors have supported climate change adaptation work performed to date and for how long?
- Has internal funding support been provided for staff time or project costs?
- What is the status of current projects and what outcomes have been achieved thus far?
- What do you see as current strengths and limitations on your climate change adaptation work in Africa?
- What are major lessons, published outputs and other materials that you might wish to share with ABCG members?

3.2. Questionnaire 2: Follow-up questions reflecting items raised during the workshop in Washington DC

Monitoring & Evaluation

1. How has your organization conducted monitoring and evaluation in your organization's major adaptation project presented in the draft ABCG report? Please provide responses as inputs in the following table.

Activity	Major activity	Secondary activity	Not performed	Indicators used	Notes
Climate monitoring					
Vegetation monitoring					
Fauna monitoring					
Impacts on biodiversity					
Impacts on ecosystem services					
Impacts on resource-dependent livelihoods					
Evaluate effectiveness of interventions					
Capacity building on monitoring & evaluation					
Approx. percent of project funding for M&E					

2. How do you address the issue of the time available to assess climate variability/climate change, impacts and project effectiveness while under project funding versus the often substantially longer time frame needed for detecting changes from climate impacts?

3. Can you share other thoughts on the issue of monitoring and integrating relevant information into program implementation? Challenges that you face, opportunities and or solutions for overcoming these?

Policy

4. How has your organization pursued policy agendas on climate change adaptation for Africa? Please provide responses as inputs in the following table.

Type of policy	Description	Major activity	Minor activity	None	Specific activities
International conventions	Active engagement with climate change policy processes (IPCC, UNFCCC-COP process, etc.)				
Regional	Engagement in regional policy on adaptation (e.g. SADC, river basin/Nile initiative, AU)				
National governments	Information sharing and advocacy with African governments on adaptation policy				
	Information sharing and advocacy with African governments on incorporating adaptation in sectoral and development policy				
Local/ community	Providing inputs to local level policy				
Donor governments	Advocacy with the US government and other donor governments abroad				
Other donors	Providing information to major non-governmental donors on salient issues in adaptation				

5. What else have you done on climate change adaptation policy not captured in the table?

Funding levels

6. Can you please list by donor the amount of funding and the period of each grant received for adaptation work in Africa?

Biodiversity, ecosystem and human adaptation

7. Which parts of the biodiversity-ecosystem-human adaptation continuum has your organization worked on in Africa? How has your organization considered people and ecosystems in your organization's major adaptation project presented in the draft ABCG report? Please provide responses as inputs in the following table – note that you will probably fill in more than one line.

Nature of adaptation	Description	Major part of approach	Minor part of approach	Not part of approach	Activities
Species adaptation	Promotes adaptation of individual plant or animal species				
Protected area adaptation	Promotes adaptation of protected area with fixed boundaries, and species/ecosystems within it; may take into account human use				
Large landscape/seascape adaptation	Promotes adaptation of ecological processes in a landscape, including river basins; may include human adaptation and use of ecosystems to help people to adapt				
Ecosystem based adaptation	Uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change – fosters natural infrastructure as a complement or alternative to hard infrastructure				
Integrated ecosystem and community approaches to adaptation	Combines EBA and CBA by: Using ecosystem services to help vulnerable people adapt, building resilience of ecosystems to climate, and taking a bottom-up, rights based approach to adaptation				
Community based adaptation	Takes a rights based approach to adaptation (bottom-up, participatory, equitable, accountable, empowering); may include small scale infrastructure and/or use of ecosystem services/natural resources				
Large-scale infrastructure / regional development	Promotes development of large scale infrastructure (e.g. dams, dikes, large irrigation schemes, etc.), to reduce human vulnerability to climate change				

Appendix 4: Schedule and participants for the ABCG workshop on climate change adaptation held in Washington DC, 19-20 July 2011

4.1 Tools and Approaches for Addressing Climate Change Adaptation in Africa

Objectives:

- To provide training on climate change adaptation to field practitioners, conservation professionals and others that will be increasingly addressing adaptation issues in their work
- To share climate adaptation approaches, lessons from the field, and tools for addressing climate change adaptation by ABCG members and their partners, with a particular focus on adaptation in Africa
- To review current status of adaptation monitoring and explore the possibility of developing monitoring guidance and protocols

Key questions/issues:

1. How do we give adaptation priority as a critical component to conservation work in Africa when our time is occupied so fully by immediate realities on the ground?
2. How do we integrate adaptation approaches, tools, science into conservation policy, planning and field operations?
3. What have we learned about partnerships and how do we overcome the main challenges of working with new and more partners on issues related to adaptation?
4. How do we mainstream adaptation within various sectors and across institutions?
5. How can we better integrate biodiversity and community adaptation (human and biodiversity well-being) and avoid maladaptation (bad effects on the other) and conflict?

What is ABCG?

The Africa Biodiversity Collaborative Group (ABCG) comprises seven international conservation NGOs (African Wildlife Foundation, Conservation International, the Jane Goodall Institute, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute, and World Wildlife Fund) with the goal of working collaboratively and efficiently and effectively to further a sustainable future for the African continent. Funding has been generously provided by The John D. and Catherine T. MacArthur Foundation, the Critical Ecosystem Partnership Fund, the U.S. Agency for International Development, the U.S. Fish and Wildlife Service, and our members.

ABCG's Vision

ABCG's vision is of an African continent where natural resources and biodiversity are securely conserved in balance with sustained human livelihoods.

19 July	Sharing climate adaptation approaches, lessons and tools with a particular focus on climate adaptation in conservation work in Africa
8:30 am	Registration and light breakfast
9:00	Welcome, objectives, overview of agenda and introductions Natalie Bailey, ABCG Tim Resch, USAID Africa Bureau Chair: Judy Oglethorpe (WWF-US)
9:15	Session 1: Setting the scene – provide a brief review of Africa’s vulnerability to climate change, and status of ABCG partners’ adaptation work in Africa <i>Overview of projected climate change impacts on biodiversity and communities in sub-Saharan Africa</i> Jeff Price (WWF-US)
9:30	<i>Overview of ABCG Member Approaches to Adaptation in Africa</i> Anton Seimon (Wildlife Conservation Society)
9.50	Q&A and discussion
10.15	Session 2: Vulnerability assessment and planning - review lessons from a range of approaches <i>Assessing vulnerability and species range shifts in Madagascar</i> Michele Andrianarisata (CI) <i>Lessons from vulnerability assessment of a mangrove ecosystem in Tanzania</i> Jason Rubens (WWF Tanzania) <i>Changes in adaptation strategy development at the landscape scale: AWF’s progress and challenges in pilot sites</i> David Williams (AWF)
11:00	Break
11.20	Plenary Q&A and discussion
11.40	Case study: Integrating Adaptation into conservation planning An example from Western Tanzania Elizabeth Gray and Kristin France (The Nature Conservancy) Sood Ndimuligo (The Jane Goodall Institute) Magnus Mosha (Frankfurt Zoological Society)
12.10	Plenary Q&A and discussion
12.30	Lunch
1.30	Session 3: Multiple level adaptation approaches - learn lessons about the value of working at several different scales Chair: James Watson (WCS) <i>Climate Change Adaptation in the Albertine Rift</i> Anton Seimon (WCS) <i>Adaptation in Namaqualand: Restoring resilience through restoration and innovation</i> Ronald Newman (CI) <i>Madagascar/West Indian Ocean Program Office Adaptation Work in Madagascar</i> Harisoa Rakotondrazafy (WWF Madagascar)

2:15	Plenary Q&A and discussion
2:40	Session 4: Discussion groups: Discuss key questions from the ABCG White Paper outlined in Anton Seimon's talk
4.00	Session 5: Tools Fair: learn about tools for climate change adaptation work Participants are welcome to explore various tools shared by ABCG members and partners, including TNC's Climate Wizard, WWF's ClimaScope and Wallace Initiative, WCS's dynamic models used in Albertine Rift, WWF's mangrove vulnerability assessment approach, and more.
5.00-7.00	RECEPTION FOR ALL WORKSHOP PARTICIPANTS

20 July Day 2

8:30 am	Light breakfast
9:00	Welcome and review of Day 1 Chair: Radhika Dave
9:15	Session 6: Mainstreaming adaptation: Discuss the importance of capacity building, partnerships, policy and scaling up approaches for successful adaptation <i>Capacity Building Lessons from East Africa</i> Jyoti Kulkarni (START - SysTem for Analysis, Research and Training) <i>The Climate Action Partnership- learning from a South African collaboration</i> Sarshen Marais (Conservation South Africa) <i>USAID strategy for supporting policy and partnerships in Africa</i> Jennifer Frankel-Reed, USAID <i>SCAPES Partnership – global learning in climate adaptation</i> Jimmie Mandima, AWF <i>Ecosystems and Livelihoods Adaptation Network – Lessons from a multi-partner initiative</i> Judy Oglethorpe (WWF) <i>Rural Futures – a continent-wide approach for African development and adaptation</i> Gabriella Richardson-Temm (WWF Macroeconomic Program Office) Q&A
10:45	Break
11.00	Session 7: Monitoring for Climate Adaptation Chair Elizabeth Gray (TNC) <i>Overview of monitoring for adaptation, challenges and opportunities around monitoring for adaptation and summary of ABCG survey results</i> Radhika Dave (CI) <i>Overview of scales of monitoring and type of monitoring (climate variables, impacts, adaptation effectiveness); current developments in adaptation monitoring</i> Meg Spearman (WRI)

11.30	<p><i>Monitoring climate variables to assess trends in climate change</i> Anton Seimon (WCS)</p> <p><i>What do we know about monitoring for climate change impacts on species, ecosystems, ecosystem services, people and agricultural services?</i> Jorge Ahumada and Jan Dempewolf, TEAM</p> <p><i>Monitoring the effectiveness of adaptation interventions</i> Terry Hills, CI</p>
12.15	Q&A and discussion with panel
12.45	Lunch
1.45	<p>Session 8: Group discussions and summary reporting Groups will discuss different topics:</p> <ol style="list-style-type: none"> 1. Capacity building, policy, partnerships and scaling up adaptation 2. Monitoring 3. Tools
2.30	Report back to plenary
3.00	Break
3.30	<p>Session 9: Final plenary: synthesis, lessons, the way forward, and next steps Chair: James Watson Discussion groups from yesterday reconvene to finalize feedback on the ABCG white paper</p>
4:00	Groups report back
4:30	Next steps
5.00	Close of workshop

Participants:

- Staff from ABCG member organizations working in adaptation programs, particularly in Africa (ABCG members are African Wildlife Foundation, Conservation International, Jane Goodall Institute, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute and World Wildlife Fund)
- Adaptation experts from other organizations
- Staff from SCAPES partners (Pact, BirdLife, Fauna and Flora International, WCS, AWF, WWF, CARE)
- Donors

4.2 Participants at the ABCG workshop in Washington

Name	Organization	Name	Organization
Natalie Bailey	ABCG	Mel Warren	US Forest Service- International
Amy Zets	ABCG	Jones Masonde	AWF
David Williams	AWF	Charly Facheux	AWF
Jimmie Mandima	AWF	Sarshen Marais	Conservation South Africa
Radhika Dave	CI	Michele Andrianarisata	CI
Joanne Sonenshine	CI	Sood Ndimuligo	JGI
Hannah Campbell	CI	Magnus Mosh	TNC/Frankfurt Zoological Society
Madeline Bottrill	CI	Jean-Remy Makana	WCS
Daniela Raik	CI	Dr. Grace Nangendo	WCS
Alice Macharia	JGI	Jason Rubens	WWF
Jyoti Kulkarni	START	Harisoa Hasina Rakoton- drazafy	WWF
Elizabeth Gray	TNC	Philip Lenaiyasa	AWF
Kristen Patterson	TNC	Ronnie Newman	CI
Kristin France	TNC	Terry Hills	CI
Jeff DeBlieu	TNC	Jorge Ahumada	CI
Chris Zganjar	TNC	Gabriella Richardson-Temm	WWF
Jennifer Frankel-Reed	USAID	Yves Pinsonneault	CI
Tim Resch	USAID	Allard Blom	WWFUS
Brian Hayum	USFWS	Ginette Hemley	WWFUS
James Watson	WCS	Marcia Marsh	WWFUS
Anton Seimon	WCS	Perl, Matthew	WWFUS
Milen Dyoulgerov	World Bank	Baker, Bryn	WWFUS
Ana Bucher	World Bank	Dick, Vanessa	WWFUS
Aarjan Dixit	WRI	Edmonds, Molly	WWFUS
Margaret Spearman	WRI	Englum, Lynn	WWFUS
Caroline Simmonds	WWFUS	Leonard, Lou	WWFUS
Ellen Bean	WWFUS	Valencia, Iván Darío	WWFUS
Jonathan Cook	WWFUS	Lukas, Terri	WWFUS
Judy Oglethorpe	WWFUS	Henderson, Laura	WWFUS
Jeff Price	WWFUS	Dietz, Lisa	WWFUS
Judith Balint	WWFUS	Ganjian, Niloofar	WWFUS
Jennifer Norfolk	ACDI/VOCA	Martin, Shaun	WWFUS
Shereen Abdelaaty	DAI	Boatwright, Denise	WWFUS
Paul Hartman	DAI	Stephanie Eisenman	WWFUS
Christy Owen	DAI	Eliot Levine	WWFUS
Brett Gleitsmann	DAI		
Julie Bourns	DAI		
Hannah Fairbank	USAID		

Appendix 5: Summaries of ABCG member organization programs on climate change adaptation

5.1 African Wildlife Foundation (AWF)

Institutional statement

The African Wildlife Foundation, together with the people of Africa, works to ensure the wildlife and wild lands of Africa will endure forever. The African Wildlife Foundation (AWF) is the leading international conservation organization focused solely on Africa. AWF believes that protecting Africa's wildlife and wild landscapes is the key to the future prosperity of Africa and its people – and for over 50 years, we have made it our work to help ensure that Africa's wild resources endure.

Organizational approach and objectives

AWF has a formalized program on climate change adaptation, designed as part of a climate change policy developed in 2009. It is based in the AWF headquarters in Nairobi, under the Climate Change Program Manager reporting to the Senior Director of Conservation Science. The program focuses on conducting vulnerability assessments and an Ecosystem-based Approach (EbA), particularly with regard to safeguarding ecosystem services for local communities (especially water) and species/habitat adaptation (e.g. corridors) and increasing the resilience of water and agriculture systems. The evolution of climate change response plans will be informed by stepped up monitoring of site/target-specific variables. The first vulnerability assessment was performed in the Virunga landscape (mountain gorilla habitat in Rwanda, Uganda and eastern DRC) in 2009-10. AWF is now adapting this methodology and applying it in several other landscapes. Monitoring/data collection of primary and secondary data for vulnerability assessments is currently underway across the AWF Program, feeding into prioritization of EbA work. The primary objec-

tive of climate change adaptation work within AWF is to support the AWF Mission, which is to work with the people of Africa to ensure wildlife and wild lands endure forever. Specific project objectives for climate change adaptation work vary.

Project implementation

The AWF initiatives are focused on engagement at the local to landscape level, with supportive work at national/regional/policy levels. Under the guidance of the Senior Director for Conservation Science, the Climate Change Program Manager leads climate change adaptation work (this position is currently vacant but soon to be filled again). This is a crosscutting position that draws on expertise from other AWF departments, landscape teams and partners as needed. An advanced GIS analyst, David Williams, works out of the Washington DC office and is focused on AWF's climate change project work in Africa. Partner organizations are generally the same as for other AWF work and include Ministries of Environment or their equivalent in the host countries, other relevant line ministries (e.g. Agriculture, Tourism), Wildlife Authorities, Forestry Departments, Local Districts, Community Development Trusts / Associations and other NGOs active in the landscapes; however, AWF has also reached out to other organizations with additional adaptation capacity such as EcoAdapt (for guidance, facilitation) and University of California at Davis (species modeling) for the Virunga project. Projects are concerned with both biodiversity and human adaptation to climate change, though for the most part climate change adaptation has not yet been mainstreamed into the larger AWF portfolio of programs. There is a recognized need to do more training with field staff and AWF is looking for opportunities to do so, either internally or through partners.

Tools used – measuring and monitoring, modeling, community level risk assessments

Historical climatic baselines are recognized as important in assessing climate change at AWF project sites. Recognizing that historical data, especially in much of Africa is very patchy, AWF seeks to complement “off the shelf” global data products such as *WorldClim* with locally available data to compile a comprehensive, if imperfect, picture. These efforts fall under direction of the GIS lead, David Williams, based in AWF's Washington DC office. Climate change vulnerability assessments are currently available only for the Virunga landscape, but similar work is now in progress for the Samburu landscape in Kenya. Modeling is central to the development of vulnerability assessments and conservation planning. AWF has sought to use external expertise to both generate species distribution models and develop in-house capacity. AWF uses a variety of internal and external resources for model development. They explore the impact of climate change on species (and ideally on habitat-

variables) using species distribution models generated with software such as *Maxent* that incorporate a range of climate scenarios and spatial data inputs. Monitoring approaches specific to climate change include:

- Establishment of long-term vegetation plots along a gradient transect to track shifts in vegetation distribution and phenology as related to habitat resources (Virunga landscape).
- Deployment of weather stations to fill gaps in meteorological coverage (in many landscapes relatively remote conservation areas are neglected) and in the Virunga landscape to track micro-climatic shifts.
- Expanded emphasis on monitoring of the water resource distribution, seasonal availability and access (by humans, wildlife populations).

Funding sources, project outputs and feedback for ABCG

- Climate change adaptation work performed to date by AWF has been funded by the MacArthur Foundation and the Netherlands Directorate for International Cooperation (DGIS). In addition, much of the climate change adaptation work to date has been funded through allocations of unrestricted private funding. The Virunga project is now well advanced, while the Samburu project is fully underway. In the Virunga landscape, the International Gorilla Conservation Program (the on the ground implementing partner) is working with partners to incorporate recommendations from the Mountain Gorilla Vulnerability Assessment and subsequent response plan. In Samburu, AWF is building on the Virunga experience with a vulnerability assessment focusing on Grevy's Zebra and elephant populations, addressing contexts of pastoralism with an emphasis on increasing resilience and reducing conflict over water resources. These efforts benefit from AWF's strengths as a landscape-focused conservation program and strong relationships with communities position them well for implementation of conservation adaptation approaches for human and wildlife populations. The most significant limitations are lack of capacity, funding and experience in climate change assessments and application of some adaptive responses. The most significant project output on climate change adaptation to date is the Virunga vulnerability assessment: *The Implications of Global Climate Change for Mountain Gorilla Conservation*. A white paper prepared by the African Wildlife Foundation, the International Gorilla Conservation Programme and EcoAdapt and funded by the John D. and Catherine T. MacArthur Foundation, 2010 ([http://www.awf.org/documents/The Implications of Global Climate Change for Mountain Gorilla Conservation in Albertine Rift FINALgw Feb28.pdf](http://www.awf.org/documents/The_Implications_of_Global_Climate_Change_for_Mountain_Gorilla_Conservation_in_Albertine_Rift_FINALgw_Feb28.pdf))

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- Updated version of December 2007 policy paper, with summary policy statements, intended for external use by AWF staff at Addis Ababa and Copenhagen climate change meetings. (http://www.awf.org/files/4359_file_AWF_Climate_Change_Policy_Paper.doc)

5.2 Conservation International (CI) and Conservation South Africa (CSA, an affiliate of CI)

Institutional statement

Building upon a strong foundation of science, partnership and field demonstration, CI empowers societies to responsibly and sustainably care for nature, our global biodiversity, for the well-being of humanity.

Organizational approach and objectives

Conservation International is an active participant in several climate change adaptation initiatives in Africa with projects currently underway in Madagascar and South Africa. In South Africa, CI operates through Conservation South Africa (CSA), which is locally registered in South Africa but an affiliate of the larger CI organization. In this summary both CSA's work in South Africa and CI's work elsewhere in Africa and Madagascar will be described.

The CI climate change adaptation program was initiated in 2007 through its Science and Knowledge division (formerly known the Center for Applied Biodiversity Science). It is now a cross divisional program, coordinated by an Adaptation Working Group which is responsible for driving CI's work on climate change adaptation and has developed an institutional vision and formal plan. The CSA engagement in adaptation also started in 2007 with the forming of the Climate Action Partnership (CAP). CSA (then known as Conservation International-South Africa) initiated this partnership with a goal to promote healthy ecosystems for climate change adaptation and mitigation. CSA aligns with this CI-wide adaptation program and has also developed a five-year strategy from 2010-2015 that has a large climate change adaptation component. For CI, the focus of adaptation activities to date has been on integrated vulnerability and adaptation assessments looking at impacts on and adaptation needs for species, protected areas, ecosystem services and direct human well-being indicators such as income and food security. In Madagascar, the projects' objectives are to assess ecosystem and ecosystem services' vulnerability and develop adaptation solutions to accommodate species adaptation and support livelihood resilience for forest and marine resources-dependent communities.

In South Africa, the CSA program and CAP foci on adaptation are both two-fold. The programs address both the enabling environment and policy engagement on national and municipal levels, and also ecosystem-based approaches by working with communities to help small-scale farmers and small business within biodiversity hotspots adapt to climate change, with a particular focus on water and grazing management and applying sustainable farm management practices. CAP does also link in mitigation approaches with its EbA work. The current CSA regional focus is the Northern Cape (Namaqualand) and will be extended to the Eastern Cape later in 2011. The CAP work is being applied across the country with adaptation projects in Eastern Cape, Kwazulu-Natal, Mpumalanga and NW Cape: a list of projects can be found on the CAP website (<http://www.cap.org.za/view.asp?pg=projects&flt=proj>). Project objectives for CSA work in South Africa are:

- By 2020, government and donors have integrated ecological approaches into their strategies for responding to climate change, and CSA has supported the maintenance and restoration of ecosystem services, particularly water catchments and habitat linkages for optimal flora and faunal persistence, through the empowerment of private and communal land stewards in three mega-corridors (>300,000 ha)
- On the ground, CSA will promote conservation stewardship in three mega-corridors. Stewardship encourages land users to protect ecosystems required for resilience to climate change by enabling and motivating them to either set aside a portion of their land for conservation or to use their land sustainably. In exchange, incentives or in-kind support by the CSA team and/or provincial conservation authorities is provided in a formal agreement with the land-user. The results are reduced vulnerability for entire communities achieved by working in a few critical areas.

An interesting additional objective in CSA's work is building consciousness on climate change issues with the public through promotion of daily weather observation, climate awareness, water saving devices and the like. As a result, the persons involved have an increased interest in viewing weather data resources online and climate change projections.

Project implementation

In active programs the CI engagements on climate change adaptation have initially been mostly at the field conservation, regional and national levels and are concerned with both biodiversity and human adaptation. In South Africa, the targets span a range of scales from international, with the CI policy team to provide inputs into UNFCCC policy, to national, with inputs into South African government adaptation plans and climate change response strategy, and to more local scales, such as work with two main districts in North and Eastern Cape on adaptation planning.

In Madagascar, the project team is comprised of a combination of CI Madagascar and US-based CI Science and Knowledge division staff, and offers much relevant experience. The team includes an adaptation scientist, (Lee Hannah), community and ecosystem adaptation specialist (Radhika Dave), community conservation specialist (Jeannicq Randrianarisoa), conservation scientists (James MacKinnon, Michele Andrianarisata, Ando Rabearisoa) and a remote sensing specialist (Andriambolantsoa Rasolohery). In South Africa the team for CSA includes Sarshen Marais, the CAP manager and a project officer, Amanda Bourne. Two additional positions are to be filled shortly within CSA: a Director for policy and markets (for national and regional government engagements) and a climate change coordinator in Northern Cape (focuses on government engagements and projects), to be hosted with the Northern Cape (NGED) implementation team, working with farmers, small business and government.

In both Madagascar and South Africa the work is highly collaborative. The Madagascar project is a collaborative effort with ABCG members WWF and WCS, and has included participation by the Missouri Botanical Garden and Kew Botanical Garden. In South Africa, CSA has seven partners in the CAP: BirdLife South Africa; the Botanical Society of South Africa; the Endangered Wildlife Trust (EWT); the Wilderness Foundation; the Wildlands Conservation Trust; the Wildlife and Environment Society of South Africa (WESSA) and World Wide Fund for Nature South Africa (WWF-SA).

In Madagascar, training for staff and local partners in the field and government representatives is planned. However, mainstreaming of climate change adaptation into the conservation agenda has already occurred within the CI Madagascar program through the long-term program on vulnerability and adaptation assessment that is concluding in May 2011. This project has provided the opportunity for US-based adaptation staff to work with CI Madagascar staff and thereby created a space for knowledge exchange and mainstreaming to a certain extent. In South Africa ecosystem-based assessment training is planned for 2011 through CI's headquarters in Washington, with inputs and learning from CI adaptation team including Hannah Campbell, Lee Hannah, Terry Hills and Radhika Dave.

In addition to these major projects are some collaborative initiatives with partners. CI is also now a collaborator on a project led by BirdLife International and with partners Durham University, the Albertine Rift Conservation Society (ARCOS) and WCS, investigating the potential impacts of climate change on the avifauna of the Albertine Rift. Specifically it is looking at three forests/protected areas in Uganda (Echuya Forest), Rwanda (Nyungwe National Park) and Burundi (Kibira National Park) to help determine population abundance and altitudinal range baselines to facilitate change detection in Albertine Rift

endemic birds under future climatic changes. The project is also engaging scientists, policy and decision makers from local to national level, to help promote the policy changes necessary to maintain the effectiveness of the Important Bird Area network in the region. Also in Rwanda, CI is leading a short-term collaborative study with project partners that include WCS on wetland vulnerability to climate change.

Tools used – measuring and monitoring, modeling, community level risk assessments

The first phase of the Madagascar work was to conduct a climate change vulnerability assessment, a collaborative project with WWF and CI as leads, and WCS, Missouri Botanical Garden, Kew etc. as partners. Climatic baselines for assessing climate change are not readily available for Madagascar, and as such historical climatic reconstruction was not emphasized in the project. However, climate projections were developed by Mark Tadross for changes in temperature and precipitation to inform discussions during the assessment (see Tadross et al. 2008). For Northern Cape, CSA uses some of the broad climate models and scenarios from IPCC and also work done for South Africa by the South African National Biodiversity Institute (SANBI) and SAN parks on predicted biome changes under climate change as well as research done through UCT (University of Cape Town) Climate Systems Analysis Group (CSAG), One World Sustainability, and the CSIR on the impacts of climate change on biodiversity. CSA also use vulnerability assessments done for the Northern Cape including hazard and disaster maps. While there has been some degree of vulnerability assessment conducted for the Northern Cape, more in depth study is still needed to inform further pilot projects and a detailed assessment is needed for the Eastern Cape. The Northern Cape assessment will be completed with the IKI funding in 2011-2012 (see below for more on this funding).

Environmental modeling has been central to the Madagascar vulnerability assessment and follows on feasibility test phase project. Work utilizing species niche models and EcoCrop was performed by scientific collaborators specifically for this project's Madagascar component. In South Africa the modeling of future states was performed by SANBI, and included tools such as dynamic vegetation and species niche models. To date measuring and monitoring tools have yet to be utilized in Madagascar, whereas CSA has a monitoring framework for biodiversity and social targets that is used for biodiversity and business initiatives. Green Choice, a partnership around sustainable agriculture between WWF-SA and CSA, has developed this framework. CSA also promotes citizen climate monitoring with some small businesses through the Skeppies fund, a small grants program funded by donors. For other CAP projects involving climate change mitigation and adaptation, CSA uses the Climate

Community and Biodiversity Standard (CCBS) as a guideline for design and monitoring of projects.

Funding sources, project outputs and feedback for ABCG

The CI project portfolio on climate change adaptation has been supported through a combination of internal and external funds. The MacArthur Foundation has provided the primary support for CI's Madagascar project. In South Africa CSA has several active donors including Citigroup, the Development Bank of South Africa and the Critical Ecosystem Partnership Fund (CEPF). New ecosystem-based adaptation funding from the International Climate Initiative (IKI) of the German Government will start by July 2011 for policy work and implementation case studies around water and grazing management and sustainable land approaches in the Northern Cape. Work in Eastern Cape will also begin in 2011 with CEPF and other sources of funding. CAP has been funded by the Douglas Murray Trust, who funded all CAP partner projects (excluding CSA) and the secretariat.

CI's second project in Madagascar, following on the vulnerability assessment that tested the feasibility of implementing several of the recommended adaptation actions, reached its completion in May 2011. Outcomes include: modeled analyses of future changes in species' richness and climate refugia, estimation of change in climate suitability for common subsistence and cash crops, review of best practices in sustainable livelihood activities and forest restoration to inform restoration under climate change (and otherwise), and based on all of these a forest restoration action plan for Madagascar including a proposed framework for prioritizing restoration efforts. The objectives of the marine components of the project were to complete research on marine environment vulnerability to climate change in Madagascar. The results of activities allowed to 1) realize notable progress in the knowledge of the coral reefs vulnerability and the species distribution under climate threats (with WCS); 2) improve conservation of marine biodiversity in Madagascar through the integration of climate change vulnerability criteria in the identification of priority sites for marine biodiversity conservation in Madagascar; 3) Complete research and elaborate a methodology to evaluate mangroves vulnerability (with WWF); and 4), conduct scientific research on the resilience and diversity of marine ecosystems in the Northeast Madagascar through a Rapid Assessment Program (conducted in partnership between CI scientists, scientists from CORDIO and the National Center for Oceanographic Research).

In South Africa, CSA and CAP have finalized an adaptation assessment project of CAP sites to determine if they are best placed in adaptation corridors which can secure biodiversity, ecosystem services and provide resilience to communities. In addition, new corridors were mapped and

a Monitoring and Evaluation report was prepared following a series of expert workshops. Workshops are also offered for small business to inform and assist in climate proofing approaches and methodologies. Some businesses have also been provided with water-saving technologies to help them adapt to decreased water availability. Other initiatives link improved stewardship with water and grazing management to assist in adaptation. CI benefits from a strong and focused program, a wealth of in-house experience, with several recognized leaders of the emerging field of climate change adaptation among their staff members. The vulnerability assessments co-led by CI and WWF for the entire island of Madagascar and its unique biota is a notable achievement. The multi-partner Climate Action Partnership coordinated by CI/CSA in South Africa is of interest as well in its structure that parallels ABCG's organization; however, the thematic focus for CAP is climate change adaptation that also includes climate change mitigation, education and research and its geographic scope is restricted to one country. It would be beneficial to have such programs extended to other landscapes elsewhere in Africa.

Strong partnerships in South Africa provide opportunities to exchange lessons learned. The new project funded by IKI will help solidify the link between vulnerability assessments, implementation of EbA actions and development of much needed case study experiences to inform policy at the district and national level. These pilot projects will be in an arid area of South Africa, Namaqualand, which is also a biodiversity hotspot – the Succulent Karoo. The project also includes Brazil and the Philippines and funding is channeled through CI.

Current climate and biodiversity monitoring frameworks provide good basis for data capture and adaptive capacity to change approaches as required and learn from successes and failures. More capacity building on ecosystem -assessment and implementation for staff and on the ground is still needed, however, as well as more assistance with field policy adaptation work and government engagements. In Madagascar, the adaptation project has served to enhance awareness of climate change and bring together groups around this issue and developed and consolidated information of climate change vulnerability for species and ecosystems. A recognized limitation from the Madagascar experience is the need for more direct emphasis on understanding human adaptation, and for this information to feed into conservation and development planning within the context of enhanced environmental management.

From the climate change vulnerability assessment work in Madagascar, CI and their partners have produced the following publications:

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- Hannah L, Dave R, Lowry PP, Andelman S, Andrianarisata M., Andriamaro L, Cameron A., Hijmans R, Kremen C, MacKinnon J, Randrianasolo HH, Andriambololonera S, Razafimpahanana A, Randriamahazo H, Randrianarisoa J, Razafinjatovo P, Raxworthy C, Schatz GE, Tadross M, Wilme L. 2008. Climate change adaptation for conservation in Madagascar. *Biology Letters*, 4(5):590-594
 - Madagascar Vulnerability Assessment Report, Final report from current project assessing feasibility of adaptation recommendations, including forest restoration under climate change.
 - Obura D., Di Carlo, G., Rabearisoa, A. and Oliver, T. (editors). 2011. A Rapid Marine Biodiversity Assessment of the coral reefs of northeast Madagascar. RAP Bulletin of Biological Assessment 61. Conservation International. Arlington, VA.

Products from CSA-CAP initiatives:

- Climate adaptation (Skeppies) SMME workshop reports
- Conservation SA 5 year strategy
- Climate diary Monitoring report for skeppies
- CAP Monitoring and Evaluation report and adaptation corridor assessment maps

5.3 Jane Goodall Institute

Institutional statement

Founded by renowned primatologist Jane Goodall, the Jane Goodall Institute is a global nonprofit that empowers people to make a difference for all living things. Our work builds on Dr. Goodall's scientific work and her humanitarian vision. Specifically, we seek to:

- Improve global understanding and treatment of great apes through research, public education and advocacy.
- Contribute to the preservation of great apes and their habitats by combining conservation with education and promotion of sustainable livelihoods in local communities.
- Create a worldwide network of young people who have learned to care deeply for their human community, for all animals and for the environment, and who will take responsible action to care for them.

Organizational approach and objectives

The Jane Goodall Institute does not have a formal program on climate change adaptation, but has a central role nonetheless in a comprehensive program in the Gombe-Masito-Ugalla landscape, its primary conservation landscape in western Tanzania. The project's objectives with regards to climate change are to ensure that conservation action plans include adaptation as part of their strategies and that the residents of the Gombe-Masito-Ugalla landscape in western Tanzania are well prepared to respond to both the challenges and the new opportunities climate change provides. An assessment on how and to what extent climate change will impact key ecosystems and natural resource based economic activities in the landscape will be conducted to develop possible mitigation and adaptation strategies to maintain the livelihoods of the population, and information about adaptation in response to climate pressures will be incorporated into training activities and into educational materials that can be widely disseminated in the landscape.

Project implementation

JGI's Gombe-Masito-Ugalla project is a highly collaborative effort being implemented in partnership with Frankfurt Zoological Society (FZS) and The Nature Conservancy (TNC) (described below). This partnership brings distinct skills and experience to the effort. With local presence of more than 50 years working in the region, JGI possesses unparalleled experience in the region working with local communities and in chimpanzee conservation. The Gombe-Masito-Ugalla project has a relatively grassroots-level of engagement, with key constituencies at the regional, local and NGO level. Emmanuel Miti, who has over two decades of experience in community development and implementing community-centered conservation programs, leads the GMU program. Sood Ndimuligo, who brings an MS in Conservation Biology, with training and experience in studying chimpanzees and surveying techniques, takes the lead role in coordinating climate change efforts with TNC under the GMU Program. From JGI's headquarters in Washington DC, Lilian Pinteá contributes his strong geospatial analysis skills to the effort, directs the scientific department at the JGI and conducts collaborative research engaging private sector and academia. The project is concerned with climate change impacts on both biodiversity and humanity.

Tools used – measuring and monitoring, modeling, community level risk assessments

JGI's partner TNC is implementing climate change activities within the GMU Program. Recently, TNC completed a climate forecast model for western Tanzania and submitted a report that outlined the impacts of climate change on key ecosystems and natural resource dependent livelihoods within the GMU area. Scientific data and visuals were used to conduct a training work-

shop in Kigoma, Tanzania (April 2011) for JGI and FZS staff and local government partners to increase their awareness of climate change impacts to western Tanzania and the GMU project area, as well as to revise conservation target and threat information from the 2009 Conservation Action Plans, in light of projected climate change impacts. A follow-on workshop was conducted in June to create ecosystem-based climate change adaptation strategies for the GMU area. The strategies were developed, discussed and prioritized. Review of integration of these strategies into ongoing efforts is underway.

Funding sources, project outputs and feedback for ABCG

For now, climate change adaptation has yet to be mainstreamed into JGI conservation initiatives elsewhere in Africa, so the Tanzania effort may serve as a test piece for activities on adaptation to be extended elsewhere in future work. The project has been funded through USAID and has also received additional support from JGI major donors. The project is in the second of four years, with an initial training workshop now complete, another workshop imminent and reports published. The primary written output thus far is the comprehensive report by Elizabeth Gray of TNC, as well as workshop report from April, 2011.

- Climate Change Impacts to Key Ecosystems and People's Livelihoods in the Gombe-Masito-Ugalla and the Greater Mahale Project Area. Prepared for: Jane Goodall Institute and Frankfurt Zoological Society by Elizabeth Gray, The Nature Conservancy, 24 March 2011.
- Climate Change Adaptation Workshop: Targets and Threats. April 5-7, 2011, the Jane Goodall Institute. Prepared by Elizabeth Gray, The Nature Conservancy.

5.4 The Nature Conservancy (TNC)

Institutional statement

The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

Organizational approach and objectives

TNC's Global Climate Change program

The Nature Conservancy's global program on climate change, including work on forest carbon, policy and adaptation, has more than a decade of on the ground experience in developing practical, cost-effective solutions to restore the health of the planet, secure future energy supplies, and protect drinking water and food sources. The Nature Conservancy's climate program is focused on linking economic development to forest protection and emissions reductions, demon-

strating how enhancing the resilience of nature to climate change goes hand in hand with helping people and inspiring vigorous public support for related policies and funding.

TNC is demonstrating how to reduce emissions from deforestation and degradation (REDD+) in two principal tropical forest countries, Indonesia and Brazil. They are promoting learning, shaping national and global policies, mobilizing public and private capital and influencing supply chains in order to tip the global balance for forest protection.

Unusual weather around the world is giving us a preview of what could become the new normal in a warmer world. To help make people and nature more resilient, TNC is adapting our science-based conservation planning methods, testing new strategies and compiling knowledge databases. Critical demonstrations include establishing marine protected areas that will be able to sustain local fisheries threatened by coral bleaching events, restoring marshes and oyster reefs that protect coastal communities from storm surges and rising seas and creating community conservation areas that maintain wildlife corridors and serve as “grassbanks” for livestock during times of drought.

TNC’s Climate Change Adaptation Program

TNC’s Global Climate Adaptation Program, currently led by Frank Lowenstein, develops methods, tools and knowledge about—and builds policy and funding support for—ecosystem-based approaches to climate adaptation. Ecosystem-based Adaptation (EbA) emphasizes working with people to help find natural solutions to prepare for and cope with climate change. TNC’s Adaptation Program works to ensure that national and global economic development and conservation strategies routinely incorporate EbA approaches, and that governments, communities and organizations worldwide rely on EbA approaches to reduce the vulnerability and increase the resilience of people and nature to climate change impacts.

As world leaders become increasingly aware of the need for climate change action to protect people and nature, they are looking for evidence and examples to inform decisions about solutions that will reduce the risk and vulnerability of their communities. Thus, practitioners and policy-makers alike need to know what works, how best to implement, and how much it will cost. To this end, TNC’s Adaptation Program supports and develops on the ground projects that show how EbA works in real places for the benefit of natural systems and human communities. The program also develops innovative impact assessment and decision support tools and works to leverage knowledge and relationships to align policies, incentives and business actions in support of EbA around the world. Initiatives included in this Proof-of-Concept portfolio

include a comprehensive water funds program in Latin America; community capacity-building programs in Papua New Guinea, Solomon Islands and Marshall Islands; and an arid lands and water program in the Southwestern United States. More information on TNC's adaptation work is available at: ClimateWizard.org, Naturepeoplefuture.org, Coastalresilience.org, and Reefresilience.org.

TNC's Africa Climate Change Adaptation work

In Africa, TNC launched a formal program on climate change adaptation in July 2010. This project is focused in western Tanzania and managed by TNC's Africa Region in partnership with the Frankfurt Zoological Society, the Jane Goodall Institute, and district governments. The western Tanzania program is a comprehensive initiative focused on ecological systems, human communities and livelihoods, wildlife species, protected areas, and ecosystem services. The project domain extends along the western side of Lake Tanganyika from north of Gombe Stream National Park down through the Greater Mahale Ecosystem and Mahale Mountains National Park. Threats to the well-being of both the people and the environment in this region are tied to extreme poverty and a rapidly growing human population. To address these issues, TNC and its partners are working to enhance the management of natural resources in the Greater Mahale Ecosystem as well as improving access to primary and reproductive healthcare and other social services by remote populations.

In addition to the work in western Tanzania, TNC's Africa Region is collaborating with partners to develop adaptation initiatives in the arid rangelands of the Greater Ewaso landscape in northern Kenya. The project's EbA strategies focus on improving grazing management that will in turn improve rangeland conditions; implementing grass banking; linking livestock markets to conservation; and developing carbon financing via grassland carbon sequestration. By increasing the resiliency of natural systems and human communities, it is hoped that the project will also reduce regional insecurity and prove to be a model that can be replicated in other places in Africa.

Project implementation

The goal of TNC's climate change adaptation program in western Tanzania is to work with a broad base of partners to develop climate change adaptation strategies for on the ground implementation. A TNC Global Climate Change Fellow, Elizabeth Gray, an ecologist based in the northwest United States, directs the western Tanzania program. Dr. Gray's climate change expertise includes co-leadership of a comprehensive, multi-partner vulnerability assessment of climate change impacts to the Pacific Northwest. In addition to support from TNC's Africa Region staff, other Conservancy staff members contribute expertise from their roles on the Conservancy's Global Climate Adaptation Team

including Evan Girvetz, for environmental modeling and impacts assessments, Anne Wallach Thomas for knowledge management support, and Jeffrey Smith DeBlieu, for institutional knowledge with a global perspective. In addition to JGI and FZS, the project works closely with national, regional, and local level stakeholder organizations such as the Tanzanian National Parks (TANAPA), the Tanzania Wildlife Research Institute (TAWIRI), and district councils of the Kigoma and Mpanda municipalities. The western Tanzania program serves as a model for export to other countries and localities, as more groups become interested in how to incorporate climate forecasts and projected impacts into conservation and climate adaptation strategies in the field. Training workshops are an important component of the work, which takes into account climate impacts to biodiversity conservation, ecosystem health, human livelihoods, and broader economies.

Tools used – measuring and monitoring, modeling, community level risk assessments

The western Tanzania program has produced two extensive reports detailing future climate change forecasts and predicted impacts to the region's key ecosystems and people's livelihoods. The first report examines historic and future climate change trends (<http://conpro.tnc.org/1735/>). Historic trends were generated using data from local weather stations that collected data consistently and reliably from 1951 until 2010. Future climate projections for the next 50 and 100 years were generated using downscaled data incorporated into sixteen general circulation models (GCMs) run under three different greenhouse gas emissions scenarios. Climate change analyses for western Tanzania were generated through Climate Wizard, a web-based analytical tool developed by The Nature Conservancy, the University of Washington, and the University of Southern Mississippi (Girvetz et al. 2009; <http://www.climatewizard.org>). Climate Wizard was used to analyze both historic climate data and future climate projections for western Tanzania, annually and across seasons.

In addition to running forecast simulations for temperature and precipitation, the Climate Wizard tool was customized to analyze two additional metrics: moisture stress and moisture surplus. Moisture stress represents the ratio between available water (based on precipitation) and evaporative demand (based on temperature and the number of daylight hours). Moisture surplus represents the amount of precipitation that falls in a specific time period above and beyond potential evapotranspiration (Ellis 2008; Wolock and McCabe 1999). Calculating metrics for moisture stress and moisture surplus is important because temperature and precipitation variables are not independent in how they affect the environment; for example, due to increased evapotranspiration, higher temperatures may lead to decreased soil moisture (increased aridity) despite an overall increase in precipitation.

A synthesis of findings from the first report includes:

- Tanzania has been warming at a rate of 0.12°C per decade since the 1950s; this temperature increase is occurring across all seasons.
- Inland areas are warming more rapidly than coastal areas.
- In contrast, there has been no significant change in precipitation during the same time period.
- Future climate analyses consistently project higher annual and seasonal temperatures.
- By mid-century, annual temperatures are projected to increase 1.3 to 2.2°C.
- By 2100, annual temperatures are projected to increase 1.6 to 3.8°C.
- Precipitation patterns are less consistent and suggest a slight increase in overall rainfall for western Tanzania. This is likely to be caused by more unpredictable and intense rainfall events when they occur, potentially causing flooding and other problems that do not result in an overall increase in available surface water.
- Due to increased evapotranspiration, aridity is projected to increase by the middle of the century. By 2100 this effect will be magnified, with the most pronounced effects occurring from March to November.
- In summary, western Tanzania is likely to be warmer and more arid, despite increased rainfall in particular seasons, in the next 50 and 100 years.

The second report details how future changes in climate are likely to impact key ecosystems of interest as well as people's livelihoods (<http://conpro.tnc.org/1735/>). Findings represent a comprehensive literature review for East Africa in general and Tanzania in particular and investigate climate change impacts to montane forest, evergreen forest, bamboo forest, miombo woodland, riverine ecosystems, wetlands, and Lake Tanganyika. Scientific information also was collected for two keystone species: chimpanzees and elephants.

A summary of impacts to ecological systems and species from the second report includes:

- Terrestrial systems will be affected in a variety of ways, including: more frequent and severe droughts, increased erosion of topsoil, changes in vegetative communities, and the increased spread of fire, disease and invasive species.

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- Riverine and wetland systems are likely to suffer lowered water levels, increased sedimentation and pollution and changes in the timing and amount of water flow.
 - Lake Tanganyika is already experiencing the effects of climate change, with increased temperatures, increased stratification, and increased sedimentation.
 - Chimpanzee ranges and distributions are likely to become more fragmented as the climate changes due to less suitable habitat availability and changes in diet. These changes are likely to affect grouping patterns and are likely to increase mortality.
 - Elephants are likely to experience a drop in population numbers due to the increased frequency and length of drought, and will very likely alter their movement patterns and migratory routes in search of food and water.

In addition, ecological impacts were discussed in terms of changes to people's livelihoods. Key findings presented in the report include:

- Climate change and variability will impose additional pressures on water availability, accessibility, and supply and demand, which will directly alter agricultural outputs.
- Climate change and variability are expected to further affect riverine systems and Lake Tanganyika, continuing to disrupt local fisheries.
- The negative impacts associated with climate change will also have a number of more indirect effects on people's livelihoods, including the possibility of an increased spread of disease (e.g. malaria) and greater difficulty finding fuel wood to generate energy.
- In summary, it is likely that in order to survive, people's livelihood strategies will need to adapt to adjust to changing conditions under a different climatic regime.

Incorporating these findings into field-based conservation and adaptation strategies has been the focus of two stakeholder meetings held in the first half of 2011. These workshops focused on:

1. Increasing stakeholder awareness of climate change and projected impacts on Western Tanzania;
2. Revising conservation strategies to incorporate climate change information (e.g., development of climate change adaptation strategies); and
3. Selecting indicators to monitor climate change in the project area.

Results of the first workshop have been published and can be found at <http://conpro.tnc.org/1735/>. Results of the second workshop will be available for distribution later in 2011.

Funding sources, project outputs and feedback for ABCG

The western Tanzania program has been funded through a sub-award from USAID and the Government of Finland through LifeWeb. Both grants have a two-year duration and are the first awarded to TNC for climate change adaptation in Africa. Prior to the procurement of these funds, TNC private donor funding was instrumental in launching the program; private donor funding has also covered the time of other support staff such as those from the Global Climate Adaptation Team. The most significant program achievements to date are the climate change forecasts for western Tanzania, the report detailing predicted impacts to key ecosystems and people's livelihoods, and successful execution of stakeholder workshops in April and June 2011.

The project has benefited from the TNC's well-established relationships in the landscape of interest and from partners hungry for information and with an ability to grasp it quickly. Having Climate Wizard as an in-house modeling tool capable of producing climate information tailored to Tanzania is a great asset. The recognition of the need to engage local communities has been fundamental to the project's success; this mirrors TNC's wider global approach on climate change adaptation. One interesting finding from the stakeholder workshops was the identification of challenges to successful implementation of adaptation strategies. These challenges may be relevant to many different geographic regions across Africa: a general lack of political will; lack of cost-effective management and adaptation alternatives; and inadequate capacity to implement new or additional strategies. In the second workshop, stakeholders addressed these challenges directly by developing a list of more than 20 solution-oriented actions and making commitments to pursue them for successful implementation of each strategy.

TNC has the following products from the western Tanzania program to share with the ABCG community:

1. Climate Change Forecasts for Western Tanzania: Projected Changes in Temperature and Precipitation over the next 50 and 100 Years
2. Climate Change Impacts to Key Ecosystems in the Gombe-Masito-Ugalla and the Greater Mahale Project Area
3. Climate Change Adaptation Workshop: Targets and Threats Workshop Report April 2011
4. Climate Change Adaptation Workshop #2: Strategies Workshop Report June 2011

Please note re: <http://conpro.tnc.org/1735/> link: in order to access the documents on the Tanzania Climate Change Adaptation Project (ID: 1735) of ConPro, please click on the “See Associated Info (4)” link on the far right side of the page. You will then see links to the four documents/reports, which you can download as PDFs.

Some recent journal articles of relevance to climate change adaptation in Africa include:

- Klausmeyer, K. R., M. R. Shaw, J. B. MacKenzie, and D. R. Cameron. 2011. Landscape-scale indicators of biodiversity’s vulnerability to climate change. *Ecosphere* 2:art88. [doi:10.1890/ES11-00044.1] <http://www.esajournals.org/doi/full/10.1890/ES11-00044.1>
- Wongbusarakum, S. and C. Loper. 2011. Indicators to assess community-level social vulnerability to climate change: An addendum to SocMon and SEM-Pasifika regional socioeconomic monitoring guidelines. <http://conserveonline.org/workspaces/climateadaptation/documents/vulnerability-assessments>
- Munang, R., I. Thiaw, J. Thompson, D. Ganz, E. Girvetz, and M. Rivington. 2011. Sustaining forests: Investing in our common future. UNEP Policy Series: Ecosystem Management 5: 1-18. <http://conserveonline.org/workspaces/climateadaptation/blog/sustaining-forests-investing-in-our-common-future/view.html>
- Game, E. T, G. Lipsett-Moore, E. Saxon, N. Peterson, and S. Sheppard. 2011. Incorporating climate change adaptation into national conservation assessments. *Global Change Biology* (2011), doi: 10.1111/j.1365-2486.2011.02457.x. <http://conserveonline.org/workspaces/climateadaptation/blog/documents/incorporating-climate-change-adaptation-into/>
- Anderson, M. G., and C. E. Ferree (2010). Conserving the Stage: Climate Change and the Geophysical Underpinnings of Species Diversity. *PLoS ONE* 5(7): e11554. doi:10.1371/journal.pone.0011554. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011554>
- Opperman, J. J., A. Warner, E. Girvetz, D. Harrison, and T. Fry. 2011. Integrated Floodplain-Reservoir Management as an Ecosystem-based Adaptation Strategy to Climate Change. AWRA 2011 Spring Specialty Conference. <http://conserveonline.org/workspaces/climateadaptation/blog/documents/integrated-floodplain-reservoir-management-as-an>
- Aldous, A., J. Fitzsimons, and B. Richter, L. Bach. 2011. Droughts, floods and freshwater ecosystems: evaluating climate change impacts and developing adaptation strategies. *CSIRO. Marine and Freshwater Research*, 2011, 62, 223–23.

5.5 Wildlife Conservation Society (WCS)

Institutional statement

The Wildlife Conservation Society saves wildlife and wild places worldwide. We do so through science, global conservation, education and the management of the world's largest system of urban wildlife parks, led by the flagship Bronx Zoo. Together these activities change attitudes towards nature and help people imagine wildlife and humans living in harmony. WCS is committed to this mission because it is essential to the integrity of life on Earth.

Organizational approach and objectives

In the WCS strategic plan (2007-2016) adapting to climate change was identified as a key challenge that needs to be addressed throughout the global network of WCS conservation sites distributed in more than 50 countries worldwide. The WCS Climate Change Adaptation Program was formally established in August 2010 within the Conservation Challenges, a new crosscutting program within the WCS Global Conservation Program. Regionally focused projects on climate change adaptation in North America, the western Indian Ocean, the Andes, Papua New Guinea and the Albertine Rift all pre-date the formalization of this structure by several years. The Climate Adaptation Program developed its strategic plan late in 2010. This strategic plan is now guiding the work of the WCS climate adaptation team. Under the current WCS-wide strategic plan climate change adaptation is to be incorporated into country and project-level planning.

The principal WCS staff members working on terrestrial climate change adaptation programs in Africa are: James Watson, Climate Change Lead, with expertise in conservation planning and adaptive management for climate change, and working with policy makers to implement adaptation strategies; Anton Seimon, an Applied Climate Scientist who leads the Albertine Rift Climate Assessment Project and brings expertise in climatology in conservation contexts, model output interpretation and developing climatological baselines; Guy Picton Phillipps, a geospatial analyst with expertise in tailoring environmental modeling output to inform conservation needs; and Andrew Plumptre, the Albertine Rift Conservation Project director who brings expertise in regional biodiversity and monitoring, and protected area creation and management. For marine systems, Timothy McClanahan, a WCS Senior Conservation Zoologist leads the Kenya-based Coral Reef Conservation Project, and brings expertise in marine ecology, fisheries, climate change effects and management of coral reefs. Additional Coral Reef Conservation Project staff members include Joseph Maina, a spatial modeler, Nyawira Muthiga, the Coordinator of WCS's Western Indian Ocean Marine Programs, with expertise in management and conservation of East African marine

ecosystems, and Carlos Ruiz Sebastian an ecosystem modeler evaluating the effects of climate change and resource use on simulation models calibrated with WCS field data.

Project implementation

Comprehensive projects on climate change adaptation are currently underway at broad regional scales in two regions of high conservation concern: the Albertine Rift and Western Indian Ocean-Madagascar region. These projects are described in sequence below.

Albertine Rift Climate Assessment Project

The WCS Albertine Rift Climate Change Assessment is a comprehensive program aimed at understanding the potential impacts of anthropogenic climate change on wildlife conservation and protected area management in one of Africa's principal biodiversity hotspots. In its first phase (2007-09), the project examined the baseline climatological conditions within protected areas, used downscaled IPCC model output to quantify predictions of regional climate change across the Albertine Rift, assessed possible future impacts and developed products that aid in estimating future distributions of biodiversity in the Albertine Rift. The project has since been developing and applying these findings in partnership with the wider biodiversity conservation community. Through the utilization of dynamic vegetation and crop models, the modeling approach was designed to generate a suite of products that now offers guidance on the potential impacts of anthropogenic climate change on wildlife habitat, key cultivars and carbon budgets throughout the Albertine Rift region (Seimon and Picton Phillipps 2010). An additional output has been detailed climatological analysis within Albertine Rift protected areas, shedding light on previously unrecognized phenomena such as intra-seasonal climatic variability, and helping to ascertain baseline conditions for assessing climatic changes within protected areas. A second phase of the Climate Assessment project is currently focusing on implementing long-term monitoring for climate change principally through climatological observations and vegetation and species monitoring within protected areas. A third phase on stakeholder consultation and output dissemination is being conducted concurrently.

Taken together, the multi-step approach developed for the Albertine Rift provides a comprehensive strategy designed to build knowledge and capacity to adapt conservation management effectively for climate change in data-poor regions of conservation concern. The specific project objectives from each phase are listed below.

Albertine Rift Phase I (2007-09):

- Review all the necessary parameters to assess future impacts of climate change on biodiversity in the Albertine Rift.
- Quantify conservative-to-extreme predictions of regional climate change during the next 20 to 50 years, across the Albertine Rift.
- Estimate the effect of climate change in the next 20 to 50 years on the future distribution of biodiversity, in light of the results of our review process and based on preliminary research.
- Examine national and regional policy frameworks and institutional capacity for monitoring and developing adaptation to climate change in the Albertine Rift.

Albertine Rift Phase II (2009-12):

- Climate monitoring: Systematize and professionalize climate data collection in Albertine Rift protected areas by establishing a long-term, scientific-quality climate monitoring network designed to detect changes in climate and make the data widely available to conservation managers.
- Vegetation monitoring: Establish long-term vegetation monitoring sites designed for detection and quantification of climate change impacts.
- Species response monitoring: Establish long-term faunal monitoring of vertebrate species with enhanced susceptibilities to climatic perturbation.
- Assessment of corridors: Assess the effectiveness of current and proposed wildlife corridors between protected areas to allow for adaptation to climate change through range change using datasets from Objectives 1-3 and modeling from the current MacArthur-funded project; and advise governments and protected area authorities on specific courses of action.
- Provide results of climate, vegetation, and species monitoring, corridor assessment, and climate modeling in useable form to decision-makers, including National Adaptation Program of Action (NAPA) task forces, protected area authorities, and regional bodies through reports and briefings.

Albertine Rift Phase III (2010-11):

- To bring together principal stakeholders and research groups for direct dialog on climate change and conservation.
- To provide a forum for both presenting the challenge and the research results to date to a wider audience concerned with implementing conservation and applying adaptations across the Albertine Rift.

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- To provide a forum for comparison of results collected by different groups and for discussion on where the climate science work should go from here to best address conservation stakeholder concerns.
 - To begin a discussion about next steps in conservation planning incorporating adaptation.

The WCS approach developed in the Albertine Rift has as principal targets for engagement key national level stakeholders and protected area managers. As an organization concerned with on the ground conservation and protected area management, WCS recognizes the need to work with both of these key constituencies to foster the enabling environment at high governmental levels needed by the conservation managers in the field. The Albertine Rift team draws upon extensive experience in climatology science, spatial analysis and draws upon intimate site-specific knowledge of biology, ecology and biodiversity conservation contexts from field staff. Partnerships with in-country partners are fundamental to our activities. In Uganda WCS works closely with the Institute for Tropical Forest Conservation (ITFC); Uganda Wildlife Authority (UWA) and Uganda Ministry for Water and Environment (MWE). In Rwanda the WCS country program and the climate change team work in close partnership with the Rwanda Development Authority (RDB). In a new study on Rwandan wetlands and climate change, WCS is working collaboratively with CI, as described in their section above.

The Albertine Rift is concerned with both biodiversity and human adaptation to climate change, through evaluation of agricultural yield changes under climate change and consideration of human livelihoods and settlement in conservation corridor evaluations. The program is fairly advanced as of the publication of this report. The first phase of MacArthur-funded work in the Albertine Rift, covering modeling, establishing baselines, and setting up a data portal is complete. The second phase, on implementing monitoring for climate change, is at its midpoint and is to be completed in 2012. The third phase on stakeholder consultation is partially complete, with a major conference convened and report now in preparation. Several outputs have been published and others are in preparation.

Western Indian Ocean Coral Reef Conservation Program

WCS's institutional expertise in both global-scale coral reef research and on the ground coral reef conservation is unique in the conservation and academic communities. These two core areas and scales of expertise allow WCS to develop, test and refine management approaches in the field that are supported by sophisticated research models and empirical field studies. Consequently, conservation science and its application at WCS develop by the interaction among

theory, findings from site-specific field studies, and comparisons of these findings across sites distributed through the tropics. This provides the basis for promoting good science-based conservation at our field sites but also provides generality that is useful to the larger tropical fishing community dependent on coral reefs, and governments and NGOs that assist the management of reefs. It has also provided an especially strong foundation for the WCS program on climate change adaptation across the Western Indian Ocean region.

Project work involves developing guidelines for policy-makers and tools for marine resource managers to understand the management approaches that will be most effective given a particular site's reef ecology, exposure to climate change disturbances, socioeconomic or human context and governance. This tool is being developed with data collected from countries and territories in the Western Indian Ocean (Kenya, Tanzania, Mozambique, Madagascar, Comoros, Mauritius, and Seychelles). It is also being refined through data collected at WCS program sites further afield in Papua New Guinea, Fiji, Indonesia and Belize. The tool involves three sources of information – oceanographic and environmental data available from satellite sources and ecological and socio-economic from field surveys undertaken by the WCS field staff. With these three sources of information it is possible to develop recommendations that are specific to the local social, ecological and management needs. Recommendations might include small community closures or national parks, or possibly gear, species or time restrictions and these will depend on the above context. Consequently, the recommendations are based on what is most likely to succeed in this context rather than decisions based a limited understanding of context.

Knowing the sites' environmental exposure, ecological susceptibility and social adaptive capacity allows resource managers to recommend the specific adaptation. The impacts of climate change on the ecosystem will be determined by the exposure and susceptibility and, in the case of coral reefs, climate-induced bleaching, coral mortality and consequent effects on fish and fisheries. Social adaptive capacity reflects a society's potential to cope or not with environmental and other perturbations. Societies can either falter or fail when they lack appropriate adaptive capacity or they can take advantage of new opportunities, whether due to climate impacts, conservation interventions, or other changes to the socio-ecological system. Each of the three factors are influenced by multiple and highly complex natural and social variables, making it difficult for managers to make informed decisions and understand the full ramifications of the choices they make without this information. This approach is expected to reduce the trial and error approach and lead to successful adaptation sooner and more often.

Identifying where sites lie within the context of these variables and how these human and natural ecosystems depend on each other will provide decision-makers with more powerful tools for making scientifically sound natural resource management decisions in the face of climate change. Depending on the relative vulnerability of a site, appropriate conservation actions will require some combination of: (1) large-scale protection of ecosystems; (2) actively transforming and adapting socio-ecological systems; (3) building the capacity of communities to cope with change; and (4) government assistance focused on de-coupling communities from dependence on natural resources. All of these may be required but the priorities will differ based on the social-ecological context.

To test management solutions in a variety of contexts, WCS is developing and improving a coral reef ecosystem fisheries simulation modeling tool that examines the consequences of management actions. The tool will be used to run potential scenarios of coral reef management options, including various restrictions on levels of effort, types of gear, and species selection that will have the greatest benefits to people while minimizing detrimental or irreversible impacts to the coral reef ecosystem and fisheries. Based on these results, WCS work will map the most effective management responses for climate adaptation and will overlay this with the maps of coral reef vulnerability. Then, these factors can be combined and used to develop a set of priorities for management across the tropical coral reefs of the world. These outputs will be released in a working toolkit to assist in the development of site-based adaptation strategies for the Western Indian Ocean, Coral Triangle and Caribbean.

Tools used – measuring and monitoring, modeling, community level risk assessments

As described above, the development of a suite of sophisticated new tools tailored for conservation needs, including climate change, is central to the WCS coral reef conservation program. Multi-year time series of a range of oceanic parameters are also used to establish baseline conditions and variability characteristics through the spatial ecology efforts of the marine program. Global satellite data on many environmental factors are constantly being analyzed and tested with field data to develop models that effectively model environmental stress and impacts on vulnerable species and ecosystems. In terrestrial programs in Africa, the WCS approach on climate change adaptation places emphasis on knowledge of climatological baselines and variability as being fundamental components of efforts to anticipate the impacts of predicted climatic changes upon humanity, ecosystems and biodiversity. For the Albertine Rift project considerable efforts were made to uncover climatological records from research stations and national parks authorities for developing site-specific climatological baselines. At present, site-specific climate change vul-

nerability assessments are generally not available for WCS conservation sites in Africa. There are National Adaptation Program of Action (NAPA) reports available for the Albertine Rift countries, but these mostly focus on socioeconomic development and hazards rather than biodiversity. A macro-scale (sub-Saharan Africa) vulnerability atlas from the Regional Climate Change Program in South Africa has recently become available (James van Hasselt et al., pers. comm.), but is of limited value at the scale of individual protected area.

Numerical modeling of environmental conditions of the recent past and future is an important component of project activities. For the Albertine Rift effort WCS outsourced dynamic vegetation modeling and agricultural output modeling to outside academic consultants at the University of Edinburgh and International Livestock Research Institute, respectively. The modeling approach utilized downscaled IPCC General Circulation Model output under different greenhouse gas emissions scenarios as inputs to the Lund-Potsdam-Jena (LPJ) dynamic vegetation model and the Decision Support System for Agrotechnology Transfer (DSSAT) crop yield model; these model outputs were then applied further through spatial modeling.

Environmental and biodiversity monitoring is another central component in both the Albertine Rift and Indian Ocean projects. The Albertine Rift project identified the need to emplace climate and biodiversity monitoring methods and protocols where none presently exist, or are performed without systematic data collection. This has involved the establishment of new monitoring networks for climate (by installing automatic weather stations within key protected areas), vegetation (plots across ecotones, phenological monitoring and long-term ecological monitoring GLORIA sites; <http://www.gloria.ac.at>) and climatically sensitive species (amphibians and chameleons).

Funding sources, project outputs and feedback for ABCG

The WCS efforts on climate change adaptation have largely drawn on support through multiple grants from the MacArthur Foundation for both the Albertine Rift and Indian Ocean coral reef work. Support for coral reef work has also been provided by The Western Indian Ocean Marine Science Association's (WIOMSA) Marine Science for Management (MASMA-SIDA) program. Some internal WCS funds supplement the greater portions procured through grants.

The Albertine Rift program has benefitted from some inherited institutional strengths fortified by the arrival of new team members. Of great benefit to both this projects and the Indian Ocean coral reef project is the institutional ability to leverage WCS strengths in on the ground science based conservation and apply them within the new contexts of climate change adaptation. The

long-term presence and expert local knowledge at WCS staff at field sites, in-house databases on biodiversity databases and a climate scientist as part of the team and have proven to be especially strong assets. The projects have also benefitted from a strong working relationship developed in previous work with the primary donor on adaptation initiatives, the MacArthur Foundation.

Primary limitations relate to the lack of precedent to guide effective project planning and implementation, and the complicated logistics of coordinating field activities in remote African settings from afar. For example, for the weather station network implementation we greatly underestimated the complexities of purchasing, shipping, obtaining import permissions for, conducting the field installations and requisite training. At most sites where WCS works in Africa our efforts are constrained by climate data availability issues (effectively absent in regions such as the Congo Basin), lack of systematic monitoring protocols and low capacity among stakeholders and in-country partners. For the program to grow and extend activities elsewhere in Africa, WCS will benefit from developing in-house modeling capability and improved observational networks for monitoring climate and the environment in priority conservation landscapes. More fundamentally, for the Albertine Rift work there remains a divide between the wealth of knowledge generated and clear steps on how to apply and implement it in conservation management. This is among shortcomings most critically in need to be addressed in order to increase the value of this work beyond the vulnerability assessment level.

For the Albertine Rift Climate Assessment, modeled products and other output are available from the Albertine Rift Climate Change Assessment website (free registration required):

<http://programs.wcs.org/Default.aspx?alias=programs.wcs.org/albertineclimate>

Further information can be found in:

- Plumptre, A. (ed.), 2011: *The Ecological Impact of Long-term Changes in Africa's Rift Valley*. Nova Science Publishers, New York.
In particular, chapter 2: Seimon, A. and G. Picton Phillipps (2011): A climatological assessment for the Albertine Rift.
- Seimon, A. and A.J. Plumptre, (in press): *The Albertine Rift*. In M. Cross, J. Hilty and C. Chester (eds.), *Climate and conservation: Landscape and seascape science, planning and action*. Island Press
- Seimon, A. and G. Picton Phillipps (2010): *Climatology of the Mountain Gorilla's Domain*. In N. Belfiore (eds.), *The Implications of Global Climate Change for Mountain Gorilla Conservation*. African Wildlife Foundation, International Gorilla Conservation Programme and EcoAdapt.

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- Seimon, A. and G. Picton Phillipps, 2009: Climatological Assessment of the Albertine Rift for Conservation Applications, Wildlife Conservation Society whitepaper
 - Picton Phillipps, G. and A. Seimon, 2009: Potential Climate Change Impacts in Conservation Landscapes of the Albertine Rift, Wildlife Conservation Society whitepaper

Results of the coral reefs studies on adaptation to climate change have led to a variety of successes based on the dissemination of this information through international and regional journals and conferences and also through local level meetings with community and resource users groups. For example, the Kenyan field program holds annual meetings with the fisheries leaders in Kenya and distributes the information from their research in the local language (Swahili) and these groups use this information to change their management systems. This has led to large-scale reductions in the use of seine nets in the south coast of Kenya and also the creation of 13 community closures. These changes have shown continual improvement in the metrics used to evaluate fisheries catches in this region (McClanahan 2010; McClanahan and Hicks 2011) and continual and increased participation of stakeholders in this adaptive management process.

Recent journal articles of relevance to climate change adaptation include:

- Maina, J., T. R. McClanahan, V. Venus, M. Ateweberhan, and J. Madin. 2011. Global gradients of coral exposure to environmental stresses and implications for local management. PLoS One in press.
- McClanahan, T. R., and C. C. Hicks. 2011. Changes in life history and ecological characteristics of coral reef fish catch composition with increasing fishery management. *Fisheries management and Ecology*, 18:50-60.
- McClanahan, T. R. 2010. Effects of fisheries closures and gear restrictions on fishing income in a Kenyan coral reef. *Conservation Biology* 24:1519-1528.
- McClanahan, T.R., J.M Maina, N.A. Muthiga, 2011: Associations between climate stress and coral reef diversity in the western Indian Ocean . *Global Change Biology* 17: 6. 2023-2032.
- Jury, M., T.R. McClanahan and J.M. Maina, 2010: West Indian Ocean variability and East African fish catch. *Marine Environmental Research* 70: 2. 162-170.
- McClanahan, T.R., J. Cinner, T. Daw, N. Graham, J. Maina, S. Stead, A. Wamukota, K. Brown, V. Venus and N. Polunin, 2009: Identifying Reefs of Hope and Hopeful Actions : Contextualizing Environmental,

Ecological, and Social Parameters to Respond Effectively to Climate Change *Conservation Biology* 23: 3. 662-671.

- McClanahan, T. R., J. E. Cinner, J. Maina, N. A. J. Graham, T. M. Daw, S. M. Stead, A. Wamukota, K. Brown, M. Ateweberhan, V. Venus, and N. V. C. Polunin. 2008. Conservation action in a changing climate. *Conservation Letters* 1:53-59.

5.6 World Resources Institute (WRI)

Institutional statement

The World Resources Institute is a global environmental think tank that goes beyond research to put ideas into action. We work with governments, companies, and civil society to build solutions to urgent environmental challenges. WRI's transformative ideas protect the earth and promote development because sustainability is essential to meeting human needs and fulfilling human aspirations in the future.

The impacts of climate change are already upon us, and are likely to grow more serious even under the most optimistic mitigation scenarios. Given the high vulnerability of poor communities to the impacts of climate change, and the threats posed by global warming to the provision of critical services by ecosystems, efforts to adapt to the changing climate are closely linked to the broader challenges of development and ecosystem management. WRI envisions a world where development succeeds in spite of climate change, lifting even the poorest, most marginalized people from poverty. Effective adaptation means finding new ways to transcend institutional boundaries, bring together diverse stakeholders, and incorporate complex information into decision-making.

Organizational approach and objectives

WRI's approach to climate change adaptation in Africa differs significantly from other ABCG members. WRI works mostly at national to international scales, and places a strong emphasis on information sharing and policy instruments for high-level stakeholders rather than on-the ground actions. At present, we have no in-country adaptation work in Africa. However, several case studies, surveys and other activities were undertaken in Africa as part of globally focused work. None of this had a conservation emphasis per se.

Within WRI, the core climate change adaptation work has resided in the 50-person Climate and Energy Program (CEP), and within that, the Vulnerability and Adaptation project led by Heather McGray. This work has been focused mostly at the policy level, for example, trying to influence decisions of the United Nations Framework Convention on Climate Change and into the forthcoming

(Nov-Dec 2011) Durban Conference of Parties (COP) documents in Durban. In addition, the forthcoming 2011 edition of WRI's signature publication, *The World Resources Report*, focuses on the theme "Decision Making Under a Changing Climate." The Report will launch in October.

WRI recently approved a 5-year strategy under its Climate and Energy Program that aims to expand its work on climate change adaptation by focusing in-depth on a few countries. The objective of this new adaptation strategy at WRI states that "By 2016, national governments in several developing countries have integrated climate risk into laws, policies and plans, leading to more climate-resilient development outcomes that reduce the vulnerability of poor and marginalized communities". The launch of this work will focus on integrating climate change adaptation considerations into the national level in Kenya and into state level policy in India.

Climate risks cannot be addressed through a single stand-alone solution, and will instead require many changes to a broad set of activities in a range of sectors. To achieve its climate change adaptation objective, WRI plans to develop country specific work under three strategic pillars:

- Information: WRI will collaborate with partners to support inclusion of climate risks in decisions by a) producing practical information products around vulnerability and risk assessments and adaptation options identification and b) promoting improvement in national information systems.
- Institutions: Through policy analysis and strategic outreach, WRI and partners will promote changes in the structure and function of national and sub-national institutions.
- Finance: WRI will help national governments and their domestic stakeholders develop systems through which to generate, access, disperse and track adaptation finances wisely.

While concern over the environment underpins WRI's projects, socioeconomic issues rather than biodiversity conservation dominates current adaptation project work. This may change according to emerging needs in-country and may include work around payments for ecosystem services and protected areas degazettement and downlisting issues.

Project implementation

This section will elaborate how the new adaptation objective will be implemented and present some of the other projected related to climate change adaptation at WRI.

Five-year adaptation strategy

Work around the new adaptation strategy is about to begin. WRI will employ a phased approach to developing projects around climate change adaptation in the countries they work in. Three phases of this project development strategy include a) Start-up, b) Deep Engagement and c) Scale-up. During start-up, WRI will develop country strategies for each country where they work. The aim of these strategies during the first year is to create country-specific projects that lead to early products and the solidification of partnerships. During years 2-4 of the strategy, projects will focus on longer-term activities that deepen our influence and deliver meaningful national outcomes. And finally, under the scale-up phase during year 3, WRI will focus on bringing lessons from implementation to bear on outcomes beyond our focal countries.

In Kenya, WRI will employ a multi-pillar project that addresses the climate resilience of land use patterns. Early scoping during the start-up phase has revealed that potential entry points to starting adaptation related work include a) exploring how water and agricultural institutions have treated climate change to date and identifying ongoing programs where activities related to institutions, information and/or finance could improve treatment of climate risk; b) studying the role of decentralization reforms, particularly in the water sector, and the resulting water resource management associations; and finally c) Kenya's national "Vision 2030" plan that entails several "flagship projects" that would represent potential platforms for developing and testing innovative ideas for how information, institutions or finance could best be leveraged for climate-proofing Kenya's development.

The World Resources Report

WRI's signature product, the *World Resources Report (WRR)*, is prepared jointly with the United Nations Environment Program, the United Nations Development Program and the World Bank. It is designed to provide global policymaking bodies with analysis and insight about major environmental and development issues. The forthcoming 2011 report has climate change adaptation as its central theme, with an emphasis on decision-making for the future under climatic uncertainty. It evaluates strategies on how decision-making processes can be designed to both respond to current climate risks and prepare for future risks – what is commonly termed "climate-proofing" development. Given the track record of past WRRs, the report has potential to become an important point of reference on adaptation for the development community, with many lessons and insights of value to conservation interests as well.

National Adaptive Capacity (NAC) Framework Assessment

The NAC Framework developed by WRI attempts to assess the strengths and gaps of national institutions to perform key adaptation functions. In looking at the ability of such institutions to perform the key functions necessary for adapting to climate change, the NAC provides an opportunity to build adaptive capacity by focusing on filling these gaps and building off strengths. So far governments and research organizations in Bolivia, Ireland and Nepal have piloted the assessment. An issue brief that synthesizes lessons from these pilots is forthcoming.

Rapid Institutional Analysis for Adaptation (ARIA)

Using the NAC Framework (above) as its conceptual backbone and WRI's Access Initiative's coalition-based assessment approach, ARIA aims to enhance government capacity to plan for and respond to the impacts of climate change. Its project strategy focuses on building the ability of civil society to engage with national governments on adaptation through collaborative research and evidence-based advocacy. Upcoming work includes development of an interactive website that will give civil society organizations easy access to the ARIA toolkit, and which will enable them to support each other globally by sharing research findings and advocacy tactics. Initial pilots have been completed in Ghana and Bolivia.

Making Adaptation Count: Concepts and Options for Monitoring and Evaluation of Adaptation

In partnership with GIZ, WRI has developed a conceptual framework for conducting monitoring and evaluation (M&E) of climate change adaptation projects and programs as a means of increasing learning and accountability. The work includes an approach to M&E that recognizes the necessity of defining adaptation success with reference to context-specific needs and parameters, a clear step-wise process that is short and straight-forward, and a set of adaptation principles and three-part typology of adaptation objectives that work across all sectors, scales and types of adaptation interventions

Tools used – measuring and monitoring, modeling, community level risk assessments

The World Resources Report draws from a series of case studies commissioned by WRI and its partners that examine national-level climate change adaptation initiatives in developing countries; the thematic focus is not biodiversity conservation, however, but instead more concerned with economic and societal impacts. Several of these reports cover African countries and thematic issues as follows:

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- South Africa: Ecosystem-Based Planning for Climate Change Increasing Food Security with Agrometeorological Information
 - Mali: Mali's National Meteorological Service Helps Farmers Manage Climate Risk
 - Namibia: Combating Desertification with Tools for Local- Level Decision Making
 - Rwanda: Maintenance of Hydropower Potential in Rwanda Through Ecosystem Restoration

The studies are mostly concerned with national-level decision-making processes that incorporate climatic risks, from both short-term climatic variability and longer-term climate change. Care was taken to select cases that had already advanced from planning to actual implementation.

In addition to these case studies, the WRR team conducted a decision-making simulation in Ghana to explore how policy-makers might approach adaptation options in the context of public investment in the energy sector.

For more information see: <http://www.worldresourcesreport.org/case-studies>

Funding sources, project outputs and feedback for ABCG

Published outputs to share with ABCG include the framing paper for the current *World Resources Report*, and the individual case study reports mentioned above. All are available for download at <http://www.worldresourcesreport.org>

- Levin, Kelly. "World Resources 2010 Framing Paper: Decision Making in a Changing Climate." World Resources Report, Washington DC.
- Petersen, Caroline and Stephen Holness. "World Resources Report Case Study. South Africa: Ecosystem-Based Planning for Climate Change." World Resources Report, Washington DC.
- Hellmuth, Molly, D.Z. Diarra, C. Vaughan and R. Cousin. "World Resources Report Case Study. Increasing Food Security with Agrometeorological Information: Mali's National Meteorological Service Helps Farmers Manage Climate Risk." World Resources Report, Washington DC.
- Matambo, Susan and Mary Seely. "World Resources Report Case Study. Namibia: Combating Desertification with Tools for Local- Level Decision Making." World Resources Report, Washington DC.
- Hove, Hilary, Jo-Ellen Parry, and Nelson Lujara. "World Resources Report Case Study. Maintenance of Hydropower Potential in Rwanda Through Ecosystem Restoration." World Resources Report, Washington DC.

Other relevant publications include:

- Bapna, Manish, H. McGray, G. Mock and L. Withey. “Enabling Adaptation: Priorities for Supporting the Rural Poor in a Changing Climate”. World Resources Institute, DC. <http://www.wri.org/publication/enabling-adaptation-climate-change>
- McGray, Heather et. al. “Weathering the Storm: Options for Framing Adaptation and Development.” World Resources Institute, DC. <http://www.wri.org/publication/weathering-the-storm>
- WRI. “National Adaptive Capacity Framework.” World Resources Institute, DC. <http://www.wri.org/project/vulnerability-and-adaptation/nac-framework>
- Spearman, Margaret and Heather McGray. “Making Adaptation Count: Concepts and Options for Monitoring and Evaluation of Adaptation”. GIZ, Eschborn. (*forthcoming*)

5.7 World Wildlife Fund – US (WWF)

Institutional statement

WWF’s mission is the conservation of nature. Using the best available scientific knowledge and advancing that knowledge where we can, we work to preserve the diversity and abundance of life on Earth and the health of ecological systems by

- protecting natural areas and wild populations of plants and animals, including endangered species;
- promoting sustainable approaches to the use of renewable natural resources; and
- promoting more efficient use of resources and energy and the maximum reduction of pollution.

We are committed to reversing the degradation of our planet’s natural environment and to building a future in which human needs are met in harmony with nature. We recognize the critical relevance of human numbers, poverty and consumption patterns to meeting these goals.

Organizational approach and objectives

A formalized program on climate change adaptation in WWF began around 2001, and a series of initiatives are currently active in Africa. In WWF-US, adaptation is led from Field Programs but the adaptation team is drawn from several programs within Conservation Strategies and Science as well as Field Programs. At least 10 staff members are involved on the WWF-US climate

change adaptation team, and the WWF Network's adaptation team has about 100 members around the world. Adaptation activities range from freshwater, marine, terrestrial, communities, policy, tools development, research and training of staff and partners. WWF-US has an adaptation strategy, and the broader WWF Network has recently finalized a network-wide strategy. The aim is to make WWF and project work "climate smart" through approaches focusing on ecosystem services, species, protected areas and communities as relevant. The vision and program objectives on climate change adaptation for WWF-US are as follows:

WWF Network adaptation goal

By 2020, WWF has shown a clear path for safeguarding the long-term survival of species, ecosystems and people in vulnerable places, by catalyzing climate adaptation efforts and supporting governments, communities and the private sector to balance conservation and development as they prepare for climate change.

Program strategies

Strategy 1: Enable WWF to prepare for the ongoing impacts of climate change. (Internal capacity)

Strategy 2: Catalyze climate adaptation processes in our priority places, so that planning integrates environment and development. (External influence)

These are being applied in several regional foci and field implementation sites in Africa:

- Cameroon coast and Tanzania Rufiji delta (mangroves)
- (Tanzania/Mozambique border, Ruvuma landscape (integrated ecosystem and human adaptation))
- Ruaha, Tanzania (freshwater adaptation)
- Madagascar (national and site specific adaptation including protected area planning, vulnerability assessments; adaptation capacity building for decision makers, technical officers and local authorities)
- Zambia (coordination of a national adaptation network)
- Kenya, Tanzania, Mozambique: Coastal East Africa (new adaptation initiative about to start)
- Mozambique – Primeiras e Segundas (vulnerability assessment of coral reefs with TNC; work with CARE)
- Congo basin (landscape level species vulnerability/planning about to start)

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- South Africa
 - Support to Kenya government in United Nation Framework Convention on Climate Change (UNFCCC)
 - Support to UNFCCC process from West Africa
 - Rural Futures: continent-wide joint initiative of the African Union Commission (AUC) and the NEPAD Agency in partnership with the Economic Commission for Africa (UN-ECA), WWF and the World Food Programme; it aims to respond to the challenge and opportunities of rural Africa including climate change)
 - Ecosystems and Livelihoods Adaptation Network (ELAN) (joint activity with IUCN, CARE and International Institute for Environment and Development to build national level capacity and promote information sharing, currently active in Zambia and Tanzania)

Project implementation

In Africa WWF is working at multiple levels, from community and site level through protected areas and landscapes, to national, regional transboundary and international levels. It is working in adaptation policy and practice; however, it has not yet fully mainstreamed adaptation into its strategies and programs in Africa, and each office is at a different stage. WWF-US currently aims to help the WWF Network prepare for mainstreaming adaptation into all its work, including in Africa, and to promote scaling up of adaptation policy and practice beyond WWF.

WWF is working with several partners at different levels. At the local level it partners with local communities, local government and several local and international NGOs from the development and conservation sectors. At landscape and national level it partners with governments and NGOs. It uses partnerships to work more effectively at multiple levels: for example, it is partnering with CARE in East Africa with funding through the USAID SCAPES program to pilot integration of local-level community adaptation with larger scale ecosystem adaptation approaches. At the continental level it is partnering with the African Union Commission, NEPAD, the Economic Commission for Africa and the World Food Program in Rural Futures. ELAN (whose core partners are WWF, IUCN, CARE and IIED) is partnering with African adaptation networks (currently the Zambia Climate Change Network and the Tanzania Civil Society Climate Change Forum (Forum CC)). ELAN focuses on enhancing poor and marginalized people's resilience to the impacts of climate change by integrating ecosystem and right-based approaches into adaptation policies and practices (www.elanadapt.net).

The WWF climate change team has several dedicated staff persons working on adaptation initiatives. The WWF Network's Climate Adaptation Team is coordinated by Helen Jeans. The WWF-US climate adaptation team is directed by Judy Oglethorpe, who brings extensive experience on community adaptation to these efforts. The US team includes an in-house climate scientist, Jeff Price, who is available to support field programs and is performing a global vulnerability assessment of WWF's 38 priority places as a common resource on climate change for all field projects, as well as developing modeling tools ClimaScope and Wallace Initiative.

The team includes Bart Wickel, Sarah Freeman and Eliot Levine, freshwater adaptation specialists working on integrated approaches to freshwater adaptation, reducing the impacts of large infrastructure development, and developing adaptation tools. Freshwater adaptation staff (including John Matthews and others in the WWF Network) recently developed an approach for freshwater vulnerability assessment and planning in partnership with the World Bank called Flowing Forward (Le Quesne et al. 2010)

Two planners, John Morrison and Al Lombana, provide support to field programs to integrate adaptation into existing conservation plans, and have been modifying the WWF Standards to incorporate climate adaptation (Morrison & Beale 2011). A training team in WWF-US led by Shaun Martin has developed a training program for WWF and partners that promotes an integrated biodiversity, ecosystems and people approach to adaptation. Training activities have been conducted in East Africa and Madagascar. WWF-US manages a popular blog, www.climateprep.org, that **aims to define climate change adaptation through illustrations of on the ground adaptation projects, explorations of adaptation concepts, and sharing lessons learned from work around the world**. In addition, a group of adaptation team members are working on developing cutting edge guidance for organizations to become more flexible and adaptable in the face of climate change (Jonathan Cook, Sarah Freeman and Eliot Levine).

The WWF adaptation program operates across a range levels of engagement, with projects that are widely distributed across sub-Saharan Africa. Work on mangroves and coastal communities in several countries, coordinated by Jonathan Cook in WWF-US, are among the most advanced field projects in Africa dealing specifically with adaptation, in this case, to sea level rise (in Cameroon, Tanzania – led by Jason Rubens). The vulnerability assessment and adaptation phases are now complete, with the project synthesis underway that will lead to production of a manual to guide programs at other mangrove sites. The WWF climate change team has partnerships with

other organizations (CARE, University of Michigan) on several initiatives in Africa concerned with climate change impacts on humanity that affect biodiversity.

Tools used – measuring and monitoring, modeling, community level risk assessments

Environmental modeling under changed climatic futures is a component of current activities. WWF-US is coordinating ClimaScope and The Wallace Initiative. Climascope is a web portal for obtaining downscaled GCM output (similar to Climate Wizard). Products available include projections of potential future local/regional climate changes and impacts for a range of emission scenarios and socioeconomic futures.

The Wallace Initiative links downscaled climate projections to Maxent based bioclimatic modeling. Globally the initiative has 50,000 species in its database, including 50 major crop types and 1,000 commercial marine species. It is currently being utilized to identify potential refugia for wild crop types and eco-crops, terrestrial species, and selected commercially important marine species, and to aid in the design of protected areas. It is also being used to identify areas of concern which are particularly vulnerable to climate change. Results from ClimaScope and The Wallace Initiative analyses are being used in vulnerability assessments and conservation planning in various landscapes in East/Southern Africa and Madagascar, and will be used more broadly in Africa as they are rolled out.

Under the USAID-funded SCAPES program, WWF is working with CARE in the Ruvuma landscape to pilot integrated ecosystem-people adaptation approaches where CARE applies the Climate Vulnerability and Capacity Assessment (CVCA) and Community Based Risk Screening Tool (CRiSTAL) to assess community vulnerability, and WWF applies tools such as ClimaScope, The Wallace Initiative and soon Flowing Forward to assess vulnerability at ecosystem and landscape levels, bringing local voices and concerns to higher levels and at the same time integrating ecosystem aspects into community based adaptation to reduce the risk of maladaptation. We are working on adapting tools for this integrated approach.

The GEF-funded mangrove project developed and piloted (in 3 countries, 2 in Africa) a set of tools and methods for understanding the vulnerability of mangrove ecosystems to sea level rise – the manual described earlier is based on these tools and methods, which are being adopted for use in other countries in Africa and globally.

WWF does not have a standard approach to adaptation monitoring. Some projects have developed monitoring systems but this is an area we need to strengthen.

Funding sources, project outputs and feedback for ABCG

WWF is at the stage where a number of individual initiatives have taken place independently, and others are still at an early stage. They need to implement activities that have been through VAs and planning. They also need to consolidate, document and learn from our collective experience, and work to mainstream adaptation into our Africa programs. But to do this we have to build more capacity and secure funding. They have strong interest from most senior management in the Africa program with is very helpful, and climate adaptation is one of the pillars of the new strategy for the East and Southern Africa Program Office, as well as the Madagascar and Western Indian Ocean Program Office. The Madagascar office has made considerable progress in climate adaptation. Apart from the mangrove project in Cameroon, very little has been done in the Congo Basin. Our West Africa office is keen to start implementing adaptation, and Namibia is starting through the Namibia Association of CBNRM Support Organizations.

GEF-funded mangrove project ends in December 2011. Full VAs were produced in both Cameroon and Tanzania; pilot adaptation activities were carried out in both countries (ranging from replanting to protected area gazettement); and scaling up opportunities are being explored in West and East Africa.

Strengths of WWF climate adaptation projects in Africa include:

- a nascent adaptation program in Madagascar and East/Southern Africa; individual projects at various stages, and mainstreaming of adaptation moving ahead in Madagascar
- recent increase in adaptation capacity in Coastal East Africa with recruitment of part-time adaptation coordinator for adaptation in CEA, and coordinator for Ruvuma landscape; recruitment of a coordinator for Africa (who will initially focus on East and Southern Africa) is imminent.
- Science based approach that combines policy and practice at multiple levels
- Strong linkages to policy makers in several African countries and regions, with opportunities to influence adaptation policy and integration of adaptation into sectoral policy
- Strong partnerships with development organizations, for integrating ecosystems in human adaptation and promoting human adaptation actions that help to restore or maintain ecosystem services

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- strong global WWF adaptation network to provide experiences, lessons and support (fundraising, technical assistance, capacity building, tools development etc)

Limitations include:

- Generally low capacity, both internally and in many partner organizations, particularly in Central and West Africa. We are planning a series of trainings to build capacity of WWF and our partners, including standard training and advanced training for those coordinating and supporting adaptation in Africa and elsewhere.
- In the GEF-funded mangrove project, a lack of baseline data that can be monitored effectively, e.g. tide gauges in coastal areas not always available; good GIS data for remote sensing analysis not easy to obtain.

Publications:

- Pittock J. (ed.) 2008. Water for life: Lessons for climate change adaptation from better management of rivers for people and nature. Worldwide Fund for Nature, UK and Switzerland. (includes an adaptation case study of Ruaha, Tanzania) <http://wwf.panda.org/index.cfm?uGlobalSearch=ruaha+freshwater+adaptation+case+study>
- Funding support for the WWF's adaptation work in Africa has been provided from global WWF national offices' core funds, USAID, the United Kingdom Department for International Development (DfID), NORAD, SIDA, MacArthur Foundation, as well as corporate foundations such as Hewlett-Packard. The mangrove VA and adaptation project was funded by the GEF, and the freshwater adaptation group has also received funding from the World Bank and HSBC. Institutional funding has also been used to team member support salaries and travel.

ABCG's members are U.S.-based international conservation NGOs with field activities in Africa. ABCG's mission is to tackle complex and changing conservation challenges by catalyzing and strengthening collaboration, and bringing the best resources from across a continuum of conservation organizations to effectively and efficiently work toward a vision of an African continent where natural resources and biodiversity are securely conserved in balance with sustained human livelihoods.

ABCG's members include:

- African Wildlife Foundation (AWF)
- Conservation International (CI)
- the Jane Goodall Institute (JGI)
- The Nature Conservancy (TNC)
- Wildlife Conservation Society (WCS)
- World Resources Institute (WRI)
- World Wildlife Fund – US (WWF-US)

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