# Ecosystem-Based Adaptation (EbA) as an Adaptation Strategy in Burkina Faso and Mali

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## 1 Introduction

One of the major threats to sustainable development is climate change (SDSN 2014). The world climate is still changing fast, posing serious challenges to sustainable livelihood and social-economic development, particularly in the developing countries. Climate change effects are evident in different sectors, such as environment, health, education, food security, energy, and inter alia (WWF 2009; Andrade et al. 2010), and they are a major risk to poor communities who lack the financial, institutional and technical capacity to adapt (Munang et al. 2014). Notably, a temperature rise beyond 2 °C can have devastating effects on crop production, water access, health and economic development (UNFCCC 2011a). This calls for different players such as governments, communities, institutions and individuals to recognize the urgency of addressing social, environmental and economic effects of climate change.

The United Nations Framework Convention on Climate Change (UNFCCC) has recognized that the Least Developed Countries (LDCs) are the most vulnerable to

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climate change effect, and has guided them in establishing the National Adaptation Programmes of Action (NAPA) (Pramova et al. 2012). NAPAs is a political instrument that helps the countries to identify and prioritize their most urgent adaptation needs, whose further delay can imply increased vulnerability and high costs later (UNFCCC 2010). Further, they provide an ideal starting point for country-specific adaptation initiatives through adaptation projects. Most recently, the UNFCCC parties have adopted the Intended Nationally Determined Contributions (INDCs) which are supposed to be addressing countries priority action for contributing voluntarily to mitigation efforts while supporting adaptation needs in developing countries (UNFCCC 2014).

Over the years, different adaptation approaches that can play a vital role in enhancing the NAPA's ability in promoting adaptation and sustainable development have emerged. One of them is through Ecosystem-based Adaptation (EbA), which seeks to promote societal resilience via ecosystems management and conservation (Colls et al. 2009). This approach recognizes the centrality of ecosystems in the adaptation process (Munang et al. 2014). Ecosystems, among others, maintain, strengthen and enrich different elements of life and livelihood on the planet (Capistrano et al. 2009). They support life on the earth through provision of ecosystem services (BirdLife International 2010), which are defined as the benefits that natural ecosystems provide to the society (Boyd and Banhzaf 2007; Prato 2008). These benefits are classified into four broad categories—supporting, provisioning, regulating and cultural (MEA 2005). The capacity of the ecosystem to deliver ecosystem services depends on its condition (healthy state) as well as the ability of the society to access it (Pramova et al. 2012).

The current study sought to (a) analyze the dimensions of the climate-change adaptation strategies, (b) Explore how ecosystem-based adaptation initiatives are incorporated in NAPA projects, and (c) draw lessons on EbA as a sustainable development strategy using Mali and Burkina Faso as case studies. It further recommended on how to improve the projects to harnesses ecosystem services, reduces negative impacts on the ecosystems, and promote social well-being.

## 2 The Concept of Ecosystem-Based Adaptation

EbA is defined as the approach of "*sustainably managing, conserving and restoring ecosystems to provide the services that allows people to adapt to climate change effects*" (Colls et al. 2009; IUCN 2015). These strategies utilize ecosystem services and biodiversity as a part of the community adaptation strategies to climate change effects (Gupta, Nair 2012; Munang et al. 2013a). The approach considers those adaptation projects that have both 'ecosystem face' and 'human face' on them. EbA recognizes the fundamental role played by the ecosystem services in the reduction of people's vulnerability to the effects of climate change (Vignola et al. 2009; UNFCCC 2011a).

## 2.1 Benefits of EbA

EbA strategies provide an array of institutional, social-cultural, ecological and economic benefits. The approach promotes restoration and protection of ecosystems; thus promoting healthy ecosystems (McGray et al. 2007) which in return acts as natural barriers to extreme weather conditions such as droughts, landslides, flooding, and extreme temperatures, among others (Andrade et al. 2010). A healthy ecosystem is resilient to the effects of climate change and ensures that communities continue to enjoy ecosystem services that they provide (Falkenburg et al. 2010). Livelihood support contributes towards poverty alleviation among communities. EbA approach leads to protection, restoration and management of ecosystems (Locatelli et al. 2008) which in return promotes conservation of biodiversity in addition to building the capacity of the people to adapt to climate change variability (Mercer et al. 2007), ultimately leading to sustainable development.

## 2.2 Principles of EbA

Several principles guide EbA strategies. Such includes promotion of multi-sectoral approach in the ecosystems management of different landscapes (Speranza et al. 2010). The EbA approach promotes collaboration and coordination of various sectors, communities and players that utilize ecosystem services (Richardson 2010; Delica-Willison and Gaillard 2011). The EbA functions at multiple spatial scales and landscapes such as local, sub-national, national and region (Cadag and Gaillard 2012). It is important to consider the complexity of ecosystems such as drivers to vulnerability, geopolitics involved in the ecosystems management, and transboundary nature of an ecosystem (McConney and Mahon 2005; Orlove et al. 2010). Lastly, it promotes participation, cultural appropriateness, accountability and embracing diversity in the project design and execution (Munang et al. 2013b).

## 2.3 Applications of EbA

The role and application of ecosystems in adaptation is recognized at the international level under the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD) and the United Nations Convention to Combat Desertification (UNCCD) (IUCN 2015). When one considers a global change context, it is widely known that climate change has a wide range of implications and impacts which are beyond those on ecosystems (Leal 2001). One special feature in EbA is the fact that, apart from the use of ecosystem services for people's adaptation, they can provide a concrete contribution towards increasing the resilience of these ecosystems to climate change (Locatelli and Pramova 2015). EbA can be used in areas as varied as:

(a) agriculture,
(b) water resource management,
(c) forest management interventions,
(d) biodiversity conservation and management.

In outlining the applications of EbA, one should not overlook the fact that we need new and enhanced adaptation approaches, so as to cope with the many problems and pressures posed by climate change, at different levels. One of them should be the engagement of decision-makers in the process, since the active participation of ecologists or environmentalists alone does not suffice (Vignola et al. 2009). Thus, there is a pressing need to engage various sectors in the planning and allocation of resources for adaptation action.

## 3 Materials and Methods

The study followed a survey approach. Two NAPAs (Gouvernement du Burkina Faso 2007; Gouvernement du Mali 2007) with a total of 31 projects were studied after which a summary was created in the form of a database for further analysis to reveal the adaptation patterns, extent of incorporation of EbA strategies, lessons learnt and prospects of EbA. The criteria for project inclusion and exclusion for analysis is summarized in Table 1.

## 4 Results and Discussions

### *4.1 Analysis of Adaptation Projects in the Study Areas*

Thirty-one projects were examined from the two countries NAPAs (61% in Mali and 39% in Burkina Faso). They were categorized into different thematic (sectors)

**Table 1** Criteria for projects selection

| No. | Type of project | Description |
|---|---|---|
| 1 | Projects without ecosystem management | These projects do not mention any ecosystem management practice |
| 2 | Project with ecosystem management for environment | They are geared towards conserving ecosystem without mentioning the human benefits and well-being |
| 3 | Project with ecosystem management for both ecosystem resiliency and human adaptation (EbA) | These projects link ecosystem management, ecosystem services with human adaptation strategies and social well-being. They are defined as EbA projects in this study |

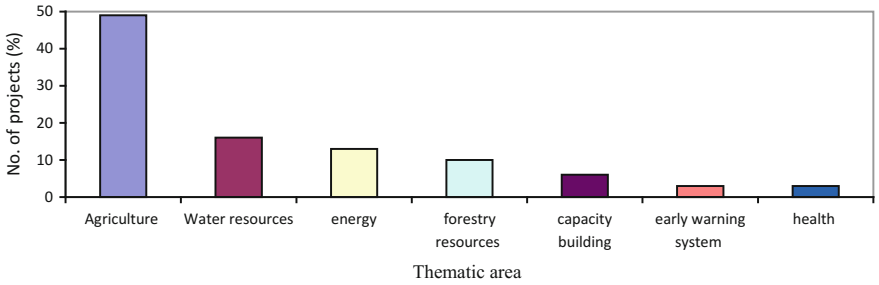


**Fig. 1** Percentage number of projects per thematic area

**Table 2** Percentage number of projects per geographical scope and scale

| | Local | Sub-national | National |
|---|---|---|---|
| No. of projects (%) | 13 | 61 | 26 |

areas that dictated the EbA approach they took. Most of the project studies (49%) fell into the agricultural sector, with Mali recording 53% and Burkina Faso 42% of the total projects. These results were consistent with studies by Richardson (2010), Pramova et al. (2012) and McGray et al. (2007) that singled out agriculture as the main area of focus in climate change adaptation due to the historical food insecurity in Africa. The water resources sector, energy sector, and forestry sector also recorded a significant percent of adaptation projects as summarized in Fig. 1.

The adaptation projects took different geographic scope and scale of execution. Three broad categories were established, local, sub-national and national scales. Most of the studies projects (61%) fell under the sub-national category, which referred to the projects that cut across two or more geographical locations (districts or regions) as well as projects that targeted ecosystems cutting across several geographical areas. Burkina Faso had the most of these projects at 75% as summarized in Table 2.

The adaptation projects also varied with the implementation duration (in years). The study established five categories based on the project's duration, ranging from less than one year to over five years. 68% of the projects studies were scheduled to be implemented within three years and 23% within two years. It is notable that 100% of the projects in Burkina Faso had three years implementation schedule.

Ten ecosystem services were established from the study and were categorized based on the MEA (2005) report—provisioning, support, regulatory and cultural services. The study established that 58% of the projects sought to provide provisioning services while regulatory services were provided by 21% of the total projects studied. Among the provisioning services, food and fodder topped the list at 50 and 29% respectively. The dominant support service was soil formation and fertility to support the provision of food and fodder, while the principal regulatory service was soil erosion/siltation control at 50%. These results were consistent with

**Table 3** Summary of Ecosystem services identified

| Provisioning services | Regulatory services | Support services |
|---|---|---|
| Food | Erosion/siltation/ sedimentation control | Soil formation/ fertility/productivity |
| Fodder | Disease control | |
| Habitats | Bushfire prevention | |
| Non- timber products | Pollution control | |
| Water services | | |

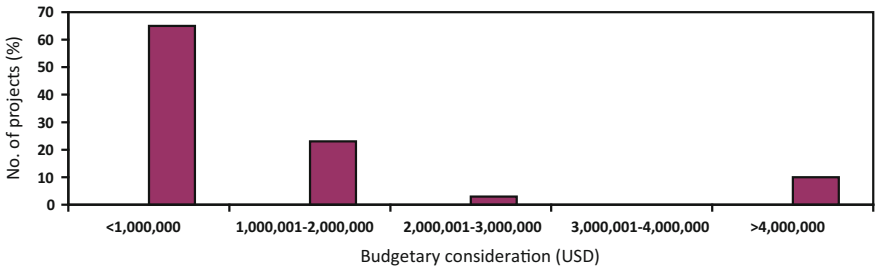


**Fig. 2** Percentage number of projects per budgetary consideration

those of Pramova et al. (2012), which established that provisioning and regulatory services are dominant within the adaptation projects. Notably, there is also a clear pattern of the high priority of the number of projects within agricultural sector and the service they seek to provide, that is food and fodder provision (Table 3). The ecosystem services established are summarised below in Table 3 based on the Millennium Ecosystem Assessment (2005) classification.

The projects also varied with their budgetary considerations. The study defined five categories of budget between one USD and over four million USD. Most of the projects (64%) had a low budgetary consideration of one and one Million USD (92% and 47% in Burkina Faso and Mali respectively). Only 16% of the projects recorded highest budgetary consideration of over 4 million USD. The results concur with those of UNFCCC (2011b) and Wamunyima and Miga (2014) that point out budgetary and financial constraints as the major challenge facing the implementation of adaptation projects. The results are summarized in Fig. 2.

## *4.2 EbA Approaches Identified in the Projects*

The EbA approach was largely dependent on the thematic area of the adaptation. Sixteen percent of the total projects studied mentioned the different way of employing ecosystem-based adaptation approach in their implementation activities and outputs as summarized in Table 4.

**Table 4** EbA approaches established in different sectors

| No. | Sector | Adaptation approach | Examples of activities established | Case studies |
|---|---|---|---|---|
| 1 | Agricultural sector | Integrated/sustainable agricultural practices to enhance food security and enhance ecosystem functioning | Rehabilitation of rangeland, agro-forestry practices, planting drought tolerant food crops | • The extension of improved varieties adapted to climatic conditions in major food crops (millet, sorghum, maize and rice) in Mali<br>• Securing pastoral areas in the Sahel and East Burkina Faso |
| 2 | Water sector | Integrated watershed management to address food insecurity, reduce poverty, enhance watershed functionality, improve people's living conditions | Run-off control, restoration of watersheds and water points, rehabilitation of watersheds, reduce watershed degradation, reforesting catchment areas | • Catchment runoff, creation and restoration of water points in Mali<br>• development and management of the pond Oursi in Burkina Faso |
| 3 | Cross-cutting sectors | Multi-sectored ecosystems management to reduce people's vulnerability to climate change effects | Improve soils productivity and fertility, control of soil and water erosion, rehabilitation of degraded lands, natural resources conservation, reforestation exercises | • Development action CES/DRS for agriculture, forestry and pastoralism projects in Mali |
| 4 | Forestry sector | Integrated forestry management | Promotion of non-timber products, promotion of reforestation, create new plantations and natural trees regeneration, biodiversity conservation | • Planning, management of natural formations and development of non-timber forest products (NTFPs) in Eastern Burkina Faso |
| 5 | Wildlife sector | Sustainable wildlife management | Species monitoring, ecological/eco-zones conservation, wildlife management, sustainable harvesting and co-management plans | • Towards promotion of management of wildlife and its habitat by local communities in the Mouhoun in Burkina Faso |

## 5 Lessons, Prospects and Recommendations of EbA in Adaptation Projects

This study reveals several key lessons, prospects and recommendations on EbA and climate change adaptation strategies as reflected in the National Adaptation Programmes of Actions (NAPA) of the two countries.

The adaptation strategies are not uniform: they vary in terms of scope, duration, thematic area, ecosystem services provided and the EbA approach put in place. The key determinant is the thematic area (sector). A common pattern of the adaptation projects was drawn from the current study. The majority fell within the agricultural sector (49%) with low budgetary allocation (1–1 M USD), conducted within sub-national geographical and ecological coverage (61%). They had a medium implementation duration (68% within three years), and majority sought to enhance provisioning ecosystem services (58%). This variability informed the diverse EbA approach taken by these projects. The 'one suits all' adaptation strategy may not be appropriate for current and future EbA projects.

The EbA strategies should integrate indigenous and contemporary knowledge. Such includes sustainable agricultural practices using indigenous knowledge and crops (such as sorghum and millet) to ensure that food security and promote soil productivity. Basing the EbA approaches on the community's experience is likely to yield more participation and success. Studies such as Walmsley (2006), Mercer et al. (2010), and Speranza et al. (2010) all points out the need for community knowledge and participation integration in the adaptation processes.

There is a need for project contextualization based on the previous social, economic and environmental experiences within the project areas. Indeed, the whole NAPA process is based on the country-specific environmental changes that have affected the region's social and economic development. This approach aids in the prioritizing of the activities that are aimed at promoting ecosystem resiliency, promoting human wellbeing, and reduction of vulnerability, supporting ecosystem services and ultimately enhancing sustainable development.

The need for research and development of EbA cannot be understated. Research involves testing, refining and up scaling the EbA approach based on the local context. The project designers should employ tried and tested EbA approaches that seek to enhance both ecosystems and human wellbeing. There is also the need to document such initiatives for replication in other areas with similar geographical and ecosystems characteristics.

The incorporation of EbA and non-EbA activities in a project is also fundamental. Such includes the development of infrastructures to support the ecosystem services provided by these projects. To illustrate, the *planning, management of natural formation and development of the non-timber forest products* project would require non-EbA approaches such as development of roads to ensure that the communities make a living from their conservation and wise resource use exercises.

Adaptation activities should seek to integrate multi-sectoral and multi-stakeholder approach to meet the broad EbA objectives and principles. The designing and execution of these projects should incorporate social, economic, and ecological dynamics to yield multiple benefits. To realize this, the project designers and implementers should understand and balance between the benefits and trade-offs related to the execution of such projects.

## 6 Conclusions

The NAPAs provides an ideal entry point to the country-specific adaptation strategies. The focus is currently shifting from NAPA to INDCs creating the need to incorporate more EbA strategies in adaptation projects to meet both human and ecosystem needs; thus promoting sustainable development. The study shows a clear adaptation pattern, with more projects classified under agricultural sector, low budgetary consideration, medium implementation duration, and mainly seeking to provide provisioning and regulatory ecosystem services. The EbA strategies are considered in 16% of the studied projects and depend largely on the project's thematic area. Some of the strategies were based on agricultural practices, integrated watershed management, multi-sectored ecosystem management, intergraded forestry management and sustainable wildlife management. The analysis of the two NAPA projects also yielded several key lessons and recommendations on EbA. The community participation and local (indigenous) knowledge should be central in the designing and implementation of NAPA projects. The external knowledge, research, monitoring and evaluation are essential aspects of EbA, and should be incorporated in the future adaptation projects. Lastly, the adaptation projects should be contextualized according to the communities and ecosystems around them. The study concludes that incorporation of the diverse ecosystem based approaches in different thematic areas can promote sustainable development.

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