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To cite this article: Colin F. Quinn, Jennifer F. Howard, Chen Chen, Joyce E. Coffee, Carlos E. Quintela, Britt A. Parker & Joel B. Smith (2016): Adaptation and poverty reduction in Mozambique: an opportunity for developing countries to lead, Climate Policy, DOI: [10.1080/14693062.2016.1258631](https://doi.org/10.1080/14693062.2016.1258631)

To link to this article: <http://dx.doi.org/10.1080/14693062.2016.1258631>



Published online: 08 Dec 2016.



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OUTLOOK ARTICLE

Adaptation and poverty reduction in Mozambique: an opportunity for developing countries to lead[§]

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ABSTRACT

Climate change disproportionately impacts the world's poorest countries. A recent World Bank report highlighted that over 100 million people are at risk of falling into extreme poverty as a result of climate change. There is currently a lack of information about how to simultaneously address climate change and poverty. Climate change challenges provide an opportunity for those impacted most to come up with new and innovative technologies and solutions. This article uses an example from Mozambique where local and international partners are working side-by-side, to show how developing countries can simultaneously address climate change and poverty reduction using an ecosystem-based adaptation approach. Using ecosystem-based adaptation, a technique that uses the natural environment to help societies adapt to climate change, developing countries can lead the way to improve climate adaptation globally. This paradigm shift would help developing countries become leaders in ecosystem-based adaptation and green infrastructure techniques and has implications for climate policy worldwide.

POLICY RELEVANCE



The Paris Agreement resulting from the United Nations Framework Convention on Climate Change (UNFCCC) 21st Conference of Parties (COP 21) in December 2015 was rightly lauded for its global commitment to cut greenhouse gas emissions. However, COP 21 was also historic because of its call for non-party stakeholders to address climate change, inclusion of a global goal of 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability', and the United States' commitment of \$800 million to adaptation funding. The combination of recognizing the need for new stakeholders to commit to climate change adaptation, the large impact climate change will have on the developing world, and providing access to funds for climate change adaptation creates a unique opportunity for developing countries to pave the way in adaptation policies in practices. Currently, developing countries are creating National Adaptation Plans (NAPs) for the UNFCCC. Through including a strong component of ecosystem-based adaptation in NAPs, developing countries can shape their countries' policies, improve local institutions and governments, and facilitate a new generation of innovative leaders. Lessons learned in places like Mozambique can help lead the way in other regions facing similar climatic risks.

ARTICLE HISTORY

Received 29 February 2016
Accepted 2 November 2016

KEYWORDS

Adaptation; ecosystem-based adaptation; poverty alleviation; vulnerability

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§The views and opinions expressed in this article are those of the authors and not necessarily the views and opinions of the United States Agency for International Development.

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Climate change is a global and cross-cutting issue that disproportionately affects the world's poorest communities and countries (Mendelsohn, Dinar, & Williams, 2006). A recent World Bank report shows that in the next 15 years climate change could result in an additional 100 million people falling into extreme poverty (Hallegatte et al., 2015). This is largely due to poorer communities being more reliant on the natural environment and small-scale agriculture for their livelihoods (Bowen, Cochrane, & Fankhauser, 2012; Schelling, 1992) as well as increased prevalence of infectious diseases (Aron & Patz, 2001), both of which will likely be negatively impacted by climate change and lead to increased poverty and loss of life. Perhaps most importantly, developing countries lack adaptive capacity – access to basic services and funding, strong governments and institutions, and infrastructure – making it difficult to prepare for or respond to climate change and extreme weather events (Smit & Pilifosova, 2001). Despite the strong link between development and climate risks, there is poor information on how to simultaneously address both. Successful climate adaptation strategies, which include a combination of increasing adaptive capacity and decreasing exposure and sensitivity to climate risks thereby reducing overall vulnerability of systems to climate change, have the potential to limit the number of people that drops below the extreme poverty line and improve human well-being by securing natural resources and providing livelihood alternatives.

Innovative techniques, such as ecosystem-based adaptation (EbA), can simultaneously address emerging climate change risks as well as broad sustainable development challenges (Jones, Hole, & Zavaleta, 2012). EbA is the use of biodiversity and ecosystem services as part of an overall climate adaptation strategy. EbA is a useful tool for combining human well-being targets with sustainable development, and ecosystem conservation. It is both the oldest form of adaptation (the planet has been doing this throughout its existence) and the newest as vulnerable communities are learning how to integrate EbA into land use planning and management. This has led to a recent increase in EbA pilot projects, specifically in developing countries where communities are more dependent on ecosystem services for their well-being. However, for EbA approaches to be successful it is important that a cross-sector approach is used that includes managers and policy makers, scientists, and local organizations (Vignola, Locatelli, Martinez, & Imbach, 2009). If done correctly, EbA can also strengthen local governance capacity and increase access to sustainable funding (Khan & Amelie, 2015). Here we use an example from Mozambique to display how using an EbA approach in developing countries can lead to successful climate adaptation, capacity building, and shape future global climate change policy and investments.

Holistic and scalable EbA potential in Mozambique

Mozambique ranks 180 out of 188 on the Human Development Index (United Nations Development Programme, 2015) and 149 out of 180 on the Notre Dame Global Adaptation Index (Notre Dame Global Adaptation Index, 2014). It is also a country prone to multiple climate-related disasters with limited capacities to respond. The lack of capacity also magnifies climate change impacts. For example, in early 2015, flooding in central and northern Mozambique affected 160,000 people, displaced 50,000, and killed 159. Later in 2015, drought resulted in increased food insecurity nationwide for hundreds of thousands if not millions of people. Coastal cities in particular are at risk due to climate-driven sea-level rise, extreme storms, and flooding. Over 60% of the Mozambican population lives along the coast. As the population grows, more people are moving to coastal cities, increasing the proportion of the population susceptible to climate risks. If the country does not adapt quickly, especially along its coasts, the estimated cost to the nation is a staggering \$450 million per year (World Bank, 2012), a devastating impact on an already fragile economy. An EbA approach is a promising strategy that addresses disproportional vulnerability to climate change while underscoring sustainable development needs.

EbA uses healthy ecosystems and species biodiversity to reduce human vulnerability to climate change. For example, protecting and restoring mangrove forests in urban environments can reduce the impacts of climate change by decreasing erosion and acting as a natural barrier to increased flooding, a likely outcome of climate change that can increase poverty (Turner, Oppenheimer, & Wilcove, 2009). Mangrove forests also provide important fish and shrimp breeding and nursery habitat that increase local communities' resilience by fuelling local economies and maintaining food security. Natural systems or 'green infrastructure' have the added benefit of

sequestering carbon and contributing to climate change mitigation. There are many examples of the multiple benefits of mangrove forest restoration, particularly along tropical developing countries' coastlines. Adaptation strategies in developed countries commonly focus on constructing or strengthening built 'grey infrastructure'. For instance, over \$14 billion was spent on new levees after Hurricane Katrina in New Orleans and in Miami, \$300 million is being spent on pumps to pump water back into the ocean to combat sea-level rise and storm surge. The success of this approach requires high adaptive capacity and access to large amounts of funding. In comparison, EbA is useful for developing countries to build capacity, whose citizens already rely heavily on natural systems and have limited access to funding. Compared to grey infrastructure, which is costly to build, maintain, and is stagnant, ecosystems are better able to adapt to changes in their environment and require little or no maintenance (Jones et al., 2012). The success of EbA techniques relies on a strong commitment from the municipal government, or local institutions, to increase capacity to adapt to climate change, as well as access to sustainable funding and using science-based techniques.

Case study – Quelimane

Quelimane is a Mozambican coastal city vulnerable to flooding, erosion, and other climate change-related impacts. Over the course of 8–12 months a community participatory approach was used to develop and begin implementation of a mangrove restoration project in Quelimane. Using both community participatory and science-based approaches were essential for project planning, initial implementation, and potential long-term success. An initial field assessment identified that harvesting mangroves and expansion of settlements along the Bons Sinais River threatened vital mangrove forests. Following the assessment, a stakeholder engagement workshop, which included representatives from the national and local governments, local universities, mangrove experts from the United States Forest Service, and members from local communities, helped formulate a plan to restore and conserve important mangrove stands. Quelimane's Municipal Government authorized the use of approximately 22 hectares of land for mangrove restoration, which will serve as a foundation for future work, provide the opportunity to build technical skills, empower local communities, and serve as an educational tool to learn about the importance of mangrove forests. Today, two communities located along the Bons Sinais, the Icidua and Mirazane communities, and the University of Eduardo Mondlane have established two mangrove nurseries and are growing and planting approximately 120,000 mangrove seedlings a year and promoting natural regeneration. Importantly, these nurseries not only grow and plant trees, but also engage with local community members on the protection of mangroves. The United States Forest Service continues to collaborate with the University of Eduardo Mondlane to provide training and technical expertise to monitor water levels and plant survival rates to help determine if mangrove restoration will be successful over time. The accomplishments seen in Quelimane are the result of the municipal government working side by side with local communities, universities, international donors, and scientists to restore mangrove forests. As a result, this project built local adaptive capacity, potentially decreased exposure to climate change, and developed technical leadership in the field that can be shared worldwide.

To promote sustainability of the work in Quelimane, donors are working with the municipality and community members to identify ecosystem services and economic benefits associated with mangrove forests, such as improved fisheries, sustainable harvesting of wood, and the potential to collect and sell honey produced from mangrove flowers. In addition, communities are gaining access to future adaptation funds, such as the Green Climate Fund and the Least Developed Countries Fund. If such funding is targeted to EbA, it could help make activities such as those in Mozambique more sustainable, replicable, and scalable. It is important for these activities to integrate consideration for future funding, either external or local, to help obtain adequate financial support. While the work in Quelimane is still in its infancy, the results of this holistic approach have the potential to inform other cities and nations about successes and failures of EbA. Furthermore, Mozambique is not the only country where EbA has been successful. Countries like Belize, Bangladesh, and the Seychelles all have experienced similar success. Strong local support and leadership is a vital component to successful EbA activities.

Policy implications and opportunities to develop adaptation leadership

There is a dramatic need and opportunity for developing countries to take the technical lead in tackling some of the current climate change adaptation and poverty reduction challenges. The combination of three factors will help facilitate this:

1. a recognition of the need for new stakeholders to commit to climate change adaptation;
2. an affirmation of the large impact climate change will have on the developing world; and
3. providing access to funds for climate change adaptation creates a unique opportunity for developing countries to pave the way in adaptation policies and practices.

In reality, many approaches that include EbA will be needed to successfully adapt to climate change and reduce poverty. In addition to coastal countries and regions, Small Island Developing Countries in the Caribbean, West Indian Ocean, and Pacific are also utilizing or considering implementing EbA techniques. The EbA approaches in these countries are particularly integrated with coastal zone and marine management, as is seen in places like the coral triangle in the western Pacific Ocean. Currently, least developed countries are in the process of submitting National Adaptation Plans (NAPs) to the United Nations Framework Convention on Climate Change (UNFCCC). The purpose of these plans is, in part, to facilitate climate change adaptation into relevant country-wide policies, programmes, and activities. Over 50% of NAPAs already submitted recognize the importance of ecosystem services to reduce people's vulnerability to climate change (Pramova, Locatelli, Brockhaus, & Fohlmeister, 2012). For countries that are still developing their NAPAs, it is an opportunity to include a strong component of EbA to create an integrated approach to adaptation that strengthens policies, local institutions and governments, and facilitates a new generation of innovative leaders to simultaneously address global development and climate adaptation challenges.

Cities like Quelimane have the opportunity to develop and lead local EbA approaches that can be scaled up to broader geographic regions and potentially influence future adaptation worldwide. There is an opportunity for developing countries, and cities, to provide technical leadership on EbA activities and teach others what works and what does not. This is a paradigm shift that could help developing countries leapfrog developed countries by using adaptation techniques, such as using green infrastructure to increase communities' resilience to climate change, to avoid some of the pitfalls of the past. This paradigm shift is especially timely due to the recent commitment to adaptation funding at the UNFCCC 21st Conference of Parties (COP 21) in Paris. The Paris Agreement was appropriately lauded for its global commitment to cut greenhouse gas emissions. However, even with the agreement, substantial climate change impacts will be experienced worldwide (Rogelj et al., 2016). COP 21 was also historic because of its inclusion of adaptation. A global goal was outlined of 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability', and the United States committed \$800 million a year to adaptation funding by 2020. Furthermore, the Paris Agreement encourages cities' contribution to reduce vulnerability. International commitments to the Green Climate Fund, Least Developed Country Fund, and adaptation in general have the potential to fund these somewhat new and ground-breaking adaptation approaches.

The severity and urgency of climate change, and the unique challenges that developing countries face, provide the motivation and potential for these countries to lead the way in simultaneously addressing climate adaptation and poverty reduction. Using scalable EbA approaches developing countries, and communities and local leaders within those countries, will improve adaptation efforts worldwide.

Disclosure statement

No potential conflict of interest was reported by the authors.

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