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EVIDENCE SUMMARY

The Economics of Ecosystem-based Adaptation

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Increasing temperatures, rising sea levels and extreme weather events like droughts and floods present serious threats to human development, economic growth and poverty reduction. Ecosystem-based adaptation (EbA) is a nature-based method for climate change adaptation that can offer cost savings compared with other approaches, as well as additional benefits, such as the provision of wild foods, carbon sequestration and biodiversity conservation. While there is a growing body of research that supports the environmental, social and financial benefits of EbA, a challenge in making the case for EbA is that many projects don't adequately capture data on the economic value of these benefits. More detailed and robust assessments of current and future EbA projects are needed to better understand their economic costs, benefits and tradeoffs (Rizvi et al. 2015).

The Cost of Ecosystem-based Adaptation vs. Hard Infrastructure

Traditional engineering solutions are among the most common approaches to climate change adaptation and include the construction of dams, seawalls, storm surge barriers and sea dikes. While these infrastructure approaches can be effective in protecting communities from climate stressors such as sea level rise, floods and droughts, they can be costly to build and maintain. For example, small-scale engineering solutions to help an urban community in Fiji adapt to more intense and frequent storms, including construction of seawalls and drainage ditches, were estimated to cost almost $7 million over a 10-year period (Rao 2013). Large-scale engineering projects for adaptation can be significantly more expensive. For instance, the cost of building a dam to help local communities in India's Godavari River Basin adapt to changes in rainfall patterns and drought was estimated to be $4 billion (Rizvi et al. 2015).

EbA involves the use of biodiversity and ecosystem services to help people and communities adapt to the adverse impacts of climate change (UNEP 2016). For example, an EbA approach for coastal adaptation might include restoration of mangroves to counter sea level rise, while an engineering option to address the same stressor would be the construction of concrete seawalls (Bertule et al. 2014). EbA approaches can be highly effective and their benefits are often long-term and landscape-scale. A recent review of the published literature on the effectiveness of EbA found that the majority of projects reported a positive result based on their own measures of success. Typical EbA approaches in the literature include sustainable forest management, reforestation, agroforestry, mangrove restoration and rangeland management (Doswald et al. 2014).

EbA approaches can also be cheaper than hard infrastructure and often offer additional benefits that support local economies and contribute to human well-being (Rizvi et al. 2015). In the Maldives, the estimated financial cost of replacing the coastal protection offered by coral reefs and other marine ecosystems with hard infrastructure would range from $1.6 to 2.7 billion, compared with about $50 million annually to sustainably manage and maintain these ecosystems and the goods and services they provide (Munang et al. 2013).

PHOTO: SHARAFF

PHOTO: MANGROVE ACTION PROJECT

Hard infrastructure solutions for climate change adaptation, such as a seawall (top photo), are often costly to build and maintain. EbA approaches like mangrove conservation are often cheaper and offer additional benefits.

Using Economic Data to Evaluate Ecosystem-based Adaptation Approaches

Understanding the economic costs, benefits and tradeoffs of different adaptation approaches can guide policymakers and development practitioners towards the most cost-effective and sustainable strategy for a particular situation. Cost-benefit analysis (CBA), which involves the systematic identification, valuation and comparison of costs and benefits of an approach, is a useful tool to compare nature-based adaptation strategies with hard infrastructure interventions (Brown et al. 2014, Baig et al. 2015, Rizvi et al. 2015). CBA can account for both the adaptation benefits of a particular approach and additional benefits for broader development. For example, a CBA of two different strategies to address water insecurity, such as watershed protection versus construction of a water filtration plant, would take into account the full suite of costs and benefits associated with each approach, including the provision of ecosystem goods and services by the watershed.

A recent study on EbA projects in six countries (Costa Rica, India, Mexico, Peru, Philippines and Tanzania) found that the main barrier to conducting detailed CBAs was the lack of data on the value, or benefits, of project impacts, whereas the costs of project implementation were generally available. Another gap was the dearth of project impact data disaggregated by gender, indigenous groups, income levels and other demographic factors. The researchers also highlighted the need to incorporate economic valuation methods early in a project to ensure that the relevant evidence is collected (Rizvi et al. 2015).

Another study that compared the costs and benefits of ecosystem-based approaches with traditional engineering solutions for climate change adaptation in Europe also found that the majority of available data on benefits were qualitative. Projects often described impacts using qualitative terms such as "habitat protection" and "recreational opportunities" rather than providing quantitative information on the value of these benefits; even when there were methods available to quantify EbA benefits, they were often not used. The researchers did note that the available evidence indicated that the majority of ecosystem-based approaches are more cost-effective than traditional infrastructure if long-term social and economic benefits are considered (Naumann et al. 2011).

The Economic Case for Ecosystem-based Adaptation

If the relevant data are available, economic analysis can help planners and development practitioners determine the best adaptation strategy in a particular context. The following examples describe how economic tools, such as CBA, were used to evaluate different adaptation strategies and make a case for EbA:

Researchers in Fiji conducted a detailed CBA to compare EbA and hard infrastructure options to help local communities in two river catchments adapt to increases in heavy rainfall and other changes in climate. The EbA approaches ranged from planting riparian buffers to upland afforestation; the hard infrastructure interventions included raising houses and river dredging. The research team conducted detailed social, physical and economic assessments, including hydrological modeling, household surveys and economic valuation. Each EbA and engineering intervention was assessed separately, and **the researchers identified riparian buffers as the intervention with the highest impact per dollar spent**, particularly due to the low implementation cost and the monetary value of the ecosystem services generated by this approach, such as the provision of non-timber forest products (Brown et al. 2014).

In the Mount Elgon region of Uganda, researchers conducted an economic assessment of two scenarios to help local communities adapt to soil erosion, landslides and drought. The first scenario, in which communities implemented soil and water conservation measures, riverbank management and reforestation, was compared with a "business-as-usual" scenario with no EbA interventions. Researchers conducted a household survey of farmers who were practicing EbA and farmers who were not and found that **gross revenues among EbA practitioners were generally higher**. These higher gross revenues were in part attributed to improved soil quality, decreased soil erosion and less need for fertilizer among the farmers practicing EbA. The economic analysis also found that for most of the districts in the study, the profitability from implementing EbA approaches could be sustained in the long term (UNDP 2015).

In the Philippines, researchers conducted an economic analysis of different approaches to help a coastal community adapt to storm surge, coastal erosion and floods. Two EbA approaches — mangrove protection and planting — were compared with the construction of a 500-meter seawall. The research team calculated the costs of implementation and estimates of avoided damage for each approach and concluded that **the most cost-effective option was the protection of existing mangroves**. The additional benefits provided by mangroves — including provision of fish, sites for ecotourism and carbon sequestration — were estimated to be more than $170,000 annually (Baig et al. 2015).

In Peru, researchers conducted a cost-benefit analysis of an EbA project in the community of Tanta to improve grassland management and help local communities adapt to higher temperatures and changes in rainfall patterns. EbA approaches included rotational grazing, planting new pasture and protecting roughly 2,000 hectares of community land from grazing by domestic animals, allowing for the return of wildlife species such as vicuna. The research team compared the costs associated with the EbA and non-EbA scenarios and calculated the value of a number of ecosystem services, such as the provision of vicuna fiber, water for agriculture and food for domestic animals. They projected that **communities would start to generate benefits under the EbA scenario by the second year of the project and that net profits would remain higher for the EbA scenario** for the full evaluation period of 10 years (UNDP 2015).

An economic analysis of the value of coastal wetlands for protection from the effects of hurricanes in the United States concluded that the conservation and restoration of these ecosystems is a very cost-effective strategy. The researchers found that a loss of just one hectare of wetlands corresponds to a $33,000 increase in hurricane damage. When the research team extrapolated these findings to the whole country, they estimated that **existing coastal wetlands in the U.S. provide more than $23 billion in storm protection services annually***. This estimate does not include the additional benefits that coastal wetlands provide, such as nutrient cycling, carbon sequestration and provision of fish (Costanza et al. 2008).*

PHOTO: NOAA

Conclusion

A growing body of evidence supports EbA as a cost-effective and successful approach to climate change adaptation, either alone or as part of a broader strategy. Economic tools, such as CBA, can help make the case for investing in EbA; however, many EbA projects don't adequately document the economic value of their results, leading to a lack of data for conducting detailed analyses that compare different adaptation approaches. Current and new EbA projects should invest in more rigorous valuation of both adaptation results and other development benefits.

Sources

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About This Series

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