Can Ecosystem-based Adaptation help smallholder farmers adapt to climate change?

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1. Introduction

Smallholder farmers are highly vulnerable to the impacts climate change, due to their dependence on agriculture for their livelihoods, reliance on rain-fed crops and location in marginal lands. **Ecosystem-based Adaptation** (EbA, defined as the use of ecosystem services and biodiversity as part of an overall adaptation strategy) is one approach that could help smallholder farmers adapt to climate change. However, to date, there is little information on what EbA options are feasible for smallholder farmers, how effective these options are, and what the opportunities and constraints are for scaling up their use.

Here we present a new framework for identifying EbA options that are suitable for smallholder farmers and examine some of the key opportunities and constraints for scaling up use of EbA across smallholder production systems. The results presented are based on the CASCADE project (Ecosystem-based adaptation for smallholder subsistence and coffee farmers in Central America), which includes surveys with smallholder farmers, characterization of agricultural practices, expert interviews and policy reviews.

2. What constitutes Ecosystem-based Adaptation (EbA) for smallholder farmers?

In our framework, practices have to fulfill at least one criteria in three different dimensions to be considered EbA practices that are appropriate for smallholder farmers (Table 1). Practices that are based on ecosystem services (dimension 1) and that deliver 'adaptation benefits' (dimension 2) can be considered to be EbA practices. Practices that that also fulfill at least one criteria in the third dimension ('improve smallholder farmer livelihoods') are those EbA practices that we consider to be appropriate for smallholder farmers.

Table 1. Summary of three key dimensions and underlying criteria that agricultural practices need to satisfy to be considered EbA practices that are suitable for smallholder farmers. (Vignola et al., under review).

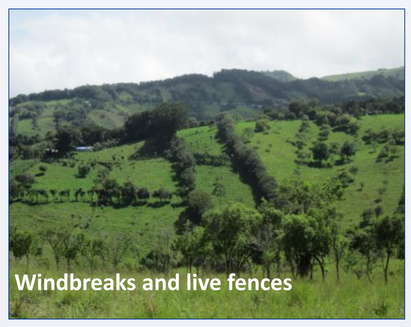
Dimension 1: **Based on Ecosystem Services**	Dimension 2: **Provides adaptation benefits**	Dimension 3: **Improves the livelihoods of smallholder farmers**
• Is based on the conservation, restoration and sustainable management of biodiversity (e.g., genetic, species and ecosystem diversity) • Is based on the conservation, restoration and sustainable management of ecological functions and processes	• Maintains or improves crop, animal or farm productivity in face of climate variability and climate change • Reduces the biophysical impacts of extreme weather events (heavy rainfall, strong winds, etc.) and high temperatures on crops, animals or farming systems • Reduces pest and disease outbreaks due to climate change	• Increases food security of smallholder households • Increases or diversifies income generation • Takes advantage of local or traditional knowledge of smallholder farmers • Uses local, available and renewable inputs • Has affordable labor and implementation costs

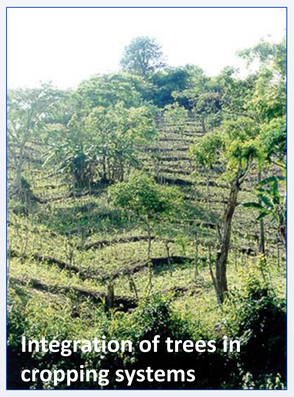
3. What are some examples of agricultural management practices that can be considered Ecosystem-based Adaptation?

Agricultural practice	Based on Ecosystem Services?	Provides adaptation benefits?	Improves livelihoods of smallholder farmers?
Use of shade trees in coffee plantations to reduce temperatures	√	√	√
Use of windbreaks to prevent wind damage and soil erosion	√	√	√
Use of live barriers, crop covers and other soil conservation techniques	√	√	√
Use of fallows to restore soil fertility	√	√	√
Crop and farm diversification to reduce risk of crop loss to climate change	√	√	√
Conservation of forests and riparian areas to ensure water provision	√	√	√

Examples of EbA in agricultural landscapes


Conservation of forest patches


Windbreaks and live fences


Integration of trees in cropping systems


Crop and farm diversification


Intercropping


Agroforestry systems

4. What are the opportunities and constraints for increasing the use of EbA by smallholder farmers?

Benefits	Constraints
• Ability to ensure the provision of key ecosystem services (e.g., nutrient regulation, pest control, pollination) on which farming depends • Ability to provide multiple co-benefits, including the diversification of agricultural production, enhanced income generation, and reduction in farm GHG emissions • Potentially more cost effective than alternative adaptation approaches (such as infrastructure or enhanced use of inputs) • Potentially more effective in the long-term at reducing the impacts of climate change	• Potentially high labor requirements and costs for establishment and maintenance • Knowledge intensive • Lack of financial incentives or programs to help cover costs of adaptation for smallholder farmers • Lack of extension services and technical support for farmers to use EbA approaches

5. What is needed to scale up the use of EbA practices in smallholder farming systems?

•Improved understanding and scientific evidence of the long-term effectiveness of different EbA practices in enhancing the resilience of crops, livestock and farming systems in the face of climate change, either individually or in combination with other practices

• Detailed information on the cost-effectiveness of different EbA practices for different ecological and socioeconomic contexts

• Mainstreaming of EbA approaches in agricultural and climate change policies, programs, strategies and funding

• Promotion of EbA through agricultural extension programs, farmer field schools, agricultural technical programs and university curricula

Acknowledgements and bibliography

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For more information, please see: CASCADE website: http://www.conservation.org/cascade

Vignola et al. 2015. Ecosystem-based adaptation for smallholder farmers: definitions, opportunities and constraints (Agriculture, Ecosystems and Environment, under review

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