

Using Ecosystem-based Adaptation for building resilience to climate change: case study from a pilot in Ha Tinh, Viet Nam.

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Ecosystem services are the benefits that billions of people around the world depend on for their livelihoods. Sustainable livelihoods are an important factor for building resilience, and any changes in ecosystem service flows can bring consequences for livelihoods and vulnerabilities (Folke et al., 2002). Ecosystem-based Adaptation (EbA) is understood that, using biodiversity values and ecosystem services to support people adapt to the adverse impacts of climate change.

Infrastructural or 'hard' adaptations to cope with climate change can have a positive impact in some certain cases, but require costly investment. Meanwhile, there are some 'soft' or green adaptation measures that offer assistance to farmers to mediate the severe impacts of climate change. EbA has comparative advantages over hard measures in that it tends to provide multiple benefits in addition to climate change adaptation (Jones et al., 2012). Since the concept EbA is relatively new, there is a need to develop and then test practical and systematic methodologies and approaches for identifying and implementing EbA practices in the field. The identification, assessment and selection of EbA practices are important not only to smallholder farmers, but also local authorities involved in developing adaptation strategies. This study shows that forest protection and enrichment is one of the most promising EbA measures for building resilience have been selected by farmers.

Smallholder farmers in Son Tho commune - a mountainous area, Vu Quang district, Ha Tinh province, Vietnam depend on ecosystems for their daily subsistence and lives. They have been severely affected by different phenomena of climate change in recent years. Thirty families in the commune were selected to participate in the EbA pilot "Natural forest protection and enrichment as a buffer during extreme droughts" - identified from the participatory Vulnerability Assessment. The pilot covers three hilly slope sections, protecting and enrichment of native timber species in the upper part, planting orange in the middle part - together with contour and soil binding techniques, and keeping bees in the lower part. One year after the start, these 30 households were surveyed to locate what ecosystem good and services they benefit from the pilot. Data was collected at meetings with commune staff, both male and female farmers through open-ended and structured questionnaires and focus-group discussions. All surveyed farmers acknowledged that they receive direct and indirect benefits of different interventions mentioned above. These benefits are to help farmers build resilience to extreme droughts - the most severe climate change phenomenon in the area.

Firstly, ecosystems are helping to maintain diversity and redundancy. Species, ecosystems, and farmers in the survey area respond differently to climate change, and different elements of this system compensate for one another functionally. According to the survey, the pilot provides all four types of ecosystem services for building resilience. Provisioning services, firewood from pruning, animal's food, and underground water in the upper part; Orange for income, animal's food in the middle part; honey in the lower part. Regulating services, water storage capacity,

micro climate regulation, runoff and erosion control, moisture and mulch contents. Supporting services, the pilot may help conserve biodiversity, increase the pollination capacity to have better fruit productivity. Cultural services, higher forest density and orange plantation bring recreational values to the community and provide opportunities for tourism.

Secondly, the participation of communities benefiting from ecosystem services is important to maintain the ecosystems. Farmers who depend on existing ecosystems for their daily lives would pay more attention to the negative impacts of the extreme weather events and the ecosystem degradation. Involvement of farmers in using and managing ecosystems is considered as key to the health and functions of ecosystems, because it increases the degree to which these farmers take ownership of them (Ostrom, 2009). The responsibility of maintaining the health of ecosystems lessens the improper using of ecosystem services by any single farmer. At the same time, the implementation of the pilot also helps to share information and raise awareness of other farmers nearby. Thus, people can see the possibilities for up-scaling pilot to a greater scale, ensure people and ecosystems have capacity to deal with climate change and continue to develop.