COST-BENEFIT ANALYSIS OF ECOSYSTEM BASED ADAPTATION FLOODING IN CENTRAL VIETNAM

Luke Brander
Ralph Lasage
Philip Bubeck
Paul Hudson
My Pham
Liselotte Hagedoorn
Toon Haer
Quang Tiến Lê
Summary

This policy brief describes the economic analysis of investments in two Ecosystem based Adaptation (EbA) options in order to reduce the impacts of flooding in Central Vietnam. Specifically, we report the results of a Cost-Benefit Analysis (CBA) of these two investments in Thừa Thiên-Huế province:

1. Planting mangroves in Tam Giang lagoon;
2. Restoring urban ponds in Hue City.

Both options deliver high returns on investment driven by substantial reductions in expected flood damages and a range of ancillary benefits to local communities including tourism and fisheries.

Ecosystem-based adaptation (EbA) can be a cost alternative approach compared to structural measures to increase flood resilience of vulnerable communities. According to the Convention on Biological Diversity, EbA “uses biodiversity and ecosystem services in an overall adaptation strategy. It includes the sustainable management and restoration of ecosystems to provide services that help people adapt to the adverse effects of natural disasters and climate change.” In the ResilNam project, we focus on two community level EbA measures:

- Restoring, maintaining, and extending mangrove forests in coastal communities of Thừa Thiên Hue
- Restoring and maintaining urban ponds and canals in Hue City of Thua Thien Hue

Figure 1: Cleaning of an urban pond in Hue to improve drainage, aesthetics and living environment
The problem of flooding in Thừa Thiên-Huế Province

The Vietnamese province of Thừa Thiên-Huế is regularly hit by floods, which stand to get worse in the future (7). Recent flood events in November 2017 resulted in VND 830 billion damages and led to the loss of nine lives (1,2). Many of Thừa Thiên-Huế’s coastal communities depend on income sources that are vulnerable to flooding and have insufficient resources to recover from disasters. For an average coastal household, 55% of its income and a little less than 20% of its food consumption comes from seafood, showing the importance of this natural resource (3). The citadel of Hue is regularly flooded negatively affecting the residents. Often women and poorer households are most severely affected by flooding and require more time to recover (4). The threat posed by floods makes adapting and managing flooding a highly urgent matter. Our analysis provides information on the cost and benefits of EbA measures. Often such information is lacking, which makes decision making and the implementation of these types of projects difficult. The findings of our project lead to tangible recommendations based on the ‘true’ value of mangroves to society, including harder to measure impacts such as aesthetics and tourism. Providing solid evidence to local and regional policy makers in support of a shift towards more sustainable DRM and CCA.

Implementing Ecosystem based Adaptation

In 2018, two EbA measures were implemented in Thừa Thiên-Huế province, by the Centre for Social Research and Development (CSRD), the Disaster Management Centre, the Women’s Union and local communities. Both EbA measures aim to reduce flood risks and support local livelihoods through a range of different ecosystem services, such as better fish stocks or an improved urban environment (4). Five hectares of mangroves were planted at two sites in Tam Giang lagoon. In the citadel area of Hue city, three urban ponds were cleaned and drainage from the ponds was restored. In bringing these groups of stakeholders together to actively adapt to climate change, the ResilNam project is helping to develop a more socially inclusive decision making process.
Cost-Benefit Analysis of Ecosystem based Adaptation investments

Cost-Benefit Analysis (CBA) is a widely used economic method for evaluating investment options by directly comparing the costs and benefits of an investment in monetary terms. This shows the value of EbA measures in a way that is easy to understand and compare to the current management options and the status quo arrangement.

Conducting a CBA of the two EbA investments involves identifying and monetizing (putting a US$ value to) all costs and benefits over a period of time in which the impacts occur. In our project we use a period of 30 years (2018-2047). Costs and benefits that occur in the future are given lower weight using a discount rate of 5% to reflect society’s preference for current benefits and delayed costs. In this assessment multiple data sources were used including stakeholder consultations, household surveys, tourist surveys, flood risk modeling and published scientific literature. More elaborate descriptions of these activities are available in the other policy briefs of the Resil-Nam project (5,6). An investment represents value for money if the calculated benefits are larger than its costs (Benefits/Costs>1).

The results of the CBA of mangrove planting are represented in Figure 1. The total costs over 30 years are US$ 38,000 with the main components being the cost of buying seedlings, planting and equipment. The total benefits are US$ 86,000, which is comprised of reduced flood damage, enhanced fish harvest and eco-tourism. The fishermen informed us that the mangroves protect their boats during a typhoon, preventing their destruction. This saves US$ 3,000 per boat, which is included in the flood protection category. The ability to directly continue fishing after a storm has not been included in the CBA, as we were not able to measure the value of this benefit. The net present value (NPV) is US$ 48,000 and the benefit-cost ratio (BCR) of 2.3 (i.e. each dollar invested returns 2.3 dollars in benefits). The value of additional carbon stored by the mangroves is estimated to be US$ 35,000 but this figure is not included in the CBA since it represents a global rather than a local benefit.

Return on investment in mangrove

The results of the CBA of mangrove planting are represented in Figure 1. The total costs over 30 years are US$ 38,000 with the main components being the cost of buying seedlings, planting and equipment. The total benefits are US$ 86,000, which is comprised of reduced flood damage, enhanced fish harvest and eco-tourism. The fishermen informed us that the mangroves protect their boats during a typhoon, preventing their destruction. This saves US$ 3,000 per boat, which is included in the flood protection category. The ability to directly continue fishing after a storm has not been included in the CBA, as we were not able to measure the value of this benefit. The net present value (NPV) is US$ 48,000 and the benefit-cost ratio (BCR) of 2.3 (i.e. each dollar invested returns 2.3 dollars in benefits). The value of additional carbon stored by the mangroves is estimated to be US$ 35,000 but this figure is not included in the CBA since it represents a global rather than a local benefit.

Figure 3: Costs and benefits of mangrove EbA investment
Return on investment in urban ponds

The results of the CBA of restoring urban ponds are represented in Figure 2. The total costs over 30 years are US$ 19,000 with the main components being the labour cost of cleaning the ponds and the cost of waste disposal. The total benefits are US$ 641,000, which is dominated by reduced flood damages, which we have assessed using a flood damage model assuming sluice gates are installed between the river and the citadel (displayed as ‘sluices in place’ in figure 4). Hence, the effect of this EbA measure is far larger if it is combined with an engineering measure. It is worth noting that the additional benefits from only recreation and tourism exceed the investment costs. The return on investment is very high with a net present value (NPV) of US$ 622,000, a benefit-cost ratio (BCR) of 34 (i.e. each dollar invested returns 34 dollars in benefits).

Conclusions

The EbA options to plant mangroves in Tam Giang lagoon and restore urban ponds in Hue City both yield high returns on investment over a 30-year period, reflecting that these adaptation measures are not costly to implement and deliver high benefits to the local communities in terms of reduced flood damages and improved livelihood from fishing and tourism. We note that the analysis is not comprehensive, particularly in terms of including all identified benefits. It was not possible to monetise and include the emotional/wellbeing effects of flood protection (see the separate policy brief for details) or the improvement in sanitation and health from pond restoration. Including these additional benefits would further increase the return on these EbA investments. The flood damage models we developed are relatively simple and include several assumptions. Hence, the results have some uncertainty. However, sensitivity analysis shows that the final outcome of a positive C/B ratio does not change due to using other assumptions.

These findings suggest that there is a strong economic rationale for exploring the potential to scale up such EbA investments in Vietnam. Moreover, by actively involving local communities in valuable adaptation projects we directly build their resilience while creating a more inclusive decision making process.
The ResilNam project

In addition to this policy brief, the ResilNam project will complement these findings by also making further recommendations regarding:

• The benefits of ecosystem-based adaptation measures for strengthening the flood resilience of poor and vulnerable;

• How local communities value ecosystem-based adaptation measures and their benefits;

• Gender dynamics in disaster risk management;

• Community level adaptation projects.

The policy recommendations across all of the ResilNam activities can help to increase flood resilience of urban and coastal communities in Thua Thien Hue Province. Additionally, the Resilnam Project directly invests in ecosystem-based adaptation measures in collaboration with local stakeholders to increase flood resilience and strengthen the role of women in disaster risk management. For instance, joint activities between the Women's Union and the Disaster Management Centre are facilitated.

More policy briefs and information on the project can be accessed at the weADAPT platform.

Contact:
My Pham (CSRD, Vietnam): dieumy.csrd@gmail.com
Philip Bubeck (University of Potsdam Germany): bubeck@uni-potsdam.de
Ralph Lasage (IVM, the Netherlands): ralph.lasage@vu.nl

References

1. KTTV. Thua Thien Hue: Khan truong khac phuc hau qua sau mua lu. 2017 [cited 2018 11th January].
6. Hudson, P, Pham M, Hagedoorn LC et al. Gender differences in flood resilience in central Vietnam. ResilNam policy brief #1, 2018