

Meso-Level Analysis on Rice-Farmers' Adaptive Measures for Slow Onset Hazard: The Case of Saltwater Intrusion in the Philippines and Vietnam

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Photo by Thi Ha Maung

Saltwater intrusion is a problem among Filipino and Vietnamese farmers. Well-constructed intervention policies and training can support the decision to continue rice cultivation and create stronger communities amidst the threats of saltwater intrusion.

Slow onset hazard brought about by climate change is a primary sustainable development challenge, which must be addressed at the local level, focusing on the adaptive capacity of people. In most recent literature, the theoretical conceptualization and empirical measures of adaptation especially on slow onset hazards remains a subject of contentious debate. This study aims to provide an alternative approach for the conceptualization and measurement of the multidimensional aspects of adaptation in the context of a slow onset hazard, such as saltwater intrusion in rice farms in northern Mindanao, Philippines, and the Mekong Delta, Vietnam.

It is well-known that rice is a staple in these two countries; thus, climatic factors affecting production could impact food security. At a certain stage, a combination of stresses may

exceed the coping capacity of vulnerable socio-ecological systems, raising the risk that could adversely affect food security goals, and eventually, outcomes of community development due to the lack of a timely response (Arbuckle, Morton, and Hobbs 2015; Byrne 2014; De Bruin et al. 2009). The losses from creeping hazards may even be more substantial than in the case of sudden-onset hazards (Bryan et al. 2013).

Clearly, slow onset hazards such as saltwater intrusion require appropriate responses in its earlier stages to avoid more damage to people's livelihoods (Arbuckle et al. 2015). According to the International Rice Research Institute (IRRI) in 2010, flooding of ricefields periodically occurs in about 15–20 million hectares of Asia's ricefields. The Food and Agriculture Organization (2010), on the

other hand, estimated that about 6.5 percent or 831 million hectares of the world's total area is affected by saltwater intrusion.

Vietnam and the Philippines present an opportunity for investigation of these issues as these two countries are some of the most threatened by sea level rise and saltwater intrusion, with global ranking at number four and seven, respectively (ADB 2017).

Methodology

The research was based on a survey conducted through personal interviews, using Kobotool App, consisting of 326 coastal rice farmers in the municipality of Plaridel, Misamis Occidental in northern Mindanao, Philippines, and 258 rice farmers in two districts in the provinces of Ben Tre and Tra Vinh in the Mekong Delta, Vietnam. One of the main goals was to come up with a typology of measures to identify and systematically track adaptation across households. This aims to draw upon the general data that can be used to provide information to policymakers and various stakeholders. This study also applied both qualitative and quantitative assessments of rural rice-farming households' adaptation measures to respond to saltwater intrusion. The measures were then classified into categories: technology-based, farm-based crop management, ecosystem-based adaptation (EBA), off-farm income diversification, and other measures. They also developed a multicriteria assessment tool on adaptation measures based on stakeholder analysis and expert judgment.

Adaptation Measures

The abandoned farms near the shoreline of the municipality of Plaridel silently testify to the ravages of saltwater intrusion. It has also driven some local farmers from the land. As the salt remains in the rivers and canals, and slowly progresses inland, it confronts progressive waves of farmers with a decision to either find ways to combat it or leave.

In Vietnam, the two provinces in the Mekong Delta region are constantly affected by saltwater intrusion given their location near ocean coastal areas, where saltwater moves into freshwater aquifers. The saltwater intrusion happens naturally to some extent; however, climate change and changes in rainfall make it more severe. In addition to saltwater intrusion, drought and rising temperatures cause problems to agriculture and aquaculture.

This is economically devastating for the farmers in the two countries. Yet, because the damage is incremental, a slow onset hazard like saltwater intrusion does not receive the same attention as the more spectacular effects of climate change. Thus, this research investigated the context-specific, local-level abilities of farmers to adapt. Specifically, it analyzed how farmers make adaptation decisions and how these adaptation decisions can be measured quantitatively.

What emerged is that the knowledge of farmers in both countries concerning adaptation is insufficient for them to make informed choices. The measures currently being implemented are mostly traditional techniques, which often provide short-term benefits, but do not address the complex hydrological conditions present, and could result in greater risks in the future.

Four measures were considered relevant and currently practiced by at least 50 percent of the farmers in the Philippines. These are replacing the damaged plants, desalination by draining the saltwater with fresh water from irrigation, engaging in non-farm income sources, and livestock production. Relatively, the same proportion of farmers practice only two measures in Vietnam. These are desalination and livestock production.

In all the typologies of adaptation measures, the observed adaptation for the previous, current, and the future cropping seasons do not significantly vary. It can be gleaned from the results that farmers follow customarily what have been practiced.

Four major criteria were chosen in the assessment of the feasibility of the adaptation measures, namely: ability to implement the measures, effectiveness, cost efficiency, and level of support from major stakeholders. The farmers' assessment of their ability to implement the measures concentrate on the most common measures they are currently implementing.

Majority of the farmers in both countries do not have insurance due to lack of awareness. Despite the insurance being provided for free in the Philippines, farmers are often intimidated to instruments coming from formal financial institutions. It also stresses the need to strengthen the popularity of insurance as an adaptation option among farmers through various supporting programs. This may include premium subsidies and insurance sensitization through the government extension workers and the farmers' associations, where they often source support for their farming activities and access primary information.

Table 1. Major adaptation measures for saltwater intrusion in the Philippines and Vietnam

ADAPTATION MEASURES	PHILIPPINES (%) n=328	VIETNAM (%) n=258
Off-Farm Diversification		
Aquaculture	1.23	2.33
Non-farming activities	50.11	10.85
Livestock production	51.56	59.3
Ecosystem-Based Adaptation Measures		
Desalination	58.90	35.27
Filtering water	17.79	5.06
Planting trees/mangroves	4.59	1.16
Fish culture in rice form	0.61	4.65
Farm-Based Crop Management		
Replacing damaged plants	65.03	3.49
Growing multiple crops	23.62	2.33
Technology-Based Adaptation Measures		
Using saline-resistant variety	2.45	6.20
Changing timing of chemical use (fertilizer, pesticide, herbicide)	31.60	3.10
Using crop rotation	20.86	1.94
Changing timing of irrigation	21.47	8.91
Other Measures		
Buying insurance (crop insurance)	10.12	0
Moving to other place	0.73	0

Figure 1. (Top) Abandoned rice plot affected by saltwater intrusion, Plaridel, Misamis Oriental Philippines (Photo taken April 2017); (Bottom) Ricefield affected by drought in Cang Long District, Tra Vinh Province (Photo taken June 2016)



The combination of adaptation measures that farmers employ, captured through the measure-based adaptation index (MAI), indicates that adaptation takes place at different levels, i.e., the propensity to adapt, the variety and diversity of adoption of various measures, the feasibility of the various measures, and the varying conditions of saltwater intrusion. The low MAI of the coastal rice farming households in the two countries makes them more vulnerable to multiple and compounded climate stresses, variability, and climate-induced natural disasters in the agriculture sector, apart from the saltwater intrusion challenge that they face. In order to reduce the saltwater intrusion-induced loss and damage, a series of adaptation options, which are not currently being implemented by farmers, must be further evaluated.

Despite the limitations in measures currently implemented by the farmers, these options could form the basis of government policy to support adaptation. But, more innovations will also be needed for effective adaptation, as the chances of crossing critical ecological, physical, and social thresholds increase.

Innovative Adaptation

Innovative adaptation means, above all else, improving the economic status of rice farming households. This is crucial as it will influence adaptation diversity and improve the overall adaptation index.

Financial viability is the major concern of farmers in choosing adaptation measures. Increasing their income in the short term will motivate farmers to adapt relatively costly measures to combat saltwater intrusion. Measures that increase their income would also ease the liquidity constraints that farmers face and encourage their adoption of new technology.

Long-term innovative adaptive transformation will, however, mean investments that most farmers cannot afford. Hence, this will require assistance from the government and agencies. This may involve innovative technology such as developing salt-tolerant rice suitable for the biophysical characteristics of coastal farms.

One way to encourage technology-based adaptation is to improve access to the inputs necessary for the implementation of these measures. This would be especially effective if more farmers can be convinced that this would have positive effects on their families and their community. Increased investment in human and social capital should also complement the adoption of the measure.

Innovative adaptation measures should be developed based on community needs and capacities. Policies should not only be based on ecology but also on economic factors, especially the financial plight of vulnerable rice farming households. The findings support the design of measures to create off-farm livelihoods, so farmers can supplement their income in the face of saltwater intrusion.

These off-farm livelihoods should build new skills and capabilities and reduce dependence on natural resource extraction. Tailored programs that encourage adoption of specific measures may be highly effective not only for improving the ability to combat saltwater intrusion, but also for reducing vulnerability.

At a lower level, innovative adaptation implies the timely delivery of climate-related information to increase preparedness in planting. This means meteorological information should be collected and the biophysical characteristics of the ricefields monitored to provide an accurate basis for assessing the likely impact on production.

Training and Social Support

The research recommends a transdisciplinary approach that links data and results with biophysical data sets. Knowledge transfer and communication from scientists must be complemented with analysis from multi-disciplinary experts and translating them into appropriate facts for local decision-makers and the farmers.

Providing farmers with training against saltwater intrusion significantly influences their decisions to take up adaptation measures. Policies that generate

incentives for active participation in farmers' groups if the efforts to boost the adaptability of coastal rice farmers and their livelihoods prove successful are equally important.

Communal water systems require adaptive cooperation, so labor and other resources can be pooled to construct and maintain canals and channels, allocate and share water, and regulate and monitor the provision and use of water. The cooperation of the farmers for irrigation plays a significant role in shaping responses to issues of social trust, reciprocity, competition, conflicts, equity, and other mutual concerns related to water access. Effective social organization and rules for collective action are crucial to coordinate cooperation for irrigation use.

Lastly, group and labor collaboration activities manifested by the labor pooling system widely practiced by farmers may be effective to incentivize participation in groups. When farmers perceive that they are supported within their groups, this may strengthen sharing of indigenous knowledge, experiences, and exchange of information about new technologies. Group membership can, therefore, enhance social learning and knowledge spillover on adaptation to saltwater intrusion.

Photo by Le Minh Quat

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