

Climate information, water management and local adaptation decision-making

Adaptation Knowledge Brief:
Lessons from Implementation experience

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Overview

How can climate and hydrological modeling best support water management and local adaptation decision-making in complex environments? This brief discusses lessons learned from a pilot project implemented by the Global Center on Adaptation (GCA) in Bangladesh that sought to introduce climate information to support farmer adaptation strategies, and makes recommendations for future programming.

This brief draws on evidence from a pilot project implemented by the Global Center on Adaptation (GCA) in Bangladesh under the “Scaling up Investments in Nature-based Solutions for Climate Resilience” project funded by Global Affairs Canada from 2023- 2026.

The project

GCA worked with BRAC (the world’s largest southern-led development organization) and the International Water Management Institute (IWMI) to implement a project entitled “*Integrated Social Development Through Climate Resilient Water Services.*” The goal of the project was to embed local climate risk assessments and hydrological modeling into adaptation planning and delivery. After conducting risk assessments and hydrological diagnostics, climate information was used to co-develop and pilot adaptation strategies that address both current climate vulnerabilities and future climate projections. These adaptation strategies would be delivered through BRAC’s integrated development programs.

Working with local partner Dascoh, the project team conducted a modified version of farmer field schools to:

1. Help farmers understand climate change impacts, water scarcity, and groundwater depletion
2. Build farmers’ capacity to adopt climate-resilient and water-efficient alternative cropping systems
3. Promote diversified alternative livelihood options and
4. Strengthen farmers’ knowledge of basic market linkage, value addition, and small-scale agri-business and livelihood models.

In addition to workshops, the project also facilitated exposure visits for farmers to see adaptation strategies currently being used by other farmers and helped model farmers establish demonstration sites.

The project aimed to shape adaptation decision-making at multiple scales:

1. adoption of adaptation solutions by farmers at the individual scale
2. institutionalization of climate risk-informed decision-making into BRAC's programming and
3. policy and planning at the regional scale for water management in the Barind tract.

Lessons for embedding climate information into farmer adaptation decision-making

The project experience points to several lessons learned and best practices for how climate and hydrological modeling can best support water management and local adaptation decision-making.

Climate adaptation and water management require integrated solutions across scales

The Barind tract region in northeastern Bangladesh is a complex environment for water management. It is a drought-prone region, with low rainfall and high temperatures (often exceeding 40 C), but is also known as the “breadbasket” of Bangladesh for its Boro paddy rice production. This productivity was enabled through the promotion of deep tube wells in the 1980s that led to the dramatic expansion of irrigated agriculture in the region and the transition from a single crop cycle to two to three cycles annually. As a result, the region is critical to national food security.¹

While climate change increases the vulnerability of water resources in the Barind region, stakeholders across the region emphasized that many of the underlying challenges are geopolitical, institutional, and reflect the history of development strategies in the region.

Due to its unique geography, which consists of a thick (20-25 cm) clay layer, there is very little water percolation and groundwater recharge. For the past 10-12 years, groundwater extraction has exceeded recharge rates, leading to groundwater depletion. In the past several years, farmers have reported needing to pump for 3-4 hours to get the same amount of water that they used to receive in 30 minutes of pumping. Based on modeling conducted by IWMI for this project, the lack of sustainable water management strategies threatens long-term ecological health of the region and is already impacting food security and farmer vulnerability.

While the project focused on farmer adaptation decision-making, many of the dynamics shaping water management can only be understood at a larger scale and require coordination with regional actors. Agriculture is highly dependent on irrigation, managed by the Barind Multipurpose

¹ Banerjee, P. S., & De Silva, S. (2019). Pro-poor groundwater development: the case of the Barind experiment in Bangladesh. IWMI. Available at: <https://openknowledge.worldbank.org/server/api/core/bitstreams/14847c39-a898-5e86-a56f-67c4bd8a8fa2/content>

Development Authority (BMDA). BMDA is a critical partner for any water management initiative in the Barind. It recognizes the importance of assuring the long-term sustainability of water resources. At the same time, BMDA's operating model is premised on fees from groundwater extraction, creating incentives for continued groundwater extraction.

One water management strategy is to increase reliance on surface water. BMDA has been investing in restoring canals to enable strategic use of surface water, but there are limits to this strategy. Most of the surface water flows through the Padma River, and water availability is highly dependent on releases upstream by India. In addition, ponds traditionally played an important role in seasonal water management, but as ponds have been increasingly used for aquaculture, their potential to serve as a reserve for water management is constrained by the water needs of the aquaculture sector. Instead, ponds now supplement water supplies during the dry season, although they still play a role in supporting water management.

Any adaptation strategy that doesn't take into consideration these broader drivers of water management and the incentives that have led to a strong reliance on groundwater irrigation is unlikely to be successful. Working with partners that are attuned to these complex political and economic realities is necessary to ensure an integrated approach.

Translating climate models into useful information for farmers requires clarity on decision-making needs

One of the biggest challenges that the project wrestled with was how to present climate data in formats that would resonate with farmers. Project partners at GCA, IMWI and BRAC identified three major challenges for translating climate information into decision-making at the local scale:

1. Time-scales:

Climate projections estimate changes out into the future (for example, the models that IMWI developed project impacts for 2060), but farmers are making agricultural decisions for the upcoming growing season, or investment decisions for the next several years. Identifying how far into the future to provide information was a significant challenge for the project team.

This issue points to the importance of tailoring climate information to the decision-making needs of different actors. While farmers may not currently be making decisions beyond a few years, the organizations that provide support to farmers, such as BRAC and Dascoh are planning longer-term strategies. As they work to promote alternative crops and livelihood strategies, being able to project the long-term viability and resilience of different strategies is very valuable.

A key lesson from this pilot initiative is that before communicating with farmers, ensuring consistent messages on climate across partners that are working with farmers is important to avoid confusion. This requires investment in capacity-building and training for field staff that informs both programming strategies and technical assistance to farmers.

2. Accuracy:

For the modelers at IMWI, ensuring accuracy and robust results was a high priority. Generating climate and hydrological models is very data and time intensive. Daily projections of rainfall and temperature from global climate models that included projections across seven global climate models and multiple future scenarios, allowing the team to select a global model that performed well against local historical data. IMWI used observational data from the Rajshahi station to validate the global models. Once downscaled local projections were developed, crop models were run for current and potential climate-resilient crops to identify agricultural impacts. Similar processes were undertaken for the hydrological modeling.

While accuracy is important, there are real trade-offs between the time and effort required to gain greater precision in modeling results and the value of the additional information for decision-makers. If decision-makers only need to understand general trends (i.e. that water stress is going to be worse in the future) to decide to invest in water-saving strategies, perhaps detailed modeling is not needed.

On the other hand, some of the crop modeling revealed thresholds for crop viability that were highly sensitive to small shifts in temperature trends (for example, changes in nighttime temperatures may make crops like wheat unviable in the future). While such crops may at first appear like strong alternatives from a water management standpoint (i.e. wheat is less water intensive than paddy rice), once the temperature projections and crop implications are integrated, a more complex picture emerges.

The pilot initiative showed that detailed local modeling can provide decision-relevant climate information but that adaptation needs must guide model development.

3. Science Communication:

After developing detailed models, the findings needed to be translated into messages that would be relevant to farmers. The feedback from the training sessions with the farmers indicated that the modeling results resonated strongly with their lived experiences and therefore was well-received, but that more time was needed, particularly to understand the implications for adaptation strategies. There is a significant gap between understanding what the science tells us about the problem to using that science to adopt solutions.

One reflection that a GCA colleague made was that while we often discuss the importance of climate information for investment decisions when

"You need to make sure the scientific language is easier for the farmer- much much easier. They don't know about the groundwater, the stress of the groundwater. They know they need to cultivate their Boro rice which is very important."

- BRAC field staff

"We were thinking if we had more time, we would have liked to convert all the aquifer science—how groundwater functions—how it works—into an illustrative video to help people understand how a resource below their ground works... you can't understand a resource you can't see, so how do you make it visible? ...The biggest challenge was the science communication."

- IMWI project partner

thinking about large-scale investments like infrastructure, farmers are also making investment decisions. Tailoring climate information with this in mind should guide the science communication process.

Adaptation initiatives should leverage policy windows of opportunity to create entry points for adoption of adaptation strategies

One of the most significant barriers to adaptation is that climate change is viewed as a “future” issue and more immediate concerns take priority. Even when actors recognize the importance of adaptation, it is challenging to compete with urgent development needs. Policies can, however, create windows of opportunity that re-shape the salience of adaptation. However, these policies on their own do not ensure adaptation; targeted adaptation efforts are also required.

The Bangladesh government recently published a degree declaring a number of upazilas in the Barind as water stressed, which triggered the enforcement of the Bangladesh Water Act of 2021, and has led to restrictions on groundwater pumping, including prohibitions on new tube wells for irrigation, limits on the number of hours for pumping, and rotations for irrigation.

The project found that being shown the modeling results of groundwater depletion helped farmers contextualize the policy decree. Field staff reported that farmers have questioned the scarcity of groundwater. They have heard reports from other locations that digging deeper wells has been successful and wanted to understand if this was a viable strategy in their location. Seeing the evidence gave them greater confidence that it is necessary to invest in shifting agricultural strategies and investing in alternative water-saving strategies.

These restrictions have created a new sense of urgency to adopt water-saving alternative agricultural techniques and livelihood diversification strategies, which were reinforced by the training on groundwater depletion. Both farmers and the institutions with which the project engaged were much more aware of the need to conserve water and ready to take action to shift than they were previously.

Promotion of alternate crops and livelihood diversification requires significant complementary support

Providing farmers with training on climate impacts and water stress, or even on adaptation strategies, is not enough; it must be paired with integrated support that enable adoption of new agricultural techniques, crops and livelihood strategies.

For this reason, BRAC is an ideal partner for this initiative. BRAC is the largest NGO in the world and is widely celebrated for its leadership role in social innovation, poverty alleviation and development. It has extensive experience delivering integrated agricultural and water management strategies for



Demonstration plot for Alternate Wet Dry (AWD) rice production, a water-conserving agricultural strategy promoted by the project

farmers across Bangladesh, including in the Barind region.

As many initiatives supporting technology adoption and livelihood strategies have demonstrated, farmer risk aversion makes technology adoption challenging.² Project partners commented on the high levels of entrepreneurship in the Barind region and openness to new strategies, suggesting that risk aversion may be lower in the region than other places, but farmers still need to see new strategies in use before making decisions to adopt unfamiliar strategies, and support to successfully use new agricultural techniques once an adoption decision is made. Support to farmers that extends only for the length of an individual project is unlikely to lead to sustainable adoption strategies. Implementing partners like BRAC with a deep and long-lasting presence on-the-ground are well-positioned to support such adaptation strategies.

In addition to technical assistance directly related to farming strategies, transitioning to alternative crops or livelihoods necessitates broader system-level support. For example, orchards were identified as an appropriate adaptation strategy in the Barind, but successful adoption requires strong market linkages, development of value chains, and business models.

If effective, these market linkages can support farmer resilience, but there can also be tensions between market-based development strategies and climate resilience strategies.³ An institution like BRAC with deep expertise in market development to support poverty-alleviation and social innovation is uniquely well-positioned to navigate these tensions.

² Kuhl, L. (2020). Technology transfer and adoption for smallholder climate change adaptation: opportunities and challenges. *Climate and Development*, 12(4), 353-368.

³ Kuhl, L. (2018). Potential contributions of market-systems development initiatives for building climate resilience. *World Development*, 108, 131-144.

Recommendations

Extend the timeframe of the initiative

The project activities were conducted in less than one year, which included multiple phased activities. A key recommendation, emphatically raised by all project partners, was that the initiative needed significantly more time to achieve its full potential.

Local climate models needed to be developed by IWMI, but BRAC and Dascoh also needed to conduct training of trainers, farmer field schools, and pilot activities with farmers in this same window. Ideally, these activities would have been sequenced, but due to the timeframe of the project, these activities overlapped. If there had been more time, coordination across partners would have been enhanced and more opportunities to translate climate information into decision-making could have been developed.

"We did not get any results, because after two months in the field, after planting some demonstrations, it will take at least a year to see some results, so we can wait for that, and some follow-up is also needed. Otherwise they will think so people came, collected some data, and left."

- Dascoh field coordinator

Initiatives that focus on demonstration need to build in time for the demonstrations to be developed. This is important not just from a practical standpoint, but also, as the coordinator reflected, in terms of the long-term trust and relationships that BRAC and partners have with farmers.

Due to the short implementation period, the project relied more on exposure visits than they otherwise would have. The team shared that exposure visits were an effective strategy to introduce people to the resilience strategies, but if there had been more time or more resources, it would have been more effective to do local demonstration activities and more peer learning on-site. This would have been both more cost-effective and enabled the project to expose a larger number of farmers to climate-resilient strategies.

As BRAC and Dascoh partners identified, particularly for agricultural interventions, it is critically important to attend to the seasonality of cropping cycles and design the project activities around the agricultural cycle. Many adoption decisions can only be made at one point in the growing cycle.

By concentrating all farmer engagement and demonstration activities in a several month period, the project missed the opportunity to demonstrate strategies across the year.

Integrate support within BRAC's Adaptation Clinics

The pilot project demonstrates the potential of this model to achieve scale. Dascoh and BRAC see enormous potential to expand the project geographically, as well as engage over a longer time period with farmers.

As a pilot, the project worked in three unions and was only able to reach a small percentage of farmers, but as BRAC as Dascoh colleagues remarked, the government declared 42 unions to be water stressed, all of which could benefit from similar initiatives.

One strategy to institutionalize the delivery of training on climate and hydrological information is to build on BRAC's Adaptation Clinics. The Adaptation Clinics are a model BRAC is piloting, primarily in the southwestern region of Bangladesh, as a "one-stop shop" for technical assistance on adaptation. The trainings strategies piloted in this project align well with this model.

Focus on internal training for BRAC and other implementation partners

One of pieces of feedback from BRAC and Dascoh was that the training on climate and water modeling was very helpful, but that more capacity-building of their field staff is required. While BRAC has a strong institutional mandate to mainstream climate change into its work, and its climate team has a high degree of capacity to interpret and use climate data, field staff do not share the same familiarity and expertise.

While there is clear value to farmers of having climate information, particularly for some impacts that are projected to occur further into the future, the highest value of the climate and hydrological modeling is not for decision-making at the farmer scale, but for programmatic planning over slightly longer time horizons.

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