

Agricultural Water Management and Livelihoods in the Jaldhaka Watershed in West Bengal, India

Key Findings

- The three main livelihood systems of the section of Jaldhaka watershed were classified as: farmers with multi-crop agriculture, households with off-farm income, and independent tea-producing farmers. Independent tea producers do better financially than those with multi-crop agriculture, who are still more secure than those dependent on off-farm income.
- The Jaldhaka watershed agricultural production and development is not restricted by availability of water resources, but by land area per smallholder household and limited opportunity to intensify water use through access to appropriate irrigation.
- Groundwater supplies most water uses, and pumps are needed for access. These are limited in availability, affecting the opportunity for optimal irrigation scheduling, thereby decreasing yields.
- Since each household depends on and manages its own resources, and there are few community endeavors related to livelihood strategies and farming, those without land, or with particularly small parcels, are very vulnerable.
- Over time, the decreasing number of animals (and thus, cow dung) due to mechanization, and increased crop intensification have led to an increase in use of chemical inputs such as fertilizers and pesticides. This, in turn, has caused an increase in health problems, especially for farm and tea plantation laborers.
- Increasing intensification of crop production on diminishing land parcels is needed to reduce poverty and raise income. Due to the difficulties in increasing income from the traditional cropping patterns, those farmers in the upper part of the watershed who have the appropriate land type and enough finances to wait the initial two years before the first harvest have shifted to producing tea as their sole cash crop.
- The cropping intensity in the watershed is very high (163 per cent in Maynaguri District and 192 per cent in Coochbehar District), and knowledge on soil fertility and soil health limited. Thus, soil fertility may be another limiting factor for improving yields on smallholder plots. Further knowledge is needed to ensure investments in irrigation are realised through good soil health and nutrient management.

What are Agricultural Water Management interventions?

Agricultural water management (AWM) interventions are increasingly being promoted as a first step to enable positive development, alleviating food insecurity and poverty in the smallholder farming systems that dominate rural South Asia and sub-Saharan Africa. These AWMs range from *in-situ* soil and water management improvements (conservation tillage, terraces, pitting) to supplemental and full irrigation systems, drawing water from a wide variety of sources in the landscape. However, re-allocation of water can potentially undermine other uses of the same water, for other livelihood purposes or, indirectly, by reducing availability for support of different ecosystem services. This case study, in the Jaldhaka watershed in West Bengal, India, aimed to create a baseline of resource-based livelihoods and to assess the local hydrology. Scenarios were developed through consultations with local watershed experts to discuss potential impacts on the various livelihoods and water resources in Jaldhaka, of various AWM interventions.



Figure 1: Farmer in the Jaldhaka watershed using a treadle pump

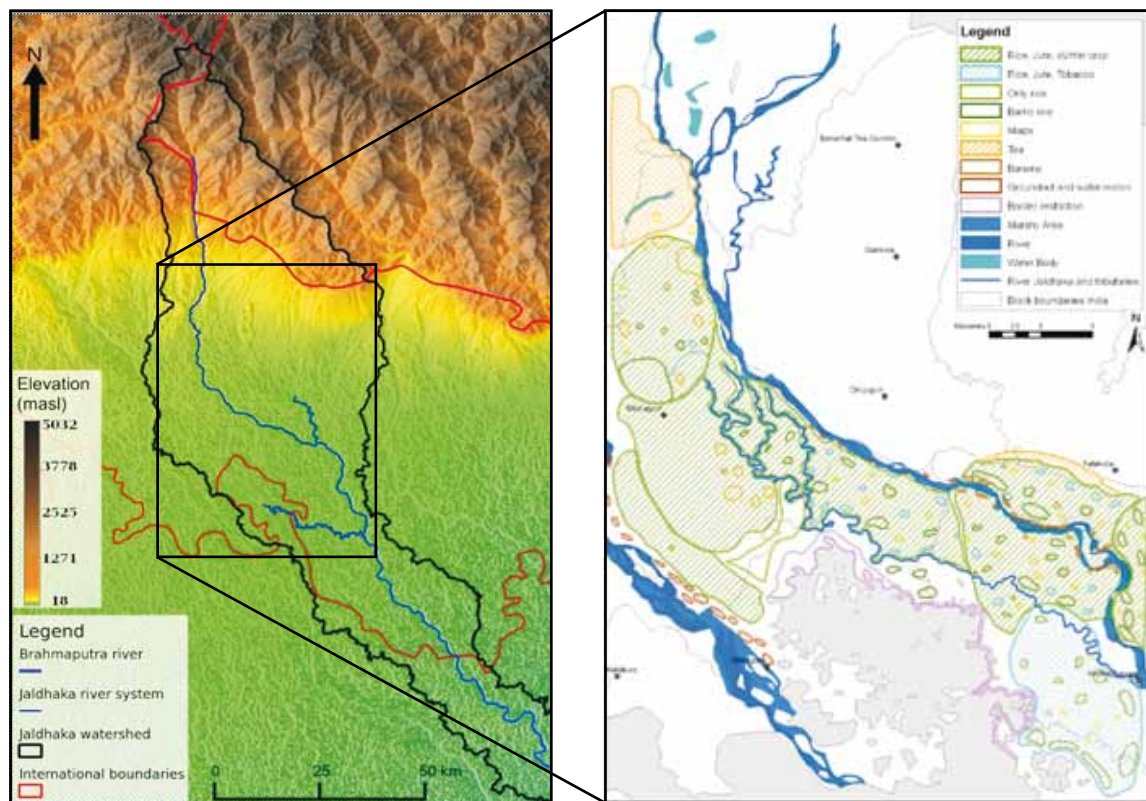


Figure 2, a: Delineation of the Jaldhaka watershed and the river tributaries, b: land use map relating to the three livelihood strategies identified.

What is the hydrologic situation in the Jaldhaka watershed?

The Jaldhaka watershed is endowed with 3,300 mm of rain per year, supporting mostly smallholder farmers. West Bengal is the most densely populated state in India, with about 900 inhabitants/km²; a large amount (about 32 per cent) of the population lives below the national poverty line. The river Jaldhaka is a tributary of the Brahmaputra River and flows through Bhutan, India and Bangladesh (figure 2a). The total area of the Jaldhaka watershed is 6,140 km², lying mainly in India (66 per cent) and the rest almost equally in Bangladesh (18 per cent) and Bhutan (16 per cent). The watershed experiences high rainfall with an average of 3,300 mm/year, 80 per cent of which falls during the rainy season, June-September. The Jaldhaka River is perennial but has high seasonal variation. There is a wealth of shallow groundwater in the area with average groundwater level at 2-4 meters deep.

What are the main livelihood strategies in the watershed?

Three main livelihood strategies were identified in the watershed: multi-crop agriculture, off-farm income, and independent tea production. The most striking aspect of the livelihoods in the Jaldhaka watershed is the strong sense of individuality: each household depends on and manages its own resources (land, trees, and groundwater), and there are few community endeavors related to livelihood strategies and farming. This makes those without land, or with particularly small parcels, very vulnerable.

Multi-crop agriculture livelihood

The average household in our study owns 5 bigha (0.8 ha). The intensity of production is high, with 3 crop cycles per year and no fallow period. The main cropping patterns are jute-rice-winter crop (potatoes, and/or vegetables) and jute-rice-tobacco (see

figure 2b). Additional crops included maize, banana, bamboo, watermelon, and groundnut. Rice is the staple crop s predominantly for consumption. Farmers with access to regular irrigation from groundwater in the lower part of the watershed grow off-season rice as a cash crop. Smallholders use some local and some hybrid seeds, a combination of fertilizers (including cow dung) and a significant amount of pesticides. They own live-stock and poultry, but cows are the most important, providing financial security in addition to milk and labour for ploughing.

Off-farm income livelihood

Some households in the watershed rely heavily on off-farm income for their livelihoods, either to supplement their insufficient farm production, or as their sole earning activity. Most households in this category cultivate crops on their own land or on leased land, using off-farm income to supplement food supply; others buy all their food. In difficult times, they may rent out their land for immediate income or mortgage it to purchase inputs. They work as seasonal labourers on other's fields or in nearby factories. Tea plantations provide work for some, whereas service work such as construction for government programs, providing school lunches as part of Self Help Group (SHG) programs, or driving a bicycle rickshaw, is another major off-farm employer. Although they may receive the most income from off-farm labour, their rice and cows are still very important. And, when prioritizing what is considered more 'desirable' work, owning your own farm is highest, leasing land is next best, and labouring is the least desirable.

Independent tea production livelihood

Some farmers, largely those in the upper part of the watershed who have the appropriate land type and enough finances to wait the initial two years before the first harvest, have started their own small tea gardens. Although there is competition from the large market-savvy tea companies, it is a lucrative cash crop. And, a few SHGs have been established to help the independent producers receive



Figure 3: A tea grower transporting the irrigation pipes to the next tea field

higher profits. Many of the independent producers participate in SHGs that collect the tea, sell it, and distribute the profits to the farmers. Being part of the SHG means that farmers do not have to pay to transport their tea and they have the security of a guaranteed buyer. Others have chosen to be ‘out-growers’, where they sell their land to a tea company, continue producing tea on the same plot, and the company purchases all of the produce. Both purchased fertilizers and cow dung are used, and pesticides are heavily used.

What are the main challenges faced by farmers?

Lack of electricity is a major concern for smallholders. Affordable electricity would enable cheaper irrigation (switching from diesel to electric pumps) and light for their children to study at night. Improvements in veterinary care would also make a significant impact on the health of their animals, thereby improving their financial security. Although marketing is a challenge, the Agriculture Department is setting up village information centres to help farmers to better handle price fluctuations.

How are people managing water for agriculture?

The livelihood group of ‘multi-crop agriculture’ predominantly uses groundwater for both domestic use and irrigation. Domestic water is accessed at each household using hand pumps. The most common method of irrigation is diesel pumps, followed by electric pumps, and then treadle and hand pumps. Along the smaller rivers farmers use canals, ponds and river lift irrigation. A few farmers in each village own a diesel or electric pump and rent them out to the others. However, pump rental is often prohibitively expensive and unavailable at the necessary time of irrigation due to high demand. The tea growers largely use flood irrigation by pumping groundwater with a diesel or electric pump. Tea gardens near to a river will also use river water for irrigation.

What potential impacts could AWM interventions have?

A small group of watershed experts discussed two possible scenarios with AWM impacts: ‘electricity for all’ was considered to be largely beneficial for the people in the watershed while ‘wide-scale expansion of independent tea production’ was seen to be overall negative. The following impacts were developed by the participants for the two scenarios:

The scenario ‘Electricity for all’

If the government provided the infrastructure for complete electrification, most would be able to afford the installation fees and connections. However, some would not be able to do so, despite possible government subsidies to lower the costs. Individuals ‘squatting’ in the riverbeds would not benefit because they have no identification or fixed address. However, others would benefit: the already powerful large electricity companies would gain power due to increased dependency on their service. Children would benefit from being able to study in the evenings, further benefiting the whole education sector. Government training facilities would improve through the use of computers, making farming clubs the portal for market information. Civil society institutions would improve their external connections through computers, and ultimately raise their budgets.

Farmers would be able to use pumps at the optimal time, increasing yields and thereby income, allowing the use of improved machinery, and further increasing yields and income. The entire chain of input shops, cold storage, processing and packaging units, marketing, and transport would benefit from the increased production. The tea growers would also benefit by being able to use sprinkler irrigation and power sprayers for pesticide application. By improving roads and increasing facilities (such as cold storage), the benefits of increased production would be even greater. However, despite the positive impacts, the increased production could lead to depletion of water resources, increased pollution from pesticides and fertilizers, and potentially negatively impact livelihoods and health in the long-term.

The scenario ‘wide-scale expansion of independent tea production’

If all farmers with suitable land took up independent tea production, those farmers would benefit from increased income. Opportunities for labor would increase, and membership in SHGs and farmers clubs would rise. Input shop owners, packaging and processing units, and the transport sector would also benefit. Because tea is a long-term crop, future generations would benefit. Further benefits would be realized if the government removed the income tax on tea and subsidized inputs such as sprinkler irrigation. Despite all of these benefits, the increased tea production would negatively impact food security in the whole area because there would be much less land available for food crop production. Because tea production requires heavy use of pesticides and fertilizers, there would be environmental degradation. Ultimately, insect populations would get out of balance, increasing pest problems for the whole agri-



Figure 4: Women participating in a baseline assessment in the Jaldhaka watershed

cultural sector. Further, the health of laborers would be adversely affected by the chemicals; government subsidies for biological pesticides and organic fertilizers, increased health center coverage, and targeted training campaigns would help to mitigate this problem. Access to water resources would also become an issue because tea requires more irrigation than food crops, and tea growers often use water inefficiently. This could hasten the drying up of rivers and deep aquifers, which has already begun. Down-stream farmers would be affected, especially those pumping water from deep aquifers. The drinking water availability would also be affected as well. In order to prevent some of these problems, the government could implement training programs or create water quotas to increase efficiency of water use.

Acknowledgements

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Background source materials:

'Baseline Assessment of Current Livelihood Strategies in Jaldhaka watershed, West Bengal, India', 'Agricultural Water Management Scenarios in Jaldhaka watershed, West Bengal, India' and 'Hydrologic Assessment of the Jaldhaka Watershed, West Bengal, India'

Considerations for future AWM interventions

- **Potential impacts of electricity are positive if steps are taken by the government to ensure equity of access and mitigate potential negative side effects, particularly pollution from agro-chemicals used in the intensified cropping systems envisaged.**
- **While independent tea production is beneficial for some smallholders, widescale adoption could limit the amount of food produced in the region, causing negative impacts on food security.**
- **Future expansion of Agricultural Water Management has to take into account possible negative side effects, such as increased pollution due to more fertilizer and pesticide use.**
- **Some development trajectories involving AWM have various levels of beneficiaries and dis-beneficiaries. Scenario analysis that explores different pathways can help decision-makers weigh desired and undesired impacts in a more transparent way.**
- **A potential barrier of intensification may be the soil health and fertility depletion associated with continuous cropping in the Jaldhaka. Further knowledge and efforts to ensure sustainability are needed to successfully realize the potential of adoption of AWM technologies.**



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