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Report for Agricultural Water Management (AWM) Solutions Project

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1 INTRODUCTION

This report describes the results of a baseline assessment of current livelihood strategies in the Jaldhaka watershed of the Brahmaputra River Basin in West Bengal, India. The work is part of the IWMI project entitled 'Agricultural Water Management Solutions' which aims to analyse the impacts and potential of AWM interventions to improve livelihoods at the community, and watershed scales and assess the opportunities, constraints and impacts of the use of AWM technologies. Similar work has been done in two other watersheds, the Nariarlé watershed in Burkina Faso and the Mkindo watershed in Tanzania. The work in the Jaldhaka watershed was done during April 2010 in cooperation with International Development Enterprises-India. After this baseline assessment different AWM scenarios were analysed.[1] Within five villages focus groups were held with different stakeholders about their current land and water resources, agricultural system inputs and outputs, health issues and different sources of income. The results were summarised in livelihood narratives for the three main livelihood strategies: Agriculture, those with off-farm income, and independent tea growers. These were presented at an expert meeting aimed to identify the livelihood strategies across the watershed grounded in detailed village level narratives. Participants mapped and discussed the current situation of water management, livelihoods and resilience of different livelihood groups. The participants worked in a part or throughout the watershed, some of which were involved in extension services, health care and finance. Others worked in the irrigation and agriculture government departments of Cooch Behar and Jalpaiguri administrative districts.

The livelihood narratives of the villages are first presented after which the baseline of resource based livelihoods across the watershed is described.

1 de Bruin, A., Mikhail, M., Brahmachari, A. and Barron, J., 2010. *Agricultural Water Management Scenarios in the Jaldhaka watershed, West Bengal, India*, York, UK: Stockholm Environment Institute.

2 BASELINE LIVELIHOOD STRATEGIES AT VILLAGE LEVEL

Focus groups were first held in five villages: Chabgar, Saptibari, Satgatchi, Baroguria Garkuta, and Bhogramguri (see Figure 1) with groups of farmers with access to a treadle pump, access to diesel or motor pump as well as women, those growing independent tea, and those with off farm income. The number of participants is presented in Table 1.

In the watershed, smallholders cultivate rice, jute, vegetables, and some tobacco and potatoes. Rice is the most important crop for them, but mostly for consumption, and only if there is excess will they sell it. Those with good access to irrigation grow off-season rice, which they call "artificial" rice; this type of rice is mostly for sale because it fetches a higher price. Most vegetables are also cultivated largely for home consumption. On the other hand, tobacco, potatoes, jute, and some vegetables (green chilli, brinjal, and pointed gourd being the most common) are the important cash crops.

2.1 LIVELIHOOD NARRATIVE FOR AGRICULTURE

The smallholders buy hybrid seeds for some crops, but also tend to save seeds and use those for the next year's cultivation. They all use a combination of fertilizers (including cow dung) and a significant amount of pesticides for all of their crops (which they apply using a rented spray machine). They use a tractor, power tiller, and use their livestock to plough. Each of the crops is harvested once in a season, resulting in three main harvests in a year.

Smallholders own cows, goats, chickens, and ducks, but cows are by far the most important of their animals because they provide milk, labour for ploughing, and cow dung as well as providing the household with income if there is a financial problem (like drought resulting in a poor rice harvest) and the household needs cash for education or healthcare. Cows and goats graze in the fields between harvests, but are tied near the home and fed rice residues as fodder during the rainy season. The major source of conflict in the villages is when one farmer's animals damage another farmer's crops.

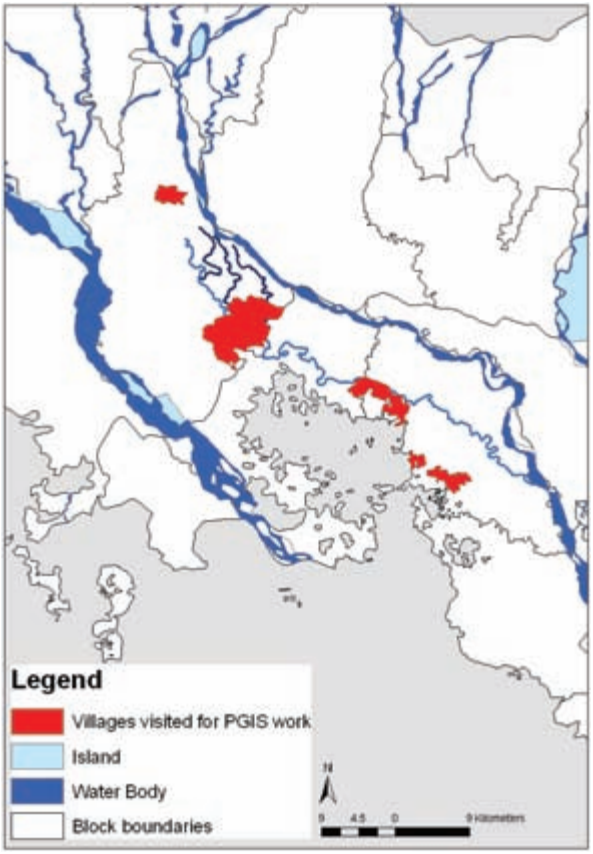

Figure 1: Villages where community fieldwork has taken place

Stands of bamboo and fruit trees grow near their homes. The fruit trees are mainly for consumption but the bamboo is used in addition to cows as a form of financial security for the household.

Table 1: Participants in Community fieldwork

Location	Male Participants	Female Participants	Total Participants
Baroguria Garkuta	14	7	21
Bhogramguri	16	8	24
Chabgar	13	6	19
Saptibari	13	7	20
Satgatchi	13	5	18
Total	69	33	102

Smallholders predominantly use groundwater for both domestic use and irrigation. Domestic water is accessed using either government-built hand pumps or personally purchased hand pumps. Some have access to treadle pumps. Others own diesel pumps. If a household has neither form of pump, they will rent a diesel pump to irrigate their fields and share borings within their fields for water access. Renting a pump is a constraint for many of them because the rent is expensive and all farmers need the pumps at the same time. The water quality is often poor with a high concentration of iron.

Access to markets, roads, and healthcare is very good. However, better veterinary care is required to keep their animals healthy. A major concern for the smallholders is lack of electricity.

2.2 LIVELIHOOD NARRATIVE FOR THOSE WITH OFF-FARM INCOME

Some villagers rely heavily on off-farm income for their livelihoods, ranging from 10-70per cent of their total income. Most of those who work off-farm do cultivate on-farm as well, however, they tend to have smaller areas, and generally only have one plot or own one small plot and lease one. Those who lease land have yearly contracts and use their income from one year to pay the rent for the next year. If they cannot pay, they will be taken to court and lose the land. For those who do own some amount of land, off-farm income is often used to supplement the food they grow themselves. Another coping strategy during difficult times is that they will rent out their land for a short period of time in order to collect some income. There can also be more than one member of a household working off-farm for income.

Some smallholders mortgage their own land in order to take loans from a bank to purchase inputs like chemical fertilizers and hybrid seeds to increase production. If there isn't enough production or they can't sell at a higher price, then there will be a loss of income and they won't be able to pay back the loan without selling bamboo, cows, or goats. The loans are generally 5-10 years; after this time, if they can't repay, the bank will confiscate the land.

Many who work off-farm labour on other's fields or in a nearby factory (plywood, carbon, etc.) The income from the factory work becomes more important when the rice harvest is low because they then have to use their factory income to purchase rice.

Those who labour on the tea plantations get paid Rs. 65 daily, which is good for their financial security. During the two-month rainy season, those who work on the tea plantations hire four -five labourers for Rs. 100/person to work on the land where they grow a rain-fed crop because they are working on the tea plantation themselves. The income they get from the labour they use to buy vegetables that they don't grow and other commodities. Labouring in the tea gardens is very important because when rice production fails, they use the income from labouring to get food to eat.

Some Self Help Groups are an avenue for women to make a small amount of off-farm income, such as receiving a monthly fee to cook lunch for school children or working as a trainer for other SHGs in the area.

Other sources of off-farm income can include owning a bicycle rickshaw, working in a ration shop, teaching in a school, or tutoring children. Those whose income is solely off-farm will buy their food from the market, although they may have some animals like chickens, which they use as supplemental income.

Off-farm income ranks first or second in income importance, usually only second to rice and cows. However, when prioritizing what is considered "better" or more desirable work, owning your own farm is highest, leasing land is next best, and then labouring being the least desirable.

2.3 LIVELIHOOD NARRATIVE FOR INDEPENDENT TEA GROWERS

Some farmers who originally grew rice and jute, like the other farmers around them, have started their own small tea gardens. They have decided to include tea among their crops because it brings them much more money, as evidenced by one farmer who mentioned a large increase in income over the four years he has grown tea.

They get their small tea plants from a nursery at a nearby hill station. Tea cannot be harvested until two years after planting, but the harvest increases over time. For eight months every 12 days tea is plucked by hand with the help of hired labour and the other members of the family. The varieties that can grow in the area around Maynaguri are called '25:26' and '22'.

Once a year they apply cow dung to the field to make the tea plants stronger. Before each harvest, pesticides

are applied by using a spray machine and fertilizers, which are bought in the market, are applied by hand after each harvest. The tea field is flooded using a diesel pump and delivery pipelines.

They have cows to plough their crop fields and provide cow dung for the tea. Goats are not part of their household because they like to eat the tea leaves. Cows are only sold when they need a new cow or cash to pay for a marriage or health treatment.

A tea growers' self help group exists in the area and provides the farmers with a place to sell their tea. The group then sells this tea and distributes the profits to the farmers. There are benefits to being part of the self help group: farmers do not have to pay to transport their tea, and the group guarantees them a buyer for their product, which is much more secure than selling to a distributor.

For farmers who have recently planted tea and not yet begun harvesting it, rice remains the primary crop for them, and vegetables the secondary crop. When drought reduces their rice yields, vegetables become more important, followed by tobacco and rice.

3 BASELINE OF LIVELIHOOD STRATEGIES AT WATERSHED LEVEL

In the Jaldhaka watershed the main three livelihood strategies are agriculture, off-farm employment with some agriculture, and tea production. All three groups produce rainfed rice in addition to their main income stream, largely used for home consumption. Those depending mainly on agriculture have different cropping patterns depending on where they live within the watershed, their ability to access water, and their wealth in terms of finance and land. Off-farm activities include labouring on others' fields or in a nearby factory (plywood, carbon, etc.), labouring on a tea plantation, working for a Self Help Group (SHG) to cook lunch for schools or train other women in the area, owning a bicycle rickshaw, working in a ration shop, teaching in a school, or tutoring children.

Participants considered the most vulnerable group in the watershed to be people dependent on agriculture. Second is the group of tea growers and least vulnerable is the group of people depending on off-farm income. Each household is highly independent, with almost no communal use of natural resources. While this leads to low levels of conflict, it also makes households vulnerable to shocks to their livelihood strategies.

As part of this baseline assessment the participants of the expert meeting also mapped the land use in the area. Figure 2 shows agricultural and tea production as well as restricted areas. For security reasons, farmers are only allowed to grow rice in the area 0.5 km out from the full border with Bangladesh because it is a low-height crop and does not hamper visibility. Another larger area in the middle of the watershed is also restricted to growing rice but it did not become clear why this is restricted.

3.1 LIVELIHOOD NARRATIVES FOR THOSE DEPENDENT ON AGRICULTURE

3.1.1 Cropping patterns

In the watershed, smallholders cultivate rice, jute, vegetables, and some tobacco and potatoes. Rice is the most important crop for them, but mostly for consumption; they will only sell some if there is excess after consumption needs are met. Those with good access to regular irrigation grow off-season rice, called 'boro' rice, which is considered a cash crop due to its high sale price. Most vegetables are also cultivated largely for home consumption. On the other hand, tobacco, potatoes, jute, and some vegetables (green chilis, brinjal, and pointed gourd being the most common) are the important cash crops. As can be seen in Figure 3, the majority of the area is covered by the cropping pattern 'jute, rainfed rice, and one or more winter crops (vegetables, potatoes or tobacco)'. There are pockets of boro rice, maize, small banana plantations and tobacco in this area as well. The government has programs that are attempting to encourage maize production because it is more water efficient than rice, thus there has been a recent increase in maize production. A second cropping pattern is that of 'jute, rainfed rice, and tobacco'. Some farmers living close to the river beds also produce watermelon and groundnut. The cropping intensity in the watershed is very high as most of the area is used for more than one harvest a year: in Maynaguri District it is 163 per cent while in Cooch Behar District it is 192 per cent.

The majority of people involved in agriculture follow the pattern of 'jute, rainfed rice and vegetables', while some focus on producing tobacco as the third crop. A small number of people grow watermelon and/or

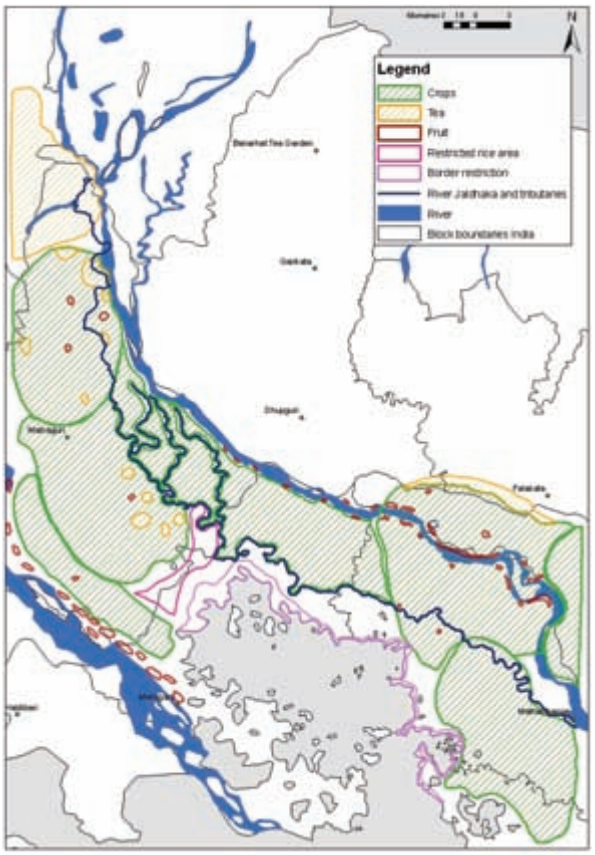

Figure 2: Land use map of the Jaldhaka watershed

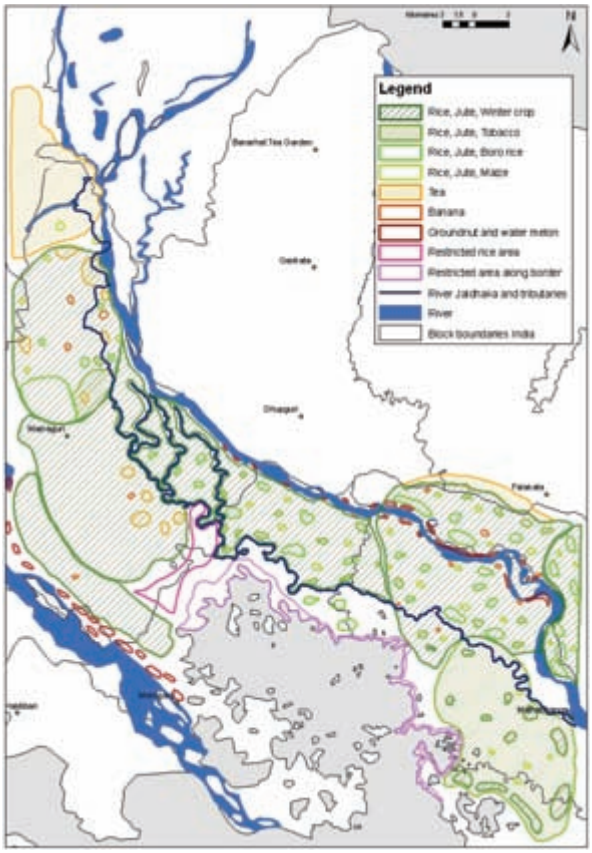

Figure 3: Different cropping patterns in the Jaldhaka watershed

groundnut right in the riverbed during the dry season in addition to the crops of the first cropping pattern. Because the river beds are vacant lands, any production in this area brings the farmers additional income. Both men and women are involved in this production.

3.1.2 Inputs

There are two types of seeds. Locally they are called 'high-yielding seeds' (with a certificate from the National Seed Company) and 'truthful level seeds' (local seeds that are not certified). The local farmers feel that the truthful seeds are not reliable because sometimes the yield is variable. At times they mix seed from the previous year with seed from the current year, creating variability in quality. For each 100 to 140 villages there is what is termed as 'a seed village' where there is a local distributor of the 'truthful seeds'. The smallholders buy hybrid seeds for some crops, but also tend to save their own seeds and use those for following year's cultivation. They are not all consistent in which crops they use hybrid seeds for, however boro rice is always produced with high yielding seeds.

They all use a combination of fertilizers (including cow dung). The agricultural department and farmer's organisations are both trying to reduce the use of chemical fertilizer by replacing it with green manure such as the bio fertilizer Azolla, a fern that fixes atmospheric nitrogen from the air. In some cases they have attempted to encourage rotations of leguminous crops, which are good to rejuvenate the soil. However, the uptake of this technique is low because leguminous crops fetch them a lower income than their usual cropping pattern. Although all farmers mentioned the use of cow dung as a substantial part of their fertilizer schedule, its availability is declining. Increased mechanization has meant that farmers are relying less on animals for labour. In addition, the increase in chemical fertilizer use has meant that less cow dung is used. The combination of these factors has led to the decline in the numbers of animals, and thus a decrease in the overall amount of cow dung available.

Farmers also use a significant amount of pesticides for all of their crops (which they apply using a rented spray machine). They use a tractor, power tiller, and use their livestock to plough. Each of the crops is harvested once a season, resulting in three main harvests a year. Zero tillage has been introduced into the area where farmers grow 'jute, rainfed rice and vegetables', but only a few are currently using the technique.

3.1.3 Livestock

Smallholders in the villages own cows, goats, chickens, and ducks, but cows are by far the most important of their animals because they provide milk, labour for ploughing, and cow dung. Cows and goats graze in the fields between harvests, but are tied near the home and fed rice residues as fodder during the rainy season. The major source of conflict in the villages is when one farmer's animals damage another farmer's crops.

3.1.4 Water use

Smallholders predominantly use groundwater for both domestic use and irrigation. Domestic water is accessed using either government-built hand pumps or personally purchased hand pumps. The water quality is often poor with a high concentration of iron.

Thirty to thirty-five per cent of the watershed area is irrigated. Much of the irrigation occurs in the downstream areas because the groundwater table is closer to the surface. In the upstream areas the groundwater table is deeper and thus more difficult to access. Treadle pumps and hand pumps are not utilized in these areas, as motorized pumps are required to lift the water. The difficulty in acquiring irrigation water is the main reason that boro rice is not grown in the upper part of the watershed.

In most of the watershed the majority of farmers use rented diesel pumps for irrigation; the second most common is electric pumps; and third is the treadle pump and hand pump. In recent years, rainfall has been less predictable, such that farmers often have to irrigate their crops even during the rainy season. In the places where they have electricity, 50 per cent of farmers use a motor pump. This is especially true in Mathabangha One and Shitalkuchi blocks. In Maynaguri block, in the northern part of the watershed, they use mainly diesel pumps. Along the smaller rivers farmers use canals and ponds and river lift irrigation. Canals are also used in Mathabangha block, but the physical structures are often in disrepair.

A few farmers in each village own a diesel or electric pump; other farmers rent out these pumps. Many farmers have at least one borehole, if not several on different land parcels. Those who do not have a borehole will share their neighbouring farmers' borehole for irrigation water access. However, renting a pump is a constraint for many of the farmers because it is costly and all those who are irrigating need the pumps at the same time during the season. Sometimes this leads to reduced yields when the farmer is unable to irrigate the crop at the ideal time. The majority of the population depends on rainfed agriculture because they do not have enough money to rent the pumps. Rainfed farmers do not grow tobacco due to the lack of access to irrigation.

3.1.5 Gender

When a household's landholding is greater than five bhigha, extra labour is often hired.[1] Otherwise, all of the family members work together. Labourers are paid in kind when there is enough production. However, if the harvest is too small, the farmer will not hire labour for harvesting because the income would be less than the labour cost. When the field is between two to three bhigha, all family members contribute to farm work. Both women and men can work as labourers on other farms. However, it is often the case that the men will labour on other farms or do other off-farm activities while the women stay and work on the family fields.

Both men and women make agricultural decisions. They make mutual decisions on outputs and on how to spend money. Often the head of the family (men) will meet with the extension agent or a government officer to learn about agricultural techniques and then discuss these ideas with family members to make the final management decision. Women do not generally go to the market to sell produce. And, if the men see opportunities while they are in the market (such as the availability of good quality seeds), then they will decide on that opportunity without discussion.

3.1.6 Financial security

Cows are the main source of financial security for households: when the household has a financial problem (like drought resulting in a poor rice harvest) and they need money for education or healthcare, they will sell the cows for income. Stands of bamboo and fruit trees grow near their homes. The fruit trees are mainly for consumption but the bamboo is used in addition to cows as a form of financial security for the household. Other farmers have developed a financial plan for themselves in which they save money and spend it when needed. Institutions that provide financial services are the Self Help Groups (SHGs) and banks. Both men and women have become involved with separate SHGs. In these groups they make small regular contributions to the revolving loan fund, after which they can receive a loan for cultivation or for personal need during difficult situations. Banks also provide farmers with different options to get money with a reasonable interest rate. One of these options is the Krishak Credit Card (KCC), which means 'farmer credit card' in Bengali. With the card they are able to get an annual minimum of Rs. 40,000 (USD 850). If they are unable to pay back the loan after four - five years, they will be given a notice and questioned. If the bank feels that the farmer's problem is legitimate, the bank will attempt to assist the farmer. According to those interviewed, defaulting on a loan is rare. When farmers register for a KCC card the bank takes the land as collateral for the loan by keeping the papers of the land in the bank. Every three years the KCC card is renewed. If the farmer is unable to pay back the loan in those three years, the card will not be renewed and the banking facilities will no longer be accessible.

3.1.7 Challenges for farmers

A major concern for the smallholders is lack of electricity. Farmers felt that with electricity they would have better access to cheaper irrigation and light for their children to study and improve their marks at school. Improvements in veterinary care would also make a significant impact on the health of their animals, an important source of financial security for the farmers.

Access to markets, roads, and healthcare in the villages was considered to be good. However, according to the one health care expert, some areas are not that accessible with doctors not being there every day, and in general there are too few health care centres. The government aims to have a health centre for every

[1] One bhigha of land is equal to 0.16 hectares

5,000 people, but this has not yet been implemented in the area.

The farmers are also having difficulties with marketing because supply and demand are not well balanced. For example, in 2009 the price of potatoes was very high, so in 2010 most of the farmers grew potatoes, causing a crash in the potato price and debt for many farmers. The Department of Agriculture and cooperation is attempting to ameliorate this situation by setting up village information centres to help farmers to better handle these fluctuations in produce pricing. Although farmers are slowly beginning to access the centres, behaviour change is expected to be slow. For example, despite the encouragement of legume production for soil regeneration and future yield increases, farmers are reticent to change their practices because legumes provide less income for the current season. Fluctuations in over and under production occur with most crops in the area, including watermelon, groundnut, potatoes and other vegetables.

3.2 THOSE DEPENDENT ON OFF-FARM INCOME

In the watershed 35-40 per cent of the people rely heavily on off-farm income for their livelihoods, which ranges from 10-70 per cent of their total income. Most of those who work off-farm do cultivate on-farm as well, however, they tend to have smaller areas, and generally only have one plot or own one small plot and lease one. Those who lease land have yearly contracts and use their income from one year to pay the rent for the next year. If they cannot pay, they will be taken to court and lose the land. For those who do own some amount of land, off-farm income is often used to supplement the food they grow themselves. The income from the off-farm work becomes more important when their own rice harvest is low because the income from the off-farm work is the means to purchase their staple food. Another coping strategy during difficult times is renting out their land for a short period of time in order to collect some immediate income. There can also be more than one member of a household working off-farm for income.

Some smallholders mortgage their own land in order to take loans from a bank to purchase inputs, like chemical fertilizers and hybrid seeds, to increase production. If production is not high enough or they cannot sell at their desired price, then they may be required to sell bamboo, cows, or goats to pay back the loan. The loans are generally 5-10 years in length and if they cannot repay after this time, the bank will confiscate their land.

3.2.1 Type of off-farm activities

Factory work

Many who work off-farm work as labourers on other people's fields or in a nearby factory (plywood mill, jute mill, dairy, saw mill, van rickshaw, and/or brick manufacturing). All of these factories provide seasonal employment. Brick-making factories shut down during the four-month rainy season because it is difficult to make bricks at that time. Plywood factories also shut down during the rainy season because the wood needs to be dried and this is difficult during the rains. During dry months they manufacture, stock, and sell.

Tea plantation work

Those who work as labourers on the tea plantations get Rs. 65 paid daily, which is good for their financial security. For two months during the rainy season, those who work on the tea plantations hire four - five labourers for Rs. 100/person to work on their land because they are working on the tea plantation. The income they receive from the tea plantation is used to buy produce to supplement their farm production and other commodities. Working as labourers in the tea gardens is very important for these households because when rice production fails, they use the income from their plantation wages to purchase food.

Off-farm income ranks first or second in income importance, usually only second to rice and cows. However, when prioritizing what is considered "better" or more desirable work, owning your own farm is highest, leasing land is next best, and then labouring being the least desirable.

Service work

The biggest employer is actually the government through the National Rural Employment Government Scheme (NREGS). People are employed to build roads, dig ponds, and conduct other community service work.

Some Self Help Groups are an avenue for women to make a small amount of off-farm income, such as receiving a monthly fee to cook lunch for school children or working as a trainer for other SHGs in the area.

Other sources of off-farm income can include owning a bicycle rickshaw, working in a ration shop, teaching in a school, or tutoring children. Those whose income is solely off-farm will buy their food from the market, although they may have some animals like chickens, which they use for supplemental income.

3.3 LIVELIHOOD NARRATIVE OF INDEPENDENT TEA GROWERS

It is difficult for farmers who have the most common cropping pattern (jute, rainfed rice, and winter crop) to step out of the cycle and grow something new. However, some farmers who originally grew the most common cropping pattern have started their own small tea gardens. They have decided to include tea among their crops because it brings them much more money, as evidenced by one farmer who mentioned a large increase in income over the four years he has grown tea. More farmers are starting to grow tea, but it is not possible for everyone because it requires high lying land.

There are two ways for smallholders to be involved in tea production. A farmer can sell his land to a company and then grow tea on this plot with the whole family providing labour and being ensured of a buyer for the tea. About 20 per cent of people in the watershed depend on this type of outgrower scheme. The other option is to establish a tea garden on your own plot but not sell the land, which is called independent tea production. A small number of people grow tea independently in pockets throughout the watershed, but it is restricted to farmers with higher lying fields.

The tea companies in the watershed (shown in Figure 4) are also local distributors for tea. The commercial tea plantations have been around for many years. The one in the north is more than 100 years old and the one in the east is at least 50 year old whereas the areas with independent tea production are around 5 to 10 years old.

3.3.1 Inputs

Farmers get their small tea plants from a nursery at a nearby hill station. Tea cannot be harvested until two years after planting, but the harvest increases over time. For eight months of the year, tea is plucked by hand every 12 days with the help of hired labour and family members. The varieties that can grow in the area around Maynaguri are called '25:26' and '22'. Variety 25-26 is much easier to grow because it grows more quickly and can be grown in any kind of soil and temperature. On the other hand, variety 22 needs to have more moist soil. Thus, most tea grown in the watershed is the 25-26 variety.

Once a year they apply cow dung to the field to make the tea plants stronger. Fertilizers that are bought in the market are applied by hand after each harvest. Before each harvest, pesticides are applied by using a spray machine. To irrigate, the tea field is flooded using a

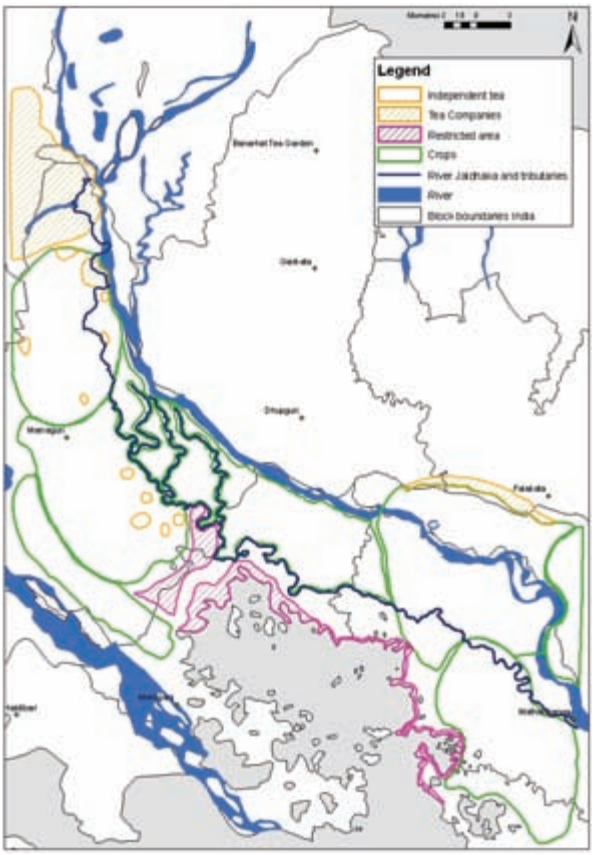

Figure 4: Areas in the watershed where tea is grown

diesel or electric pump to lift groundwater and delivery pipelines are brought to the field. The tea companies use more efficient sprinkler irrigation. Tea gardens that are close to a river will also use river water for irrigation. If there is sufficient rain, there is no need to irrigate with a pump. However, if there is insufficient rain, they irrigate three times a month for a period of three months.

Farmers have cows to plough their crop fields and provide cow dung for the tea. Goats are not part of their household because they like to eat the tea leaves. Cows are only sold when they need a new cow or cash to pay for a marriage or health treatment.

3.3.2 Institutional support

There are at least two tea growers' SHGs in the area. Each has 500 members and assists the farmers in selling their tea. The group collects the tea, sells it, and then distributes the profits to the farmers. There are benefits to being part of the self help group: farmers do not have to pay to transport their tea, and the group guarantees them a buyer for their product, which is much more secure than selling to a distributor. For each kilogram of tea delivered, the SHG keeps one Rs in savings;

the SHG then returns the final collected sum to the tea growers at the end of the harvest period.

3.3.3 Problems

For farmers who have recently planted tea and not yet begun harvesting it, rice remains the primary crop and vegetables the secondary crop. When drought reduces their rice yields, vegetables become more important, followed by tobacco. The independent tea growers anticipated that establishing sprinkler irrigation systems similar to the companies would be beneficial to them because flood irrigation is not as effective for tea cultivation. Sometimes it is difficult to find the liquid cash necessary to purchase pesticides at the right times for cultivation. Independent tea growers also have to compete with the much more advanced marketing techniques of the tea companies, making their profits less secure. If many more smallholders took up independent tea production, there could be overproduction of the product without an adequate market, but at this point it is lucrative for the few who undertake the shift.

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